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**The Equitable Leadership Practices of Teacher Leaders in Secondary Science Instruction**

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The Equitable Leadership Practices of Teacher Leaders in Secondary Science Instruction
Latanya T Brandon, PhD

University of Connecticut, 2020

The purpose of this case study is to investigate science teacher leadership for educational equity at the secondary school level during a period of reform. The current reform in science education acknowledges inequity and calls for significant changes in instruction (NRC, 2012). This study is designed to address two research questions: (1) ‘How do participants describe science teacher leaders’ educational practices for equity?’ and (2) ‘How are science teacher leaders’ equitable practices related to organizational structures and social norms within secondary schools?’. Three data sources: interviews, field observations, and artifacts, were collected and analyzed qualitatively. A social justice leadership framework (Theoharis, 2007) allowed for a deep analysis of the ways in which these science teachers are challenging dominant views of teaching content and leading for equity. Of the ten high-leverage equitable leadership practices (Ishimaru & Galloway, 2014), four appeared in the four cases. Engaging in self-reflection and inquiry or dialogue around equitable teaching was present in all cases, whereas holding colleagues responsible for equitable instruction and publicly advocating for socially just policy appeared in three and two cases, respectively. The evidence suggests that science teacher leaders’ educational practices vary with the leadership structures of secondary schools and that advocating for equity exacerbates tensions in interactions with colleagues and administrators. The findings of this study warrant further discussion on how to capture the role and impact teacher leaders have in achieving the vision for science education set forth in the Framework (NRC, 2012).
The Equitable Leadership Practices of Teacher Leaders in Secondary Science Instruction

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A Dissertation
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Doctor of Philosophy
at the
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2020
The Equitable Leadership Practices of Teacher Leaders in Secondary Science Instruction

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University of Connecticut
2020
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# Table of Contents

**Chapter 1: Introduction** ........................................................................................................... 1  
  Conceptual Framing .................................................................................................................. 3  
   A Model for Science Teacher Leadership for Equity ............................................................ 4  
   Equitable Leadership Practices ............................................................................................ 7  

**Chapter 2: Literature Review** ................................................................................................ 9  
  Background ............................................................................................................................ 9  
   Teacher Leadership: A Promising Lever for Improving Instruction .................................... 14  
   Teacher Leadership: A Promising Lever for Addressing Inequity ...................................... 17  

**Chapter 3: Methodology** ....................................................................................................... 22  
  Research Design and Rationale .............................................................................................. 22  
  Participants ............................................................................................................................. 24  
  Data collection ...................................................................................................................... 25  
   Tools and Instruments ......................................................................................................... 27  
  Procedures .............................................................................................................................. 27  
  Data analysis ......................................................................................................................... 31  

**Chapter 4: Findings** .............................................................................................................. 35  
  Case A ..................................................................................................................................... 36  
   The context ........................................................................................................................... 36  
   Roles and relationships ......................................................................................................... 38  
   Vision (Perceptions of equity) ............................................................................................. 45  
   Case A: Analysis .................................................................................................................. 47  
  Case B ..................................................................................................................................... 57  
   The Context ........................................................................................................................... 57  
   Roles and relationships ......................................................................................................... 59  
   Vision (Perceptions of equity) ............................................................................................. 62  
   Case B: Analysis .................................................................................................................. 63  
  Case C ..................................................................................................................................... 71  
   The Context ........................................................................................................................... 71  
   Roles and Relationships ....................................................................................................... 73  
   Vision (Perceptions of equity) ............................................................................................. 74  
   Case C: Analysis .................................................................................................................. 76  
  Case D ..................................................................................................................................... 81  
   The Context ........................................................................................................................... 81  
   Roles and Relationships ....................................................................................................... 82  
   Vision (Perceptions of equity) ............................................................................................. 83  
   Case D: Analysis .................................................................................................................. 84
Findings related to the conceptual framework................................................................. 88
Significance of leading for equity in science teaching.................................................. 92
  Institutional tension ........................................................................................................ 92
  Social tension .............................................................................................................. 100

Chapter 5 Discussion.......................................................................................................... 105
  Summary of Findings .................................................................................................... 105
  Discussion .................................................................................................................... 109
  Limitations .................................................................................................................. 115
  Recommendations for future research ....................................................................... 116

References ....................................................................................................................... 117
Appendix A: Equitable leadership practices................................................................. 127
Appendix B: Case Study Protocol ................................................................................. 130
Appendix C: Data Collection Table ................................................................................. 132
Appendix D: IRB Approval Form ..................................................................................... 133
  Interview Consent Form ............................................................................................. 136
Appendix E: Semi-structured Interview Protocols ....................................................... 139
Appendix F: Recruitment Scripts and Emails ............................................................... 144
Chapter 1: Introduction

The purpose of this case study is to investigate science teacher leadership for educational equity at the secondary school level during a period of reform. Much of the extant literature surrounding school leadership for equity centers on principal leadership (Khalifa, Gooden, & Davis, 2016). In contrast, a number of scholars argue that school leadership is shared, distributed, or collective and extends beyond an individual leader (Bredeson, 2013; Eckert, 2018; Hallinger, 2011; Ishimaru & Galloway, 2014; Louis, Mayrowetz, Murphy, & Smylie, 2013; Supovitz, Sirinides, & May, 2010). Further, shared leadership is inclusive of teachers as leaders and shared leadership is a component of effective schools (Gordon, Klugman, Sebring, Sporte, & SREE, 2016; Louis, Dretzke, Wahlstrom, 2010). Schools, their leaders, and teachers are all political actors in creating a more democratic and socially just society (Zeichner & Liston, 1990). Yet, little is known about the role of teachers as leaders for educational equity (Gershon, 2012).

To date, public education has fallen short in providing an education that reflects the national ideal (Rebell, 2002). In three different academic disciplines, gaps in student achievement across racial, ethnic, and socioeconomic groups persist in each four-year span measured from 1971 to 2012 (NCES, 2000). Schools have been unable to provide the same types of educational opportunities to non-dominant populations as they have to dominant ones (daSilva et al., 2007). Even approaches to instruction and learning reflect class biases (Anyon, 1980; Payne, 2005). Local communities have resorted to lawsuits in an effort to establish more equitable schooling for their students (Stanford, n.d).
Equitable schooling is a pressing concern. The National Center for Educational Statistics predicts a two percent increase in public school enrollment over the next ten years (Synder, de Brey, & Dillow., 2016). In addition, the U.S. Census Bureau reports that 50.3% of children under the age of five are identified as racial and ethnic minorities as of 2015 (Cohn, 2016). Addressing inequity in education, particularly in STEM fields such as science, will likely involve a multi-faceted approach.

Targeting school leaders is one approach. Schools and their leaders are called upon to adapt and respond to challenges as they prepare a more diverse student population to fully participate in a technologically advanced nation. The current reform in science education acknowledges inequity and calls for significant changes in teaching. (NRC, 2012). Policy arising from state adoption of Next Generation Science Standards (NGSS) introduces a unique circumstance for science teachers to lead as they engage in practices specifically targeting more equitable outcomes. Thus, science teacher-leaders may play a critical role in improving and reforming science education. However, there is little research to indicate just how teacher leaders influence instruction and the school community in ways that promote equity.

Teacher agency is an integral part of reform as teachers are both targets for and agents of change. As targets for change, teacher participation in professional development for continuing education credit is often mandated as a condition of teacher certification (Connecticut Teacher Certification Regulation, 1998). Simultaneously, teachers may act as agents of change, as they educate the whole child for the purpose of active citizenry and humanity (Ayers, 2004; Freire, 1982; Tyack, 1974). While the current reform in science education involves a shift in instruction, the broader political
environment involves a shift in the role of teachers. Given the present inequities highlighted earlier, science teachers with sociopolitical consciousness are more likely to recognize their position and their agency and engage in practices to promote educational equity. This study will address two research questions: (1) ‘How do participants describe science teacher-leaders’ educational practices for equity?’ and (2) ‘How are science teacher-leaders’ equitable practices related to organizational structures and social norms within secondary schools?’ For this study, I define these teacher leaders as classroom science teachers who work to influence the conditions of teaching and learning for students through increased participation in decision-making (York-Barr & Duke, 2004).

**Conceptual Framing**

The Framework for K-12 Science Education: Practices, Cross-cutting Concepts, and Core Ideas (The Framework) and NGSS provide an impetus for instructional change in more equitable ways but pedagogy and leadership will vary greatly with local conditions. Adoption of NGSS or closely related standards require science teachers’ knowledge to include and extend beyond academic discipline (National Academies of Science, Engineering, & Mathematics, 2015). Science teachers will need to continually learn in order to be responsive to changes and provide instruction in more equitable ways. This study examines the intersection of science teacher-leaders’ actions with school conditions during the NGSS science reform movement. Teacher leaders act in ways that influence social norms within schools (Bridwell-Mitchell, 2015; Collinson, 2012; Cooper et al., 2016; Fairman & Mackenzie, 2015). The significance of teacher leaders’ influence is underscored by evidence of teacher leaders as mediating factors in
overall teachers’ organizational commitment (Devos, Tuytens, & Hulpia, 2014). I seek to explore the school conditions and social norms surrounding science teachers’ instructional leadership for equity as well as how those relationships connect to their enactment of equitable leadership practices. I aim to uncover a mechanism through which science teacher-leaders promote equity beyond their individual classrooms.

The ways in which equity are defined and understood are related to the social and historical contexts under discussion. These contexts will be developed in the literature review. Here, I reveal my subjectivities as a former science teacher of color, now educational researcher. My experiences have led me to define equity in terms of agency and community involvement. This study emerged from my interest in science teachers’ professional learning and the extension of that learning as it relates to the work of teacher-leaders. As I worked more closely with a group of teacher leaders around NGSS, we often puzzled over and discussed issues of equity that emerged. These interactions spurred actions such as the formation of an informal group, adjustments to instructional planning, professional development sessions, and course syllabi, as well as the current study involving an exploration of science teacher leadership with an equity focus.

**A Model for Science Teacher Leadership for Equity.**

Theories from instructional leadership and social justice leadership guide the conceptual framework for this study. Models are often used to describe the complexity of educational leadership, but models focused solely on teacher leadership are still emerging (Gumus, Belibas, Esen, & Gumus, 2016; Wenner & Campbell, 2017; York-Barr & Duke, 2004). Some scholars describe teacher leadership in ways consistent with
instructional (Collinson, 2012; Jacques, Weber, Bosso, Olson, & Bassett., 2016) and/or transformational leadership models (Portin, Russell, Samuelson, & Knapp, 2013; Pounder, 2006). An instructional leadership model will inform this study given the importance of science instruction. For this study, instructional leadership and leadership for learning models are considered synonymous terms used interchangeably. The leadership for learning model is inclusive of teacher leadership and is the instructional leadership framework upon which this study builds. The emphasis within the model on the relationship of leadership to instruction and, indirectly to student learning, aligns with the scholarship on teacher leadership that focuses on learning (Collinson, 2012; York-Barr & Duke, 2004) and such an emphasis is pertinent to this study.

According to Hallinger (2011), leadership for learning encompasses a range of leadership sources that contributes to instructional practice and ultimately influences student outcomes. In Hallinger’s proposed model, leadership is directly impacted by the leaders’ beliefs, values, knowledge, and experience. His model also acknowledges that leadership for learning is situated within a local context, shaped by the characteristics, culture, and organization of the school community. My research will apply the leadership for learning model to the context of instructional teacher leadership (see Figure 1 below) in secondary schools. Specifically, I will examine how social conditions and organization within and across schools relate to teacher-leaders as they enact equitable leadership practices in science instruction.

Central to this study are the science teacher-leaders’ values, knowledge, and experience with respect to addressing inequity. I elaborate on this aspect of the conceptual framework using the theory for social justice leadership developed by
Theoharis (2007). Theoharis describes social justice leadership as principals working toward inclusive educational practices that eliminate the marginalization of student groups. He frames the principals’ social justice leadership work around ‘resistance’, i.e. challenging the norms of a community. His study’s participants ‘resist’ or challenge the norms or institutional arrangements that perpetuate the marginalization of student groups by implementing specific steps or strategies to alter institutional arrangements. The three aspects of social justice leadership are identified as resistance the principal “enacts” (p. 248), resistance the principal “faces” (p. 248), and resistance the principal “develops” (p. 248). The principals’ leadership practices are described, however those practices are described as ‘ways principals enact social justice’ (p. 231). Thus, Theoharis’s work (2007) informs the conceptual framework by articulating characteristics distinct to social justice leadership while situating that work in a school community.

Based on the leadership for learning model (Hallinger, 2011), I will examine how individual aspects and the context of secondary schools relate to the work of a subgroup of instructional leaders, i.e. science teacher-leaders. Additionally, based on the social justice leadership framework, I will examine how individual aspects and context of secondary schools relate to the work of a specific subgroup of instructional leaders, those science teacher-leaders who are leading for equity. Next, I operationalize the science teacher-leaders’ leadership for equity.
Equitable Leadership Practices.

Teacher Leader Model Standards (Teacher Leadership Exploratory Consortium, 2011) describe the knowledge and skills specific to teacher leadership that are grounded in a collective leadership framework. The Teacher Leader Model Standards are organized into seven domains of leadership.

However, the Teacher Leader Model Standards fail to specify a social justice position. Leadership practices that reflect a social justice stance are more suited for examining science teacher leadership for equity. I draw on the work of Ishimaru and Galloway (2014) to identify leadership practices for equity. Their research with education administrators articulates ten high-leverage equitable leadership practices (Ishimaru & Galloway, 2014). Educational leaders engage in these practices to address systemic inequity (Ishimaru & Galloway, 2014). I compared the Teacher Leader Model Standards and the ten high-leverage equitable leadership practices for areas of overlap.
Seven overlapping practices informed my research design (See Appendix A) and data analysis. These seven overlapping educational practices are then used to operationalize the central focus for this study, science teacher leadership for equity.

To reiterate, while this study draws from scholarship on principal and administrative leadership, the focus is on teacher leadership. York-Barr & Duke (2004) identify three conditions that influence teacher leadership, i.e. school culture and context, roles and relationships, and structures. The science teacher-leader will likely contend with these same conditions as the science teacher-leader enacts equitable leadership practices (Ishimaru & Galloway, 2014) for instructional change. For this study, I will focus on two of these three conditions, i.e. roles and relationships, and school context.

The conceptual framework combines three dimensions that will likely relate to science teacher leadership for equity. The first dimension, vision, stems from the leadership for learning model and the social justice leadership framework. The science teacher-leader will likely have a vision for science instruction, shaped by their individual aspects, i.e. beliefs, values, knowledge, and experiences. The equitable leadership practices enacted by the science teacher-leader will stem from their vision. The second dimension, context, also stems from the leadership for learning model and the social justice leadership framework. These theories, together with scholarship on teacher leadership point to school organization, culture, and social norms as shaping and being shaped by the science teacher-leaders’ equitable practices (Figure 1). The third dimension, roles, stem from scholarship on teacher leadership. Both theories, leadership for learning and social justice leadership are based on principals and
administrators who occupy formal leadership roles. This study focuses on teacher leadership where the leadership role varies considerably (York-Barr & Duke, 2004). The science teacher-leaders’ role will likely shape or be shaped by their equitable leadership practices. I adopt the qualitative case study approach to investigate the intersection of action and conditions as they relate to science teacher leadership for equity. The central research question for this study examines science teacher-leaders’ enactment of equitable leadership practices within secondary schools.

Chapter 2: Literature Review

As part of the national effort to combat educational inequity and promote full participation in an increasingly technical society, new standards in science have been adopted by a number of states (NSTA, 2017). The Next Generation Science Standards (NGSS) are subject-specific K-12 standards for learning based on the vision for science education set forth in the Framework (NRC, 2012). With support from the National Academies of Sciences, Achieve, the American Association for the Advancement of Science, and the National Science Teachers Association, these standards were developed by 26 lead states and underwent additional state and also public review. The collective goal was to develop standards which would “provide all students [with] an internationally benchmarked science education” (NRC, 2013, p. xiii).

Background

To illustrate the significance of a national, cross-organizational focus on providing all students with a rigorous science education, I turn to some historical trends in science education, more specifically in science curriculum. The Biological Sciences Curriculum Study, BSCS, was established in 1959 by The American Institute of Biological Science
to “contribute to the improvement of secondary school education in the field of biology” (BSCS, 1963). BSCS, at the time, developed thematic, color-coded textbooks. Vocabulary was heavily emphasized through the use of study aids within the text. There were highlighted words and definitions along with pronunciation keys. The developers sought to emphasize investigation and inquiry without neglecting the “wisdom of earlier scholars and without superficiality” (BSCS, 1963). One critique of this type of science curricula is that it promotes privilege and exclusivity. Examples, images, and scientists included in the curricula were of European descent and reflected mainstream dominant culture. Western scientific theory was prominent throughout the texts and absent were any references to earlier or non-dominant ideas.

In the past, typical high school instructional sequence for all students included general science and biology, but fewer students pursued advanced coursework that included chemistry and physics. By 1986, only 40% of high school students took chemistry and a mere 11% took physics (NCES, 2000). The civil rights movement had occurred in the 1960s -1970s and there was some pressure in education to allow for broader access to academic fields. However, strong political and social pressure to adapt curriculum in ways that would make sense to all student demographic groups was not yet present and advanced science knowledge remained exclusive. NAEP science assessment scores from the 1970s indicate a decline in science scores across all ages and racial groups and also revealed a science achievement gap between white and minority students (NCES, 2000).

The National Science Education Standards developed in 1996 by the National Research Council was designed to prepare a “scientifically literate populace” (National
Research Council, 1996, p.2). “Other countries are investing heavily to create scientifically and technically literate work forces. To keep pace in global markets, the United States needs to have an equally capable citizenry” (National Research Council, 1996, p.1). The National Science Education Standards pushed for scientific literacy as a means for social advancement. Individuals with an understanding of science and its associated processes will have valuable skills to meet the demands of various workplaces. An underlying belief in this reform effort is that the nation, as a whole, will maintain global competitiveness through its scientifically and technically skilled workforce. Yet, standardized test results from that time period indicated a persistent achievement gap between White, middle to upper class students and poor and working-class minoritized students (NCES, 2000). Although federal standards for science education were developed in the 1990s, states were not obligated to adopt them. These centralized standards could not address the disparity in part, because they were not adopted across various states.

Moving toward the 21st century, data from international tests indicates three trends: 1) U.S. students performed relatively well in the lower grades compared to peers in other countries, 2) when asked to apply scientific skills, U.S. 15-year olds performed worse than about half of their international peers and 3) generally, White 4th and 8th grade students had higher than average science scores compared to their Black and Hispanic peers (Lemke and Gonzales, 2006). The problem of demographic mismatch persisted despite reform efforts for a more scientifically literate American populace.

Science education reform efforts toward establishing equity and excellence continued into the new millennia. BSCS designed new textbooks to address the
exclusivity of science. Their textbook remained thematic. However, they also included practical examples, case studies, and other applications for student knowledge. One example, Biology: The Human Approach (2006) reflects the trend to provide opportunities to engage non-dominant groups in the content. The textbook relies on more common language to explain scientific phenomena and identifies students as the intended audience for materials. Yet, one of the criticisms for adoption of the textbook at a school I taught in was that it lacked academic rigor. The authors of the textbook highlight five-unit themes which correlate to the broad life science conceptual themes identified in the National Science Education Standards (BSCS, 2006). However, the textbook did not contain some of the content knowledge identified as essential at the local level via the state core curriculum (New York State Department of Education, 1996). Mirel (2006) argued that watering down curricula was a disservice to students because the students “drifted through their high-school years unchallenged and uninspired.” While attempts have been made to provide curricula that allow students to make meaning of the content and align with the democratic aims of schooling, critics often cite how such curricula is not rigorous, i.e. exclusive. An underlying assumption of this critique of such curricula involves deficit-thinking toward non-dominant viewpoints and fails to account for the various ways that knowledge may be constructed. A considerable amount of literature refutes this assumption and posits that relevant connections to science concepts reflect a deeper understanding of the content (Banko, Grant, Jabot, McCormack, O’Brien, 2013; Collins, 2002; Konicek-Moran & Keeley, 2015; National Academies of Science, Engineering, and Medicine, 2017; National Research Council, 2012).
The Commission on Equal Opportunities in Science and Engineering (2004) pushed for science as more inclusive, “The need—indeed, the imperative—to include ALL Americans in bringing the best of creativity and innovation to the entire STEM enterprise is more vital than ever. The ethical imperatives of equity and justice, along with many pragmatic reasons dictate this need” (pg. ii). With many states adopting NGSS or similar standards, it is important to note that not all tensions are automatically balanced. The new standards are purported to prepare successful students to be college and career ready. Yet, it mentions that those students who wish to pursue science may require additional advanced coursework. This statement implies that students will self-select more advanced coursework, thus reiterating the trend that few students take advanced science course work as part of their secondary education in public schools. Research has shown that students from financially unstable and resource-deprived schools and districts may not have rich, rigorous opportunities in science education (National Academies of Science, Engineering, and Medicine, 2015). What has been identified as the science achievement gap, may be more accurately described as a science opportunity gap (daSilva, et al., 2007). NGSS also mentions but does not address the need for a variety of curricular and organizational supports to implement the foundational changes in science instruction at the district and school level. Curricular development and organizational support for teachers’ instructional decisions rests with local districts and remains at risk of perpetuating existing patterns of inequity that have been present in curricula and science instruction since the 1960s. Without adequate local support, implementation of the standards may deviate from expectations.
Implementation of these new standards for science education requires a significant shift in instruction (National Academies of Science, Engineering, and Medicine, 2015), science instruction that will focus less on teaching science and more on fostering student learning. The adoption of new science standards creates pressure for teachers to engage in professional learning to meet Framework (NRC, 2012) expectations for providing high quality science instruction for all their students, an expectation that has been embedded in the standards.

**Teacher Leadership: A Promising Lever for Improving Instruction.**

Instructional leadership is important for meeting the challenges set forth in the new standards. In a review of instructional leadership, Hallinger (2011) cites evidence that an instructional leadership model (~0.40) has higher estimated effects on student learning when compared to other leadership models (~0.30). Although instructional leadership often falls under the purview of principals (Devos et al., 2014; Grenda & Hackmann, 2013; Leithwood & Sun, 2012), teacher-leaders are well positioned to practice instructional leadership (Bredeson, 2013).

This research study focuses on the leadership practices of teacher-leaders in science instruction for several reasons. First, teacher leadership is tied to improving student learning and success (Cosenza, 2015; Noland & Richards, 2014; Wenner & Campbell, 2017). Noland & Richards (2014) sought to examine the relationship between teachers as transformational leaders and student motivation and learning at the collegiate level. A modified Multi-factor Leadership Questionnaire version 6s was completed by 273 college students with an average age of 18.75 years. Using multiple regression analysis of the data, the authors reported that transformational teacher
leadership is significantly and positively related to student motivation \((r = .53)\) and learning \((r = .69)\). While the study involves a specific leadership style and student motivation and learning at the collegiate level, it is reasonable to infer that a positive relationship between teacher leadership and student motivation and learning could extend to the secondary level given that the respondents were young, entry-level undergraduates. Additional evidence supports this inference, Leithwood (2016) conducted a review of the literature to examine the impact of department heads on school improvement. The review included 42 studies, approximately 70% were qualitative, 16% quantitative, and 14% used mixed methods. Evidence from at least three different, large scale quantitative studies, all conducted in the United States, were examined and, taken together, suggest a strong association exists between student performance and proximity of leadership work at different school organizational levels. Thus, teacher leadership, as defined by Wenner and Campbell (2017), is most likely to have a greater impact on student outcomes since it occurs in greater proximity to classrooms than principal leadership.

A second reason this study focuses on teacher leadership in science instruction is that teacher leaders contribute to school improvement (Wenner & Campbell, 2017). Shared leadership is inclusive of teachers as leaders and shared leadership is a component of effective schools (Gordon et al., 2016; Louis et al., 2010). What's more, schools that distribute leadership between administrators and staff perform better than those that do not (Louis et al., 2010). Shared leadership may contribute to more than gains in student accountability measures. Research suggests that students also benefit when adults model democratic participatory forms of governing (Barth, 2001 as cited in
Shared leadership models that include teacher leadership may serve as useful models of democratic participation in school governance. Leadership that promotes participation from multiple perspectives is consistent with the more democratic aims of science education.

Lastly, the current reform in science education promotes the inclusion of all students, yet research shows policy changes do not always equate with change at the classroom level (Rowan, Barnes, & Camburn, 2004). We know teacher-leaders impact organizational change by influencing or even changing the teaching practices of their colleagues (Cooper et al., 2016; Supovitz et al., 2010). This study of teacher leadership is warranted since teacher agency is an important consideration for maintaining or changing instructional practices during times of reform and policy change (Bridwell-Mitchell, 2015).

While research indicates the importance of teacher leadership to student outcomes and school improvement, little is known about discipline-specific teacher leadership. Wenner & Campbell (2017) did not generalize about teacher leadership within academic disciplines due to a small number of discipline-specific studies within the ten-year span of their literature review. In general, formally recognized teacher-leaders occupy department head positions due, in part, to their subject matter expertise. Strong content knowledge places department heads in the best position to lead instructional change yet, the leadership component of the department head’s role is understudied (DeAngelis, 2013).

In an examination of data from the U.S. 2007-08 School and Staffing Survey, DeAngelis (2013) reported five characteristics that distinguished department chairs from
other high school teachers. The five characteristics of department chairs were as follows: 1) older than other high school teachers, 2) more years of teaching experience, 3) more years of experience working in their current school, 4) more likely to have graduate training in educational administration and to have majored in their teaching assignment field, and 5) less likely to be a teacher of color. High school teachers providing departmentalized instruction were included in the sample whereas prek-8, non-departmentalized high school teachers, and teachers whose primary position was not teaching were excluded from the sample. This finding indicates that department chairs could serve as ideal participants for this study as department chairs maintain classroom duties and may be well informed about the school conditions surrounding science instructional leadership based on their years of experience teaching and working in their schools.

**Teacher Leadership: A Promising Lever for Addressing Inequity.**

A search of peer-reviewed literature on teacher leadership for equity in science education from 2012 to 2017 produced dismal results. Sources included Google Scholar, as well as the research databases ERIC, Scopus, PsychINFO, Academic Search Premier and Professional Development Collection. Since “science teacher leadership” and “equity” yielded very few, if any, direct results, I expanded the search to include reference lists, reviews, and dissertations on teacher leadership. In one such review of teacher leadership from 1980 to 2000, York-Barr and Duke (2004) did not report any teacher leadership articles on issues of equity. In Wenner & Campbell’s (2017) more recent review of teacher leadership from 2004-2014, only a small percent (9%) of articles with triangulated data, empirical data that went beyond description, and
a sample size greater than or equal to 5, also discussed issues of equity and/or diversity. With these findings in mind, we know very little about the relationship between teacher leadership and equity or even about the role of teacher-leaders as social justice advocates (Gershon, 2012). Some science teachers may identify as equity-minded or as social justice advocates and this aspect of identity is important for their success and resilience as teachers (Richmond, 2017). Others may have been purposefully prepared to develop a social justice identity and enter teaching self-identifying as change agents (Rivera Maulucci & Fann, 2017). The question of how equity-minded science teachers take action and lead is central to this study. I seek a better understanding of teacher leadership and issues of equity within an academic discipline, potentially identifying malleable school conditions that impact teacher advocacy, resiliency, and organizational change in ways that promote equity at the classroom level.

Drawing on research in educational leadership, the leadership for learning and social justice leadership frameworks guide the development of this dissertation. Hallinger (2011) proposed a leadership for learning model based on his work in instructional leadership. Leadership for learning moves beyond individual leadership that rests solely with the principal and conceptualizes instructional leadership more broadly. Four dimensions are captured with the model: values in leadership, leadership focus, context for leadership, and sources of leadership. Values are important for leadership in that values “define both the ends toward which leaders aspire as well as the desirable means by which they will work to achieve them” (Hallinger, 2011, p. 128). A leadership focus describes the indirect pathways through which leadership is linked to student learning. Context for leadership describes leadership behaviors as adaptive to
changing circumstances and the needs of the school. Shared leadership describes the leadership practices of principals for involving others in decision-making.

The Leadership for Learning model is a robust model that captures a great deal of the complexity surrounding instructional leadership. However, the model has some limitations. It was developed through decades of work involving principal leadership in school improvement studies at urban, elementary schools. While the model acknowledges multiple sources of leadership, the primary focus remains on principal leadership. The reasons for studying science teacher-leaders as instructional leaders are clear: their leadership occurs in close proximity to the classroom, is influential to peers, and will likely have an impact on instructional change within classroom. All of which calls for shifting the focus of attention to teacher-leaders rather than principals when seeking to understand how teachers’ practices are impacted by reform efforts for equity in science education. Still, the Leadership for Learning model lacks specificity around leading and attending to issues of equity.

In this section, I elaborate on the different conceptions of equity and social justice work and define such work for this study. Equity and equality are sometimes conflated as both relate to justice. A focus on equality seeks to establish fairness based on sameness, for example the Brown vs. Board of Education decision relied on principles of equality to declare the racial segregation of public schools as unconstitutional. The decision states “segregation of children in public schools solely on the basis of race deprives children of the minority group of equal educational opportunities,” (Warren, 1953, p. 483). In contrast, a focus on equity seeks to redress unfairness and is distinct from equality. School leaders electing an equity audit is one example. An equity audit is
a process of examining the relationship between different components of the learning environment and opportunity gaps in education. A district leader in Chicago Public Schools noticed a high percentage of English Language Learners with high attendance rates were off-track in reading and mathematics. The district leader sought to work with an instructional leadership team to examine data for inequitable patterns of student learning and facilitate discussion around instructional strategies and factors contributing to the inequity (Soria & Ginsberg, 2016). The process was designed to guide the work of an instructional team toward recognizing a minoritized group, reaching a shared understanding of contributory factors, and collectively deciding action steps to minimize or eliminate the inequity. The equity audit process resulted in collective decision-making to address the high percentage of English Language Learners who were off track and, in this way, incorporated justice.

Social justice is more varied in its conceptualizations and relates to the enactment of the Universal Declaration of Human Rights (UN General Assembly, 1948). Social justice work can take on three forms, distributive, cultural, and associative (Gewirtz, 2006; Furman, 2012). Distributive justice involves shared or equal access to resources. Cultural justice involves an absence of cultural domination and the recognition and acceptance of different ways of life, culture, and values. Associational justice involves the full participation of marginalized groups in decisions that affect their lives and surrounding conditions, and this is the perspective on equity and social justice that provides the lens for this study. Gewirtz’s (2006) paper on social justice in education reminds us that social justice work is context-dependent and also dependent upon the organizational level in which it is enacted. A principal’s view of a social justice
issue may be viewed and mediated differently than a teacher’s view of that same social justice issue. This study is crafted from the teacher’s perspective on an issue of equity in the context of science instruction in secondary schools.

I adopt a social justice leadership framework (Theoharis, 2007) to further guide the investigation into teacher leadership for equity. Theoharis (2007) developed the theory using a critical, positioned-subject qualitative approach to investigate how principals enacted social justice in schools. He noted three aspects of social justice leadership: resistance the principal “enacts against historic marginalization of particular students” (p. 248), resistance the principal “faces as a result of their social justice agenda” (p. 248), and resistance the principal “develops to sustain their social justice agenda in the face of resistance” (p. 248). The social justice leadership framework is based on an empirical study of principals’ leadership practices. For this study, I have defined equity as distinct from equality and refer to Theoharis’s framework (2007) to define this type of leadership as centering on inclusive educational practices that address or eliminate the marginalization of students due to their race, ethnicity, class, ability, or language. In the next section, I describe my methodological approach to examining how teacher-leaders, who possess an equity focus, enact leadership practices to include student and/or teacher perspectives in school policies and procedures that impact science instruction in their respective schools.
Chapter 3: Methodology

Research Design and Rationale

The Framework and NGSS promote educational equity and teacher-leaders may play a pivotal role in implementing those reforms at the classroom level. In this study, I investigate the educational practices of science teacher-leaders within secondary schools as they work to develop and sustain instruction that promotes the full participation of all students. York-Barr & Duke (2004) found that research on teacher leadership was largely qualitative and the difficulties associated with quantifying teacher leadership were reflected in the few large-scale quantitative studies performed. With that being said, the case study approach has emerged as one of the predominant methodologies for studying teacher leadership due, in part, to the complex nature of teacher leadership.

The methodological approach of a collective case study has been selected for the following reasons. First, a case study approach provides data that are timely and situated (Creswell, 2013). My research question involves the process of science teacher leadership for equity and a case study approach allows me to examine this process as it occurs in its context. Second, an instrumental case study design allows me to closely examine the activities, structures, and social norms surrounding each case (Baxter & Jack, 2008). This design leads to a deep understanding of science teacher leadership for instructional change in ways that address inequity.

Some scholars argue that the case study methodology may be most useful for generating hypotheses. However, case studies are well suited for both generating and testing hypotheses (Flyvbjerg, 2006). I propose that teacher-leaders are well positioned
to improve science instruction and address inequities at the classroom level. Each case is carefully selected to test this proposition and determine the conditions surrounding science teacher leadership for equity (Yin, 2003). An instrumental case study design can facilitate our theoretical understanding of science teacher leadership for equity.

To be clear, this study aims to learn more about the relationship between secondary school organization and culture and teacher leadership in science instruction that is geared toward educational equity. One way to investigate this relationship is through the selection of critical cases. The careful selection of cases provides insight into science teacher leadership for equity as each case is scrutinized and the results compared across cases. Lastly, a collective case study approach allows an exploration of how differences across local contexts, i.e. schools, relate to the process of teacher leadership in science instruction, leadership that is consistent with an equity focus (Baxter & Jack, 2008; Creswell, 2013).

The case study is bound in three ways to ensure feasibility. First, the target population consisted of science teachers who work to influence the conditions of teaching and learning for all students through increased participation in decision-making (York-Barr & Duke, 2004). Second, the science teachers were described as leaders when participating in decision-making and influencing others at the school level. Lastly, these science teacher-leaders self-identified as equity-minded through their work to address or eliminate the marginalization of students and improve science instruction for those who have not been well served due to their race, ethnicity, class, or language (Ishimaru & Galloway, 2014). There is scant research on the intersection of teacher leadership and equity in science education, particularly at the secondary level. To
contribute to the knowledge base, only those science teacher-leaders who are working within a middle or high school were included.

**Participants**

Ideally, the primary research participant is an equity-minded secondary science teacher working on an NGSS-related instructional leadership project or working as an NGSS-related instructional leader within secondary schools. Science teachers who shared these four characteristics: a) work at the secondary level b) provide instructional leadership, c) have an equity orientation based on self-report, and d) are located within a reasonable travel distance for the researcher, were targeted for recruitment. Four science teacher-leaders with an equity focus were enrolled in the study (see Table 1). There were two White science teacher-leader participants, one male and one female, and two science teacher-leader participants of color, both of whom were female. Two of the science teacher-leader participants self-identified as middle-aged and one self-identified as homosexual. Three of these science teacher-leaders taught 9th graders in public high schools while the fourth science teacher-leader taught eighth graders in a public middle school. All of the science teacher-leaders are experienced teachers with more than 5 years of classroom teaching experience, and two possess more than twenty years of classroom teaching experience.
Table 1. Summary of science teacher-leader participants

<table>
<thead>
<tr>
<th>Case</th>
<th>Name</th>
<th>Identity</th>
<th>Years of Teaching</th>
<th>School location</th>
<th>Type of School</th>
<th>Grade Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Pilar</td>
<td>African-American, middle-aged, female</td>
<td>&gt;20</td>
<td>Suburban</td>
<td>Public, Middle School</td>
<td>8</td>
</tr>
<tr>
<td>B</td>
<td>Jazmin</td>
<td>White, homosexual, female</td>
<td>6</td>
<td>Urban Periphery</td>
<td>Public, High School</td>
<td>9/10</td>
</tr>
<tr>
<td>C</td>
<td>Cierra</td>
<td>Black, Latina, female</td>
<td>7</td>
<td>Urban Periphery</td>
<td>Public, High School</td>
<td>9</td>
</tr>
<tr>
<td>D</td>
<td>Craig</td>
<td>White, middle-aged, male</td>
<td>&gt;20</td>
<td>Urban Core</td>
<td>Public, Magnet, High School</td>
<td>9</td>
</tr>
</tbody>
</table>

Data collection

To recruit a purposeful sample, I spoke with colleagues, former colleagues, science teachers, and professors to identify science teacher leaders focused on equity. I recruited participants from among friends, colleagues, and former colleagues, i.e. teachers connected to me personally and/or professionally through associations as a former secondary science teacher, associations as a doctoral student, and as a participant in community organizations. A recruitment email was sent to each science teacher-leader and each of the four science teacher-leaders agreed to participate. The discussion at the initial, face-to-face interview centered on the science teacher-leaders’ views on science instruction and equitable educational practices. We determined a convenient time frame to shadow the science teacher-leader and conduct observations of their leadership. In cooperation with the science teacher-leader, I sought to identify two to three colleagues, an administrator, and the principal who may consider participating in the study.
Data were collected to explore how teacher-leading enact equitable leadership practices for science instruction across four schools. The data consisted of interviews, observations, and artifacts of leadership. Each case involved three semi-structured interviews with the primary, equity-minded science teacher-leader who volunteered to participate. Cases A and B consisted of additional semi-structured interviews with two colleagues who worked with the science teacher-leader and in Case B, the principal. Cases A, B and C included an artifact of leadership, while cases A, B, and D included observations within the school setting. The interviews allowed participants to articulate their views, practices, perceptions of equity, school organization, and school culture. All semi-structured interviews were audio-recorded and later transcribed for in-depth analysis.

The observations allowed the researcher to obtain a holistic view of the enactment of the educational practices of the science teacher-leaders as they occurred within the school environment. Ethnographic field notes were taken “contemporaneously with the experience and observation of events of interest” (Emerson, Fretz, & Shaw, 2011, p. 22). These notes captured how the science teacher-leader interacted within the school. I noted instances of leadership, instances when the science teacher-leader took on a leadership role, and instances when and if attention to equity occurred.

The artifacts supplemented the observations and interviews. Artifacts consisted of meeting agendas (Case A), meeting documentation (Case B), teaching schedules (Cases A & B), photographs of meeting spaces (Cases A & B), and documentation of a leadership project (Case D). Preliminary de-identified data was shared with participants
during final interviews, and consistent with member-checking, perceptions and accuracy of the data were then discussed.

A case study protocol (Yin, 2003) was used to increase the reliability of this research. It included an overview of the case, field procedures, case study driving questions, and a reminder for the development of my dissertation (see Appendix B).

**Tools and Instruments.**

1. Semi-structured interview protocols (1 for science teacher-leader (STL), 1 for Principal, 1 for 2-3 colleagues, see Appendix E)
2. Ethnographic field notes
3. Document outlining equitable leadership practices (see Appendix A)

**Procedures**

For recruitment, I contacted potential participants via email (see Appendix F) and word-of-mouth to provide an IRB-approved information sheet and consent form (see Appendix D). Next, I purposefully selected participants who a) work at the secondary level b) provide instructional leadership, c) have an equity focus based on self-report, and d) are located within a reasonable travel distance. Although small sample sizes are a criticism of research pertaining to teacher leadership, I recruited four science teacher-leaders to maintain feasibility. While a multiple-case study can require extensive time and resources beyond my means as a doctoral student, four cases of science teacher-leaders’ enactment of equitable leadership practices allowed for the careful comparison of cases for literal replication of the conditions and actions surrounding science teacher leadership for equity (Yin, 2003).
During the study, I conducted three semi-structured interviews with each of the four science teacher-leaders, totaling approximately 427 minutes of the interview data. The semi-structured protocol was designed to elicit responses that describe the science teacher-leaders’ perceptions of their role in leading for equity, school organization and culture shaped by and shaping their leadership practices, school culture related to their vision for science instruction, their enactment of equitable leadership practices, and their relationships with colleagues and leadership (administration). The first interview was an initial interview to establish rapport and discuss science teacher-leaders’ values, beliefs, and vision for science instruction that addresses or eliminates inequity, i.e.: the marginalization of students who have not been well served in schools, as well as improves school conditions. We also discussed the enactment of equitable leadership practices (ELPs) and I sought opportunities to observe those practices. During the second interview, the science teacher-leader reflected on and discussed ELPs using the document outlining equitable leadership practices (Appendix A) and drawing on their own experiences as well as discussing some implications of those practices. Lastly, the third interview involved closing thoughts and any reflections on the relationship between school organization and culture on the enactment of ELPs. Preliminary findings were revised according to science teacher-leaders’ feedback.

Interviews were also used to capture the perspective of those who interact with the science teacher-leader. At the initial interview, I asked to meet 2-3 colleagues the science teacher-leader works with in a leadership capacity. I invited those colleagues to participate in the study. I also asked to meet the principal and extended an invitation to participate. I conducted semi-structured, one-to-one interviews with each colleague and
each principal, totaling 200 minutes of the interview data. The purpose of these interviews was to discuss their observations and perspectives regarding the interactions and conditions surrounding science teacher leadership for equity as well as how the science teacher-leader’s practices have influenced their own. All interviews were audio-recorded and later transcribed for in-depth analysis.

Observations and document analysis provided additional data on the conditions surrounding the science teacher-leader’s enactment of ELPs. I conducted field observations of the science teacher-leader enacting equitable leadership practices by shadowing the science teacher-leaders and visiting their schools. I observed the ecology surrounding the science teacher-leader as a participant-observer and took extensive ethnographic field notes (Emerson, et al., 2011). Following each observation of the science teacher-leader’s enactment of ELPs, I summarized the social interactions using jottings and added these jottings and anecdotes to my ethnographic field notes. Lastly, I collected artifacts and documentation (agendas, pictures of layout, handouts, etc.) related to science teacher-leader’s enactment of equitable leadership practices whenever possible. Appendix D outlines the data collection process. Within tables 2 and 3, I provide a summary of the alignment between my data sources and my research questions (Baxter & Jack, 2008). Information from several data sources are linked to my research questions based on my review of the literature (Yin, 2003). This table lays the foundation for analysis.
<table>
<thead>
<tr>
<th>RESEARCH QUESTIONS</th>
<th>DATA SOURCE</th>
<th>INITIAL CODING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RQ1. How do participants describe educational practices related to equity and inclusion ...</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| a. when engaging in reflection | STL Interview protocol #1 & #3; Colleague Interview protocol; Principal Interview protocol | i. (Ishimaru & Galloway, 2014) Code ELP by number, e.g.: “ELP1”- “Reflecting”. These ELPs are parent codes. Sub-codes will be created based on participant responses, ex: “ELP1” \rightarrow “privilege”.
| | | ii. (Brown, 2004; Theoharis, 2007) Social Justice Leadership will be abbreviated “SJL” |
| b. when leading other teachers (informal, incidental, intentional, …), and | STL Interview protocol #1; Colleague Interview protocol; Principal Interview protocol | i. (Ishimaru & Galloway, 2014) Code ELP by number, e.g.: “ELP1”- “Reflecting”. These ELPs are parent codes. Sub-codes will be created based on participant responses, ex: “ELP1” \rightarrow “identity”.
| | | ii. (Hayes et al., 2016) “NGSS-inclusion”
| c. in actions extending beyond their classroom? | STL Interview protocol #1, #2, & 3; Colleague Interview protocol; Principal Interview protocol | i. (Ishimaru & Galloway, 2014) Code ELP by number, e.g.: “ELP1”- “Reflecting”. These ELPs are parent codes. Sub-codes will be created based on participant responses, ex: “ELP1” \rightarrow “bias”.

Table 3. Alignment of Research Question 2 and data sources

<table>
<thead>
<tr>
<th>RESEARCH QUESTIONS</th>
<th>DATA SOURCE</th>
<th>INITIAL CODING</th>
</tr>
</thead>
<tbody>
<tr>
<td>RQ2. How are participants’ equity practices related to “organization structures and social norms” …</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. when engaging in reflection</td>
<td>STL Interview protocol #1; Observations</td>
<td>i. (Ishimaru &amp; Galloway, 2014) Code ELP by number, e.g.: “ELP2”- “Examining”. These ELPs are parent codes. Sub-codes will be created based on participant responses, ex: “ELP2” → “dialogue”.</td>
</tr>
<tr>
<td>b. when leading other teachers (informal, incidental, intentional, …), and</td>
<td>STL Interview protocol #2; Colleague Interview protocol; Administrator Interview protocol; Artifacts; Observations</td>
<td>i. (Ishimaru &amp; Galloway, 2014) Code ELP by number, e.g.: “ELP2”- “Examining”. These ELPs are parent codes. Sub-codes will be created based on participant responses, ex: “ELP2” → “dialogue”.</td>
</tr>
<tr>
<td>c. in actions extending beyond their classroom?</td>
<td>STL Interview protocol #1; STL Interview protocol #2; Artifacts; Observations</td>
<td>i. (Ishimaru &amp; Galloway, 2014) Code ELP by number, e.g.: “ELP2”- “Examining”. These ELPs are parent codes. Sub-codes will be created based on participant responses, ex: “ELP2” → “dialogue”.</td>
</tr>
</tbody>
</table>

Data analysis

Three kinds of data, (1) qualitative interviews (2) field observations and (3) structural artifacts, were collected and later analyzed qualitatively (Miles & Huberman, 2014; Saldana, 2016).

Analysis of interviews: Transcription of audio-recorded interviews was performed by a third-party vendor, Temi. It is a web-based, automated audio-to-text transcription
service. The audio file was uploaded into a password-protected Temi account. Completed transcripts were reviewed, edited for mistakes, de-identified, and downloaded. Transcripts were read and re-read for patterns and themes.

First-round coding was provisional, based on a-priori codes that corresponded to seven equitable leadership practices chosen for this study of teacher leadership (see Tables 2 and 3). The following passage illustrates first-round coding:

*being lumped in a category and having to be with that category and associate only with that category that you would make assumptions based on that category that I don’t identify with. So when I think about the racial issues, that’s where I go back to. There have definitely gotta be people in the African American category or the Latinx category or the Asian Pacific category. That’d be like, no…* (personal communication, April 5, 2019).

This excerpt was coded with the parent code “ELP 1” Reflecting and the sub code “identity”. During interview #2 with Jazmin, she reflected on how her targeted identity raises her awareness of complex identities and inaccurate assumptions.

NVivo software was used to facilitate coding, memo-ing, and organizing the de-identified data and analysis material. Following multiple readings of the data, codes were condensed, emergent codes were added to the codebook, and unused codes eliminated. Analytical memos were written to facilitate code mapping prior to beginning the second round of coding (Saldana, 2016).

Concept coding (Saldana, 2016) was used for the second round of coding. Concepts from leadership for learning and social justice leadership were used to inform
the codebook (Saldana, 2016), i.e. vision, values, & resistance. Data displays were created to organize emergent themes (Miles & Huberman, 1984).

Analysis of field observations: Field notes were fleshed out with analytic memos. Immediately following an observation of the science teacher-leader’s enactment of equitable leadership practices, I dedicated a minimum of fifteen minutes to write my reflections and thoughts in an effort to capture the dimensions of social interactions as the situation unfolded. I later revisited these notes post-observation and added details and impressions (Emerson et al., 2011). These field notes were analyzed and coded. Concepts from social justice leadership theory, i.e. resistance, were used during the second round of coding of the field observations.

Analysis of structural artifacts: The artifacts were read and examined for patterns and themes. Codes from the codebook were applied and analytic memos were written about emergent themes. This data source was used to triangulate emergent themes.

The results of these analyses were shared with the science teacher-leaders and an open-dialogue was established for the purposes of member checking and validation. The codebook was iteratively revised in light of participants’ feedback, for example ELP 6 *Family inclusion* was omitted while ELP 10 *Modeling* was added.

At level three, the cross-case analysis, I created a case-ordered display to facilitate a deeper understanding of the relationship between science teacher leadership for equity and secondary school settings (Miles & Huberman, 1994). The cases were ordered according to the schools’ instructional leadership structure, then the science teacher-leaders’ roles, and lastly the equitable leadership practices enacted by the science teacher-leader, ordered from most to least prominent. Additionally, the science
teacher-leaders reported practices in relation to an issue of equity. The issue of equity facing the science teacher-leaders was added to the matrix. I compared the prominence of the equitable leadership practices across cases and noted relations among the practices, the science teacher-leaders’ role within the instructional leadership structure and the issue of equity facing the science teacher-leader. The findings from the cross-case analysis is reported in Chapter 4.

Limitations.

The study followed a qualitative case study design when the primary methodology for this area of research has been qualitative (Wenner & Campbell, 2017). A qualitative case study design is the most appropriate method for capturing the multiple data sources needed to address my research questions. There is scant research on the intersection of equity, teacher leadership practices, and science instruction and this design is appropriate for examining the complex process of teacher-leaders enacting equitable leadership practices within the structures and characteristics of secondary schools.

Another critique of research on teacher leadership is that only 61% of studies included in a recent review used theory to inform their work (Wenner & Campbell, 2017). The theories of leadership for learning and social justice leadership guide the conceptual framework for this study. Specifically, this study relies on the instructional leadership model, noted herein as leadership for learning (Hallinger, 2011), equitable leadership practices (Ishimaru & Galloway, 2014), and social justice leadership as the theories for the conceptual framework informing the design, data collection, and analysis.
This study is likely influenced by my subjectivity as an African-American, middle-aged female, former urban science teacher, and current teacher educator/educational researcher. I accept limitations associated with science teacher-leaders’ self-report of an equity-focus, their practices, and the conditions surrounding their work. Multiple data sources are used to increase the trustworthiness of this case study. I accept the small sample size of this study as necessary for an in-depth understanding of discipline-specific teacher leadership focused on equity. I anticipate that my assumptions and biases influence my work. Thus, I report my subjectivities and control for confirmation bias by bracketing, memo-ing, and member-checking with participants.

Chapter 4: Findings

This chapter contains four case descriptions. The descriptions are presented based on the conceptual framework, beginning with the context for the science teacher-leaders’ leadership work, followed by the science teacher-leaders’ roles within the school, and lastly with individual aspects, i.e. vision and goals that impact their leadership. Individual case analyses using the social justice leadership framework follow each case description. The conceptual framework is then revisited. The chapter ends with an analysis of the tensions that emerged from a cross-case analysis.

The setting for this study involves town classifications, i.e.: wealthy, suburban, urban periphery, rural, or urban core (Levy, Rodriguez, Villemez, 2004) that are used to describe school districts. Population density, household income, and poverty levels are the categories used for town classification. Wealthy districts are located within towns with above average household income, while rural districts are located within towns with average household income. Urban core districts are located within towns with the
highest population density, the highest poverty levels, and the lowest income levels. Urban core districts also have the highest percentages of Black and Latino populations. Urban periphery districts are similar to urban core districts in that both are located within towns that have high population densities and below average income levels. However, urban periphery districts are located within towns with average poverty levels. Suburban districts are located within towns with low poverty levels, above average income levels and a moderate population density. The schools in this study are located in suburban, urban periphery, and urban core districts as summarized in Table 4.

**Table 4.** Description of school districts in this study

<table>
<thead>
<tr>
<th>Study Participants’ Schools</th>
<th>Classification</th>
<th>Population Density</th>
<th>Household Income</th>
<th>Poverty Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crescent Middle School</td>
<td>Suburban</td>
<td>Moderate</td>
<td>Above average</td>
<td>Low</td>
</tr>
<tr>
<td>Matador High School</td>
<td>Urban Periphery</td>
<td>High</td>
<td>Below Average</td>
<td>Average</td>
</tr>
<tr>
<td>McMan Commerce Academy</td>
<td>Urban Core</td>
<td>High</td>
<td>Low-Below Average</td>
<td>High</td>
</tr>
</tbody>
</table>

**Case A**

**The context.**

Crescent Middle School is part of a suburban school district and the school’s science department began modifying science instruction around 2017. The work to design units, lessons, and assessments to meet the instructional expectations embedded in NGSS is ongoing. As illustrated in Figure 2, leadership is organized hierarchically with the principal as the primary leader. Some administrative duties, analyzing standardized test data for example, are delegated to facilitators. Facilitators
are formal teacher-leaders within the academic content areas: math, language arts, science, and social studies, and they are required to have an administrator qualification.

Figure 2. Organizational structure for Pilar's leadership within Crescent middle school

Case A focuses on the real-time practices of a science teacher-leader, Pilar, as she pushes for equity within Crescent Middle School. Pilar, a teacher with over twenty years of teaching experience, is the only African-American teacher at Crescent Middle School. She occupies a formal teacher-leader role, science facilitator, while carrying a full teaching load of five-8th grade classes containing a total of 91 students. There, teachers meet weekly, once in grade teams and another time by academic subject. The principal is the formal leader of the grade teams, while the academic subject teams or
content groups are led by facilitators. As Case A centers on Pilar, I report on her grade team and content group.

There are eight teachers in the 8th grade team, two teachers per subject area. At the time of this study, the district hired and placed an additional, part-time science teacher in Crescent Middle School. The science teacher splits her time between the two eighth-grade science classes, one day in Pilar’s classes and another day in Tabitha’s (Pilar’s science teacher colleague) classes, providing support to students as needed. The part-time science teacher does not participate in grade team meetings nor in content group meetings. The content group for science, i.e. the science department, consists of six experienced teachers, two from each grade. All of whom have more than five years and four of whom have more than ten years of teaching experience. Pilar participates in the scientific research-based intervention team (SRBI) and the 8th grade team. Additionally, she leads the science content group as the science facilitator (see Figure 2).

Roles and relationships.

Case A demonstrates the complexity of balancing the roles of teacher and leader within a middle school. A typical school day extends well beyond the first and last bell. For Pilar, Monday morning begins long before sunrise. She takes care of her family and, as the sun peeks above the horizon, she sets off toward her school building. For the month of October, Pilar is assigned bus duty which means she stands outdoors to greet students as they arrive. Middle school students, individually or in pairs, appear sliding out of cars or stepping down off school buses. They walk, most weighed down by large backpacks, toward the school building, where Pilar offers a robust “Good Morning” and
waves periodically to the adult drivers. Some students return the greeting, some smile, while others mumble a reply or respond with a nod. After approximately seven minutes in the brisk morning air, Pilar enters the building and her demeanor shifts. More urgently, Pilar heads down the main hall to her classroom, greeting staff and students along the way. These early morning greetings reflect her commitment to developing relationships that will set the foundation for her leadership practices.

Teacher.

Pilar created a classroom culture where students take an active role in its management. Roles are organized into pairs and students select from these on a monthly basis. Class typically begins as follows: students enter and take their assigned seats, while the ‘do now’ pair distributes the ‘do now’ sheet. After approximately 5 minutes, the ‘do now’ pair walks to the front of the room, one of the pair asks, "who has an answer?". Students raise their hands and one of the ‘do now’ pair calls on a peer. The ‘do now’ pair asks if anyone would like to add to the response or if everyone agrees or disagrees. The class reaches consensus with nods or student-led call and response. The ‘do now’ pair returns to their seats while the ‘lesson review’ pair walks to the front of the room. The ‘lesson review’ pair states what the class has done or worked on the prior day and returns to their seats. Another pair gets up and reminds the class of the essential question (not verbatim from the board) and informs the class of where the work is situated in the 5E unit. Another pair walks to the front and sets the due date for the homework based on class consensus.

During one of the lessons, Pilar intervened to point out to four of the five classes that the due date should have less time. However, the class requested more time based
on their workload including assignments from other classes. Pilar allowed students to set the due date for their assignment after pressing them for a rationale. Students actively participate and direct their learning.

A new pair of students walks to the front and reminds the class of what they will do and how they will work. The pair then asks if anyone would like to change anything and when no responses were received, returned to their seats. Another pair reviews the rubric and reminds students to refer to the rubric as they work. At this point, Pilar adds reminders, such as wearing safety goggles, etc. Students are prompted to work. They worked in pairs for the duration of my visit. Pilar circulates amongst the students and probes with questions.

At the end of a class period, typically within the last 5 minutes, students again take on their roles. A pair goes to the NGSS board and identifies which aspects of the three dimensions the class used. For example, following the pendulum lab lesson observed, the pair selected the following dimensions for their learning: DCI: physical science; SEP: planning and conducting experiments; and CCC: cause and effect. The pair checks for class consensus or disagreement over the pair’s selection. Another pair walks to the front and asks for a four-finger check of student understanding for the unit. The class responds by holding up anywhere from 0-3 fingers.

Technology is incorporated into science instruction daily. All of Pilar’s students have access to shared documents (consensus sheets, an interactive notebook table of contents, lab rubrics, etc.) via Google classroom and each student has an assigned Chromebook from the school. The eighth-grade classes are beginning a physical science unit on waves. The waves unit follows the 5E instructional model: Engage,
Explore, Explain, Elaborate, and Evaluate (Bybee et al., 2006); the lessons observed occurred during the Explore and Explain stages. On this day, student pairs either collect additional data or report data onto a class consensus sheet. Pilar adds information to the shared consensus sheet, while each student copies, pastes, and adds information into their own copy of the consensus sheet.

Prior to beginning the new unit, Pilar reviewed expectations for an upcoming interactive notebook check. Students had the opportunity to revise and add to the notebook as needed. Pilar also returned students' final explanation of the car crash phenomenon, a performance task from the prior unit. She reviewed expectations for citing text-based evidence and emphasized that students' will be held to a high standard when citing. As these housekeeping activities wound down, students assumed their roles as described above.

**Leader.**

In addition to classroom teacher, Pilar is the science facilitator for Crescent Middle School. It’s a two-year position that involved a criterion-based application process. At the time of appointment, Pilar was the only member of the department with an administrator qualification. Pilar’s leadership duties include organizing and facilitating monthly science department meetings, acquiring and distributing science materials for the department, coordinating summative and standardized testing schedules, and compiling and disseminating assessment data.

Pilar believes that all students are capable of learning and that teachers should adapt and modify instruction to support student learning. These beliefs are evident in her leadership practices. She identifies a number of challenges facing the science
department at Crescent Middle School. One challenge was that a significant number of students from the sixth and seventh grades were assigned remediation in the form of homework club rather than enrichment in the form of specialized classes. Pilar states,

*The majority of the students, they’re in that homework club because they are failing science. I want to address it with the teachers, their use of scaffolding in order to help support students in their work you know, as a strategy. You know, talk [to the teachers] about some strategies that can be used to help students and to meet the needs of all of them [students].*

During the February science department meeting, Pilar introduced scaffolding to the teachers as a strategy for supporting students in class in contrast to the homework club. She modelled the instructional technique and invited teachers into her classroom to observe implementation of scaffolding.

Pilar uses her position as science facilitator to push teachers to consider how their actions and practices impact students’ success in science classes. She expresses her belief that teachers should reflect on their views and their practices regularly to address inequity within the classroom and the school:

*Another meeting I had with the teachers, I showed them a picture of equity...I discussed and reflected with them about equity. I think it’s really important and we talked about it because we talk about NGSS. We do like many of the aspects [of NGSS], especially, giving everybody a fair opportunity to engage in the science. Starting [students] on the same playing field with all the phenomenon and models and all that stuff, so that’s pretty cool.*

In this excerpt, Pilar expresses the view that dialogue is an important component for addressing inequities. She talks about how phenomenon-based instruction and its alignment with NGSS and Framework expectations relate to fairness. Pilar goes on to
discuss a few instructional strategies that teachers could use to reach all students and facilitate their learning of science concepts.

Pilar models equitable practices and self-reflection in her classroom. When reflecting on issues of equity within her classroom, she shares her thoughts on working with a student with autism, ‘Patrick’:

So, I know the student is unique, [he] doesn’t fit what we call normal mode and [into] this education thing. Cause I have kids in that same class, come every day on time, start their classwork, finish their homework, and [are] engaged. This kid wasn’t [doing those things], so I needed to know what I needed to do for me to establish equity. [In other words.] I wanted him [Patrick] to get the same out of this class as that young lady or that young man [who were] doing everything they’re supposed to do. So, there are times when you [as a teacher] got to do things differently. You [the teacher] got to think out of the box to help kids. It’s doing whatever it takes in order for them to be successful.

Pilar’s reflection demonstrates her belief that all students are capable learners and that teachers should adjust their practice to better suit students' needs. Within her classroom, she works to empower students to take control of their learning.

**Relationships (Social Identity).**

Pilar experiences social pressure at Crescent Middle School as an African-American role-model:

*When I first got here [Crescent Middle School], I had people coming to visit me. Parents say: “Tell me a little bit about yourself.” Then, kids [would] come in and say, “I just wanted to see you.” I had a kid from eighth grade come and visit: “I just wanted to see you.: I said, “Why?” He goes, “I’ve never seen an African-American teacher.”*
She serves as an African-American role model even beyond this middle schools’ walls. In a recent encounter with educators from her school district, Pilar is aware of her isolation as the only African-American teacher. Pilar highlights her experience on a district-sponsored day-long trip to a college for professional development. A summary of the incident is narrated below:

Teachers, school, and district administrators attended. Pilar was among the first to arrive and purposefully occupied the front seat on the bus. An assistant superintendent, in response to urging from colleagues, asked Pilar to move from the seat. Pilar declined to move indicating a need to sit where she was. However, some colleagues continued to talk and one told Pilar that she was supposed to hold the seat for a friend and asked if the friend could sit with her. Pilar consented to sharing the seat despite her initial introduction to the friend. The ‘friend’ was a teacher from another school who questioned who Pilar was as soon as the ‘friend’ entered the bus. The ‘friend’ voiced her discontent about someone occupying the front seat that she needed due to motion sickness. Conversations among some of the teachers and administrators on the bus continued until the superintendent was prompted to ask Pilar to trade places with the ‘friend’. Pilar refused. Pilar firmly announced that she was willing to share the seat, that she arrived early for a reason, and is unwilling to relocate or to continue talking about the seat. She heard some continued mumblings and saw some people looking at her and talking among themselves through the rearview mirror. However, no one explicitly said anything more. At the conclusion of the event, Pilar was reminded that the incident was not over. When she returned to the bus, she found someone had moved her belongings from the front seat and placed them in the back. No one else had their belongings moved. Pilar confronted the entire group. She pointedly asked, why, as educators, no one asked if Pilar had a need to be accommodated. Pilar wanted to know why the ‘friend’s’ need was assumed to be more important than Pilar’s need. None from the group of teachers and administrators who pushed for Pilar to relocate
responded. Pilar’s last message to the group was another pointed question whether children were being treated as Pilar was: “Were brown girls and boys having someone else’s need placed above theirs?”

Pilar is neither outraged nor shocked by the incident. She uses storytelling to facilitate our conversation about equity. Pilar used this incident to bring to light microaggressions and illustrate the impact of bias within the science department and the school. As Pilar reflects on this situation, she is saddened and continues to wonder whether or not educators automatically question the validity of accommodations for black and brown children under their care.

**Vision (Perceptions of equity).**

Pilar’s experiences with equity occur not only within her own classroom, but also during interactions with other educators. She works with teachers and pushes them toward more equitable teaching practices:

> *Growth, having that growth mindset and opening up and receiving information from somebody you know, you might not relate to as well, [to] relate to somebody that looks a bit different.*

Here, Pilar is referencing growth mindset as a way to assist teachers during change. As a staff, Crescent Middle School teachers underwent a series of professional development sessions to engender a growth mindset amongst students. Pilar relies on the staff’s shared language of growth mindset to push her colleagues to think about their response to her leadership and feedback.

Pilar talks about how her position as science facilitator has impacted her relationship with her colleagues.
Being out in this position as a science leader without being an administrator has put me in a weird spot from time to time. So my delivery has not always been accepted by my colleagues who have been placed under my supervision in a way. So sometimes, because we [as a staff] need to do certain things and have those tough conversations, I think some of my colleagues have kind of pushed me away. We’re not as close as we used to be.

Not only does Pilar feel isolated from her colleagues, she also feels her demeanor influences the extent to which teachers accept her leadership. In this case, science teacher leadership for equity is costly for Pilar both socially and personally.

State adoption of NGSS is a policy change that sets the stage for change at the classroom level. Equitable leadership practices (ELPs) are used to describe the educational practices used by the science teacher leaders to promote equity. Figure 3 provides a summary of the five equitable leadership practices that appear throughout this study. One or more of the ELPs will be referenced in each case within the analysis sections.
Figure 3. Summary of equitable leadership practices. Numbers reference tool appearing in Ishimaru and Galloway, 2014

Case A: Analysis.

Case A findings are based on three, in-depth interviews with Pilar, individual semi-structured interviews with two colleagues, field observations at Crescent Middle School, agendas and notes from several science department meetings led by Pilar, and Pilar’s work schedule (see Table 5). The evidence captures many of Pilar’s educational practices, both instructional and leadership. Table 5 illustrates which data sources triangulate on her equitable leadership practices and on the different dimensions of social justice leadership. Four of Pilar’s educational practices are consistent with four equitable leadership practices (see Figure 3) that I will now elucidate.

The first practice, Reflecting (ELP #1), illustrates Pilar’s self-reflection for equity:

*I know what it feels like to not have a need met while in school. So, it’s really important to me. I try to meet the needs of all of them [students].*
The statement reflects Pilar’s heightened awareness of issues of equity, as well as her commitment to address them. During one of our talks after school, Pilar expressed concern about the learning of a student struggling with a (dis-)ability. The student, Adam, was losing his eyesight and struggling to adjust to the physical changes. Pilar maintains contact with the family. Just as she had with Patrick, Pilar recognized Adam retreating from classroom interactions and she sought ways to counter deficit-thinking around Adam’s (dis-)ability. She works to ensure Adam is included in conversations with his parent about science class. I observed her strategic use of scaffolding to include Adam in both the classroom learning activities and the decision-making process. Not only did Pilar share scaffolding resources with her colleagues, she uses them to promote inclusion within her own classroom. Pilar’s experiences with equity and her awareness of inequities that students may face allows Pilar to engage with colleagues around educational practices that address inequity in science education.

The second practice, Examining (ELP #2), involves Pilar’s work to engage in dialogue and collaboration, grounded in an understanding of disparities, to provide high-quality instruction for every student. As noted previously, Pilar has a heightened awareness of inequities based on her firsthand experiences surrounding race and (dis-)ability. She engages her colleagues in dialogue to reach a shared understanding of how one’s actions can impact issues of equity. Pilar pushes colleagues to discuss issues of equity as evidenced in the October science team meeting agenda. She states,

*We got together in our meeting [October science team meeting], you know, we talked about fairness. We talked about the points kids could earn if it was certain situations. We went through scenarios: they [students] do this, this, this, they [students] won’t be able to even come back from that [loss of points] you know.*
So we went through that [discussing what-if scenarios] and had the hard conversations about those [scenarios].

Teachers felt that providing a scoring rubric promotes equity since all of the students have an equal opportunity to maximize their score by following the rubric. Pilar pushed the collective of teachers to question the structure and language of the rubric. Different scenarios were posed in which teachers could preempt students’ choices. The entire group of teachers examined the rubric and determined the organization penalized students so severely for minor errors that a student knowledgeable in the science concepts could fail the assessment if conventions were not followed.

Teachers faced a dilemma. Knowing science concepts without knowing scientific convention is insufficient. Yet valuing conventions places at least 2 groups of students at a disadvantage: (1) students who had not received science instruction in prior grades and (2) students whose home values differed from the science conventions. While the scoring rubric was intended to provide all students with an opportunity to maximize their score, it also further disadvantaged certain groups of students.

The conversations within the October science team meeting may have resolved the equity dilemma embedded in the rubric, but more importantly, the conversations shed light on one way that practices must be examined and questioned if the intention is to promote success for each student. Pilar’s practice of questioning and discussing teachers’ instructional decisions is consistent with Examing in that the collaboration centers on examining a scoring rubric using an equity lens even as equity was not explicitly named in the conversation.
Pilar also fosters conversations about issues of equity and equitable instruction outside of the science team. Her 8th grade team colleague, Greg, indicates that  

*Equity comes up and we make sure it does. We don’t … it’s … it’s one of those topics that people don’t like to talk about necessarily. I think it needs to be just said like, “Are we doing the right thing per this or that student?”*

Pilar engages others to question and modify instructional practices in light of inequities students may face within the school.

The third practice, *Promoting* (ELP #4), involves Pilar’s use and promotion of equitable instruction. Tabitha, a science teacher, does not think that equity is a focus in the science team. Tabitha describes the science team as focused primarily on implementing NGSS into instruction. Although she mentions differentiation and time within a lesson to assess, meet, and work with students, Tabitha attributes these instructional practices to NGSS implementation, separate from equity. Issues of equity are present even as those issues may not be acknowledged by all parties. Tabitha’s perspective provides insight into some of the resistance Pilar faces as she pushes colleagues to examine their practices using an equity lens. The concept of resistance will be explored later in the analysis of case A. Here, I highlight a distinction between Tabitha’s views on equity and Pilar’s views. While Tabitha describes equity as important, it is removed from her current instructional practices, distant. Pilar says,

*We discuss it and talk about our instructional practices and, um, how equitable are they. I think it’s a hard conversation and one of those tough conversations that need to be had, and not just with us.*
For Pilar, implementing NGSS, differentiation, and other instructional techniques are necessary to provide access to content and to meet the needs of every student. The rationale, her perception of equity, is central to Pilar’s instructional practices and her instructional leadership. Addressing inequity is a primary target for Pilar and integrated with high-quality science instruction. Both science teachers are similar in their view that science instruction must change. Where their views differ is in relation to their perception of equity. Pilar leverages her experience with inequity and her position as science facilitator to question instructional decisions and promote practices for equitable instruction. She pushes colleagues to think creatively about how to provide additional help for individual students across different classes and with limited time afterschool.

The fourth practice, ELP #10, is Modeling. Pilar leads by example and works toward more democratic aims of teaching:

*My kids run the classroom and that’s the… I have a reason for that. Well, they have a voice and they have input.*

Students have input in classroom management. Pilar encourages students to work collectively to set due dates and to manage learning activities. Pilar’s classroom management style reflects her belief in participatory learning. Pilar invites colleagues into her classroom to encourage colleagues to use equitable instruction in their classrooms. Greg, a member of the 8th grade team, shares how he is influenced by Pilar’s leadership,

*Pilar is really good at having the kids run the show. She wants them to make due dates. I try to incorporate certain things like that in here [Greg’s classroom].*
Pilar designates time in the science meeting agenda to talk with colleagues about equity. She shares her experiences with equity and poses reflective questions such as ‘whose needs are being served by the homework club policy?’ and ‘are we as educators using the most appropriate strategies to support the learning of each child?’.

Table 5. Summary of Case A findings related to RQs. An ‘X’ indicates evidence of the leadership practice. A (+) indicates evidence that corroborates the leadership practice. A (–) indicates evidence that contradicts the leadership practice.

| RQ 1: How do participants describe educational practices related to equity and inclusion? |
|---|---|---|---|---|
| **Data Source** | Reflecting | Examining | Promoting | Lobbying |
| STL Interviews (qty: 3) | X | X | | X |
| Interview with others (qty: 2) | (+) | (-) & (+) | | |
| Observations | (+) | (+) | | (+) |
| Artifacts | (+) | (+) | | |

| RQ 2: How are participants’ equity practices related to “organizational structures and social norms”? |
|---|---|---|
| **Data Source** | Resistance enacted | Resistance faced |
| STL Interviews (qty: 3) | Examining (ELP #2) | science teachers |
| Interview with others (qty: 2) | (+) | (+) |
| Observations | | (+) |
| Artifacts | (+) | |

A social justice leadership framework (Theoharis, 2007) is applied to understand how Pilar’s leadership practices attend to equity. Three constructs, i.e.: the resistance the leader “enacts against historic marginalization of particular students” (p. 248), the
resistance a leader “faces as a result of their social justice agenda” (p.248), and the resistance the leader “develops to sustain their social justice agenda in the face of resistance” (P. 248), all set social justice leadership apart from other types of leadership. I discuss Pilar’s leadership practices in terms of the resistance she “enacts”, “faces”, and “develops” to provide a high-quality education to every student. Of the four educational/equitable leadership practices described above, I use Examining (ELP #2) to illustrate one way that Pilar leads for equity and social justice.

Teacher-leaders who regularly examine their own and other’s craft, who foster dialogue and inquiry based on an understanding of disparities to provide equitable instruction are doing Examining (ELP 2). For Pilar, equity means that teachers are constantly working to meet the needs of each student. Pilar reflected on meeting the needs of students with (dis-)abilities. Rather than rely on assumptions using an able-bodied perspective, she considers each student capable of learning and selects strategies that would enable the students with (dis-)abilities to fully participate in learning.

The October science team meeting illustrates one way that Pilar uses her formal position of science facilitator to engage her colleagues in dialogue by setting aside time during the monthly science team meeting to discuss issues of equity. Greg, a colleague outside the science department, reported that he and Pilar often converse about issues of equity within the school and community. Conversations, similar to the ones illustrated above, give rise to self-reflection and metacognition. These conversations are often uncomfortable, yet necessary for addressing disparity. These conversations function to raise awareness around an issue of equity and adjust educational practices accordingly.
The bus seating incident demonstrates how educators can completely overlook the less visible physical disability of one person, Pilar, to address the needs of a more vocal person, the ‘friend’. Pilar’s targeted identities in race and ability help shape her awareness of disparity in education. Pilar articulated a disparity between the needs of an African-American, (dis-)able-bodied person and the needs of a White, able-bodied person to the educators involved in the bus incident. Her reflections on the microaggressions she experiences as an African-American teacher and (dis-)abled person supports Pilar’s awareness of how students can be silenced or marginalized. Her awareness of disparities influences her leadership actions. She engages her colleagues in *Examining* (ELP 2) to raise educators’ awareness of disparities.

Yet, Pilar’s actions are not always well-received:

*sometimes a culture, um, will not allow you to put things into practice. Um, you know, you’re limited sometimes in what you [are permitted to] do. So I have certain views that I don’t put into practice because of that.*

Pilar is referencing her views on equity and her leadership practices. Teachers occupy a unique niche within the school. Pilar’s leadership for equity is constrained by and dependent upon her role as a teacher.

Tabitha concurs that Pilar faces resistance from members of the science team,

*It is what it is. But in terms of everybody else treating her that way, I don’t think she gets the respect that she deserves in terms of a leader by the department.*

Tabitha offers that resistance from the science team stems from another science teacher wanting the position. The science teacher worked in an informal capacity prior to the role being formalized. She has since vocalized that she should have the role
since she was already doing the job. Tabitha pointed out that Pilar was the only member of the science department with the required administrator qualification.

Pilar relies on her influence as an experienced, exemplary science teacher to work with her colleagues to examine their educational practices using an equity lens. She acknowledges that her views on equity are not shared throughout the science team and that the lack of a shared understanding limits such an examination of practice. While dialogue and collaboration around equitable instruction is a priority for Pilar, Tabitha exemplifies some of the resistance to using an equity lens to examine practices that Pilar faces from science teachers. Tabitha points out that implementing NGSS is the priority,

*I think the way we’ve structured our units and stuff, I think it’s like super-differentiated and I think it does allow us the time to go and meet with kids and see where their shortcomings are and work with them. Um, but do I think equity is a focus? I don’t think so.*

She does believe that equity has a place, although not as a focus for the science department, and Tabitha defines equity as giving all students what they need to succeed.

Tabitha acknowledges that students have different backgrounds and different abilities, she then shares how she attributes success for some students differently:

*My belief is, [if] I see that you’re [student] doing it. I’m not going to have you [student] do like 30 of them [questions], especially if you’re struggling with those three [questions]. That’s one example of where we [Tabitha & Pilar] do differ, but that’s not a bad thing. It’s just my…. the standards that I’m holding each kid to are different and if they [students] can show me they know it, I’m not, they don’t*
have to answer all 30 [questions]. If you [student] answer the three and you know it, then you’re good.

While there is not enough evidence to support claims about Tabitha’s assumptions, here we see that Tabitha’s assumptions about equity remain unchallenged during this exchange. Tabitha is describing her definition of student success and does not elaborate on the assignment being referenced in her example. This is one instance of how Tabitha’s views of equity and success differ from Pilar’s. In this example, Tabitha resists examining the assumptions underlying her statement that students struggling to answer 30 questions could demonstrate proficiency by answering a tenth of the questions posed. Tabitha does not elaborate on how answering 3 questions out of 30 is considered ‘good’ enough for some groups of students.

Pilar is persistent in leading for equity as a science teacher-leader by working alongside her colleagues. She works to combat science teachers’ resistance to examining assumptions that impact teaching and student learning by setting aside time during science department meetings and probing adult thinking with targeted questions.

Pilar relies on her social network to counter the resistance she faces and to support her as she leads for equity. Pilar turns to the other content facilitators in her school for leadership support. These colleagues discuss strategies and trends. Pilar turns to Greg and her principal for support in dealing with teachers’ resistance to addressing inequity. For example, the principal implemented an instructional policy, NGSS boards, subsequent to discussion with Pilar. The NGSS boards are poster boards, displayed in the classroom and referenced by students to orient their learning to the expectations embedded in the standards. In Pilar’s class, a pair of students
culminated the lesson by referring to the NGSS board to determine which of the three dimensions the class was working on. The NGSS board is another instructional strategy that Pilar shared with the science team in order to empower students to monitor their learning. Resistance within the science team manifested through teachers’ comments such as ‘NGSS boards are unnecessary’ and ‘an extra expense’. This resistance was countered through principal support. The principal promoted NGSS boards as a school-wide policy for science classes. Pilar also counters resistance from science teachers by adjusting her approach. Pilar has a powerful singing voice which she softens to relay her message to the science department. She reasons that sometimes people resist the delivery of her message rather than the message and if she adapts her delivery, then her colleagues may be more receptive to her leadership efforts.

Case B

The Context.

Matador is a large, comprehensive, neighborhood high school in the urban periphery school district of Mapleton. Jazmin is the primary science teacher-leader under examination in case B. Here, instructional leadership is shared. First, I describe the leadership structure at the school and Jazmin’s placement within that structure, then I narrow the focus onto Jazmin’s practices. As the principal and school leader, Robin sets the tone for the school building (see Figure 4). She leads the administrative team of two vice principals. Robin also directs a team of guidance counselors for a school with over 1,000 students and directs instruction through the department chairs. Her work with an external partner led to funding that was used to create flexible staffing, including additional guidance counselors and content teacher coaching positions, one for each of
the core areas: math, language arts, science, and social studies. These teacher-leader positions have been in place for five years at the time of this study. Robin targets the ninth grade as part of her vision for school improvement and equity. Her approach to increase the number of ninth graders promoted to tenth grade involves a teaming model for the ninth grade. A dedicated guidance counselor and additional staff made possible through the flexible staffing fund, i.e.: two permanent guidance counselors, two grant-funded counselors, and a grant-funded, flexible staffing counselor for 30 of the at-risk ninth graders, were assigned to the ninth-grade teams. Each of the two ninth grade teams also has four-core, content teachers, a physical education and a health teacher. The 17 members of the ninth-grade team meet regularly and work strategically to support ninth-grade students through the transition to high school. Jazmin is a former member of the ninth-grade team who now primarily teaches tenth grade science. Jazmin was selected and volunteered to fulfill the role of NGSS coach as part of her contractual duties. As the NGSS coach, she works with teachers throughout the science department as opposed to working only with the ninth-grade team. Schoolwide, teachers join various teacher/staff committees that tackle issues and projects delegated by Robin. Jazmin is a member of the district-wide equity team as her service committee.
Figure 4. Organizational structure for Jazmin’s leadership within Matador high school

**Roles and relationships.**

Case B also demonstrates the complexity of balancing the roles of teacher and leader within a high school. Jazmin arrives at the school around 6:00am. The first bell signals the students’ arrival at 7:15am while the start of class bell buzzes at 7:30 sharp. Jazmin meets with a pre-service teacher in the morning between 6:30-7:20am before the start of classes. Each class is approximately one hour. There are seven periods each day and eight periods for scheduling classes. Teachers with a five-class teaching load teach approximately four periods each day. However, the school follows a rotating letter schedule (A-D) so different classes meet on specific letter days. Teaching schedules vary across the rotating letter days. Jazmin does not have a typical teaching schedule and her prep period is often spent fulfilling her leadership duties. Student
dismissal occurs at 2pm. However, Wednesdays are unofficial office hours for Jazmin. Students stay from 2:15 to 3:00pm for extra credit, academic support, extra time, or missed work as well as teacher-provided snacks and juice boxes. During the athletic coaching season, Jazmin leaves school at 2:30 and coaches children till around 6. Outside of the athletic coaching season, Jazmin typically leaves school around 4pm to go home, take care of the dog, and have a meal. She often works well into the night on lesson planning and grading due to her busy school day schedule.

**Teacher.**

Given the rotating letter days and the eight-period class schedule, Jazmin teaches four or five classes daily. Jazmin is assigned primarily 10\textsuperscript{th} grade science classes with one 9\textsuperscript{th} grade class. Botany and Biology are the 10\textsuperscript{th} grade subjects while Integrated Physical Science is the 9\textsuperscript{th} grade content area. Her sixth class is an AP Biology class.

Jazmin has undergone extensive training for NGSS implementation. She continually reads, focusing on research in science teaching and learning. She reflects and modifies her practice based on her readings and student feedback. Jazmin is an active member of a professional learning community for leadership in and professional support with science instruction. Within her class, students are tasked with evaluating phenomena, as well as their own learning. Students’ evaluations are based on evidence and captured through criteria-based rubrics, questions, written responses, and discussions. Jazmin’s classroom serves as a model for instructional practices that are consistent with the expectations outlined in the Framework and NGSS.
**Leader.**

This is the first year Jazmin’s school implemented an eight-period schedule with most teachers assigned a support role within another teacher’s classroom as part of their contractual duty. In contrast, Jazmin picked up an extra class as an alternative to the support role path. She is carrying a six-class teaching load across three science disciplines. In addition to the extra class, Jazmin performs her newly created role of NGSS specialist/coach. She is available to support science teachers as they work to implement NGSS within their classrooms. One colleague reports,

*I utilize her more for the implementation of the NGSS protocol. Okay, what are they [administrators] looking for [?], for modeling [?], what are they looking for [?], for like a concept map [?] How do they want me to explain x, y [?], it doesn’t matter what it is. I can make shifts and I can, I have the content knowledge, I have two masters’ degrees, three classes until my PhD is finished. I’m pretty confident I know what I’m talking about. So, um, it’s just the implementation.*

Teachers visit her classroom to observe or for guidance. Alternatively, Jazmin is able to meet individually with colleagues or to conduct classroom walk-throughs to facilitate NGSS implementation.

*Relationships (Social Identity).* Jazmin recognizes both a targeted and an advantaged identity that has impacted her relationship with students. Jazmin identifies as a White, conservative, homosexual, female. With regard to her targeted identity, she states,

*We actually have multiple teachers who are very open with their sexuality here. I noticed their interactions and the number of my kids that were questioning and having trouble with certain stuff that kind of was, why am I... I can be a resource.*
She is an accepted member of the teaching staff and did not disclose any negative interactions as a result of her sexual identity. Jazmin shares how her advantaged identity impacts her worldview:

_We were doing SATs and there was a question of, ‘are you a U.S. citizen or not?’ And I had a kid in tears and I couldn’t figure out what the hell was going on and the kid was like: “If I put no, is ICE going to be on my door?” And one of the options is--working on becoming [a U.S. citizen] or something like that, and the kid’s in tears like: “my parents brought me here when I was two”. I asked: “Do you want to become a U.S. citizen?” And the kid was like: “Yeah.” [Jazmin responds to the student:] “Check that you are working on becoming one.” But then, I was thinking afterwards and thinking about the stress that was associated with this [question], ‘are you a citizen or not?’. That is going to 100% impact how the kid did on those… on that SAT. That has nothing to do with anything other than the privilege of being [a U.S. citizen], I am safe and I am a citizen of this country, versus not._

Jazmin relies on this and other reflections to set goals and guide her instruction.

**Vision (Perceptions of equity).**

Jazmin defines equity as access for all students and expresses her belief that all students can learn. In her instruction and when she leads workshops for other teachers, she focuses on transferrable skills such as problem-solving, critical thinking, and science and engineering practices. Jazmin states,

_If I define equity as access for all students, I am constantly making the argument with teachers about this kid can’t do this. I think that’s where I am constantly drawing that line and going: “No, this is an equity issue. You need to stop saying this kid can’t do this.”_
Jazmin relies on culturally responsive teaching strategies to address the marginalization of some student groups in classroom instruction. Jazmin shares her views on equitable instruction,

*I think our kids here hear a lot, and I hear it from them a lot, the story that they can’t, they can’t do it. Um, science is hard. They can’t do it. And I think when we are constantly showing them the people that did it that are different than them, it only perpetuates that feeling of: “Well, I can’t do it”. Whether it’s conscious or subconscious, and finding more and more stories of people that are similar to our kids, whether they are similar socioeconomically or culturally or ethnically or whatever it is. They get to see that it’s not the typical person who, the typical white male who is in science and just showing them that they can do it. I spend most of my year convincing them that you [students] can do it: “Whether you [students] believe it or not, we’ll [teacher & student working together to] get there.”*

These views are manifested in her work coaching and leading other teachers.

**Case B: Analysis.**

Case B findings are based on three, in-depth interviews with Jazmin, individual semi-structured interviews with two colleagues and the principal, field observations at Matador High School, documentation from science department meetings led by Jazmin, notes from Jazmin’s equity leadership project, and Jazmin’s work schedule (see Table 6). Table 6 illustrates which data sources triangulate on the equitable leadership practices and the different dimensions of social justice leadership.
Table 6. Summary of Case B findings related to RQs. An ‘X’ indicates evidence of the leadership practice. A ‘(+ ’) indicates evidence that corroborates the leadership practice. A ‘(- )’ indicates evidence that contradicts the leadership practice.

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Reflecting</th>
<th>Examining</th>
<th>Promoting</th>
<th>Lobbying</th>
<th>Modeling</th>
</tr>
</thead>
<tbody>
<tr>
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<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
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<tr>
<td>Observations</td>
<td>(+)</td>
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<tr>
<td>Artifacts</td>
<td></td>
<td>(+)</td>
<td>(+)</td>
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<td></td>
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</tbody>
</table>

RQ 2: How are participants’ equity practices related to “organizational structures and social norms”?

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Resistance enacted</th>
<th>Resistance faced</th>
<th>Resistance developed</th>
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<tr>
<td>STL Interviews (qty: 3)</td>
<td>Promoting (ELP #4)</td>
<td>science teachers</td>
<td>Individuals for support PLC for support</td>
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<tr>
<td>Interview with others (qty: 3)</td>
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<tr>
<td>Artifacts</td>
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</table>

**Case B: Equitable leadership practices.**

Three of Jazmin’s educational practices are consistent with three equitable leadership practices. Evidence indicates equitable leadership practices Reflecting, Promoting, and Modeling are prominent in Jazmin’s work (see Table 6). The first, Reflecting (see Figure 3), involves self-reflection. Jazmin states,

*I definitely can recognize [the] privilege that I’ve had from my socioeconomics, where I grew up and the opportunities I’ve had. And I’m very conscious about*
how I view the world through those lenses. And how that definitely means that some of my perspectives on things is very different than [the perspective of] my students sitting in front of me.

Jazmin reveals her awareness of privilege and how privilege impacts her views and she is not alone. Jazmin works very closely with Jamie, both within the school and outside of school on the district-wide equity initiative. Jamie talks about equity in relation to the NGSS work she does with Jazmin,

\textit{I feel like I've done a lot of like the background work of trying to understand why are these NGSS standards important and why is this equity so important and why we should be promoting the things that the district is asking us to promote.}

Jamie believes that Jazmin’s work as an NGSS coach aligns with their district’s equity goals. Jazmin is able to work with Jamie and engage in cycles of reflection and action regarding her work with colleagues to implement NGSS and promote equitable instruction across science classrooms within Matador.

The second leadership practice, \textit{Examining} (see Figure 3), involves dialogue and inquiry based on an understanding of disparity to promote equitable instruction and is closely tied to the third leadership practice, \textit{Promoting} (see Figure 3) where teachers and leaders continually monitor and hold each other accountable for providing equitable instruction. For example, Jazmin uses phenomena as an access point for students and collects data on student engagement and student choice. The data on student engagement drives her instructional selections. The data on student choice is monitored for patterns of exclusion. Jazmin examines the student data for whose perspective is being heard and whose perspective is missing. Jazmin’s actions are then consistent with \textit{Examining} in that she monitors her practices for patterns of advantage and
disadvantage. Jazmin looks for ways to adopt more culturally responsive practices. For *Promoting*, Jazmin selects phenomena-based instruction as a strategy for encouraging colleagues to use phenomena to promote more equitable instruction.

The science team meets to learn and discuss the strategy. At the next meeting, teachers are presented with results from classroom implementation of phenomena-based instruction. Jazmin leads the collaborative inquiry cycle to delve into how phenomena-based instruction relates to student learning and conceptual understanding in science classrooms. She shares,

*It’s just outside of our comfort zone. So, this is an hour of time. Take a look at it [a phenomenon]. [She’ll ask teachers:] ‘Do you have any questions?’ [teachers ask:] content questions?’ [indicating that teachers are concerned with a factual understanding of the phenomenon]. Um, it’s been a huge thing, [to staff, she would say:] ‘this is not about content guys’, it [the statement] throws everybody off, but we’re getting more comfortable with that concept [building conceptual understanding through discourse]. Um, so we do that one meeting then we go and we do it [lead a discussion about the phenomenon from the staff meeting] in our classroom and the next [staff] meeting everybody brings three to four examples of student work. We shuffle them up and names are taken off, who was the teacher is taken off, and we norm [the] grading [process].* 

*It’s [phenomenon-based instruction through staff meetings] led to some interesting conversations and it’s also led to us being able to start thinking more [about] conceptual understanding versus misconception and a detriment perspective. So slowly, but surely. I don’t think, again, we’re, we’re aware fully of the shifts.*

In this excerpt, Jazmin talks about her leadership work with the science department. We see Jazmin is pushing her colleagues to incorporate phenomena-based instruction. By
designating time within the meeting to review student work samples, Jazmin is relying on group norms to hold colleagues accountable for equitable instruction. Jazmin leads the team through dissonance as the team considers what is seen as ‘less than’ in the student work samples. By removing identifying information, Jazmin is guiding the team toward identifying assumptions that underlie their analysis of student work. Jazmin describes leading the process of examining practices for underlying assumptions and then improving those practices to provide high-quality instruction for each student as “slow”. Jazmin prompts colleagues to consider different ways instruction can be adapted to promote student engagement and even inclusion in instructional decisions such as selecting phenomena. Over time, Jazmin is leading departmental discussions around instructional practices using an equity lens, albeit an implicit equity lens.

The third equitable leadership practice prominent in Jazmin’s leadership is **Modeling** (see Figure 3): modeling ethical and equitable behavior. Jazmin responds to instances of racism and class-ism in ways that promote a collective understanding of these forms of oppression. The school is facing an issue of racism toward a small group of African-American students. Jazmin is responding to the incident by preparing a proposal for in-school professional development. If enacted, Jazmin will work to help colleagues understand how instructional strategies can transmit and perpetuate inequity within classrooms. Jazmin plans to share her experiences learning about and implementing culturally responsive pedagogical strategies within her classroom with the intention of influencing her colleagues to shift toward more equitable instruction. Jazmin also responded to an instance of inequity in which a teacher is perpetuating the belief that some students are incapable of engaging in higher-order academic assignments by
withholding the opportunity to engage in such assignments. During one such coaching meeting, Jazmin carefully probed the assumptions underlying a teacher's hesitation to implement new instructional strategies in the classroom. The teacher revealed a practice of lowering expectations for a group of marginalized students whom the teacher assumed unable to complete the assignment. Jazmin responded by sharing not only the strategies she uses, but also, the impact of these strategies on student engagement and student performance on formal assessments. This aspect of Jazmin's leadership, the resistance she enacts, faces, and develops, will be explored using a social justice leadership framework.

Social justice leadership framework.

Here, I discuss Jazmin's leadership practices in terms of the resistance she “enacts”, “faces”, and “develops” to provide a high-quality education to every student. Of the three educational practices described above, I rely, primarily, on Promoting (ELP #4) to illustrate one way that Jazmin leads for equity and social justice.

Jazmin enacts resistance in response to teachers’ deficit thinking towards students. As noted earlier, Jazmin’s leadership involves challenging deficit mindsets from her colleagues using Promoting (ELP #4). The following narration is one example of both the resistance to change that Jazmin faces from a colleague as well as the resistance Jazmin enacts:

During a one-to-one NGSS coaching meeting, Jazmin and Bret reviewed concept mapping. Bret expressed concern over his ninth-grade students completing the concept map assignment with the same level of proficiency expected of them in the tenth grade. Jazmin reviewed her procedure for concept mapping with the tenth graders. She explains how the students are allowed choice with the goal of
students showing what they know. Jazmin shares specific ways that she scaffolds the assignment for students who struggle. Bret had exhibited a heightened interest in the procedures Jazmin uses in her classroom. The pair discussed expectations for concept mapping and reviewed two student exemplars, one below proficiency and one borderline proficiency. Bret does not commit to including new or alternate strategies for concept mapping in his instruction, instead he indicates that he needs time. When pressed to share his concerns, Bret notes that this type of assignment is a “challenge for ED [emotionally disturbed] students.” He indicates that his response to this concern is to have the students make up the work when they can and to focus on the ones who can be saved. Jazmin counters that a very high percentage of her students, many of whom are also ED students, successfully complete the concept map assignments and are also successful on the concept map portion of the state exam. Jazmin encourages Bret to consider modifying a portion of what he already does.

Jazmin reflects on her work with Bret, “it’s a process” (personal communication, April 5, 2019) She describes her equity leadership as follows:

So, [when] working with my staff, my department, I have my goals and I present as our objectives of the day and they’re very similar to teacher objective versus student objective. That I say we’re working on x, really in the background, I’m working on y and z. But you’re [the staff] focusing on x currently, then I’m scaffolding and building in the y and z, moving you [the staff] in a direction without necessarily saying that’s where we’re moving you [the staff]

Here, Jazmin describes how her equity leadership is implicit where x is an instructional strategy while y and z may be identifying patterns of deficit thinking and prescriptive assumptions. Similar to Pilar’s enactment of resistance, Jazmin enacts resistance using dialogue and expresses constraint. She is aware that deficit thinking is detrimental to inclusive student learning and equitable instruction. She counters deficit thinking by both
Examining (ELP #2), i.e. facilitating conversations that bring deficit thinking to the forefront, and by Promoting (ELP #4) via sharing alternate strategies as evidenced in the excerpt above and in her meeting with Bret. Jazmin pushed Bret to share what fueled his hesitation to use modified concept mapping strategies in his class. His hesitation stems from a belief that the modified concept mapping strategies would “challenge” a specific group of students. Jazmin identifies this belief as deficit thinking and considers how she might identify a situation in which Bret’s assumption may not be true. She counters her colleague’s deficit thinking by sharing her experience with ED students in her classroom. Ideally, her colleague would consider changing one’s practice as Bret did. Jazmin elects to counter deficit thinking in a nonconfrontational manner.

Jazmin is not the only leader in her school with an equity focus. She has the support of her colleague, Jamie, the science teacher-coach, when leading for equity in terms of access to rigorous science opportunities for all students. Jazmin also has the support of her principal, Robin. As part of her principal’s vision for equity, Robin added the eighth period to allow ninth grade, ELLs, and other targeted populations more course options and elective opportunities. Robin talked with me about her vision for equity within the school and teacher leadership. While Robin defers science instructional leadership to the department chair and Jamie, the science teacher-coach, Robin wonders about the sociopolitical context of science knowledge and expresses views similar to Jazmin’s with regard to equity in science instruction.

Currently, the principal is confronting a racial issue within the school. A group of African-American students filed a formal complaint regarding the formation of a school
club. At the time of the study, Robin was attuned to race as an issue that must be addressed at the school level. She values open dialogue and shared her experience mediating a conversation about race between a parent and a teacher. Jazmin spoke with me about the racial issue. She expressed concern about the incident and the subsequent reactions that occurred. Jazmin believed that her work with equitable instructional practices and with her colleagues positions her to step forward and lead by sharing her experiences. She expressed concerns about how her leadership for equity as a relatively young, White teacher may be perceived by colleagues and staff. Despite these concerns, Jazmin was preparing a proposal to work with staff on culturally responsive teaching practices. Jazmin relied on the support of Jamie and another colleague to revise the proposal and present it to the principal.

**Case C**

**The Context.**

Pickles High is part of an urban periphery school district serving a diverse population comprised of more than 25% multi-lingual students. Pickles High is unique in that it is located within a state that adopted a modified version of NGSS. At the time of this study, the science standards referenced at the district level were literacy-based standards and these science standards do not emphasize the three dimensions of science instruction present in NGSS. Instructional leadership within the school is organized hierarchically with the principal as the primary leader, followed by an assistant principal, and lastly the department chair who is a teacher within the science department (see School 1 in Figure 5).
Cierra teaches in a different district than when she was first contacted for participation in this study. Instructional leadership in the new school, School 2 (see Figure 5), is consistent with instructional leadership in School 1. However, the focus for this study is Cierra’s leadership for equity at her former high school, School 1, herein named Pickles High.

At Pickles High, teachers are assigned to classes based on their subject area license. Those assignments follow an informal hierarchy, where ninth grade and biology licenses are perceived as a lower status, while eleventh, twelfth grade, physics licenses or a masters’ degrees in a physical science are all perceived among the highest status. Cierra teaches in the lower grades, primarily ninth. Like Jazmin, Cierra has fewer years in teaching than most other members of the science department.

**Figure 5.** Organizational structure for Cierra's leadership within the high school
Roles and Relationships.

Cierra has completed two teacher leadership programs, one for science education and the other for equity in science instruction. Cierra thinks about equity in terms of student voice. One of her leadership projects involved sharing a strategy with science educators that she used to address an issue of equity within her classroom. Cierra selected the exclusion of a group of students from decision-making as the issue of equity to be addressed:

*I could do a project that could possibly address some of their [students'] concerns and maybe get some student voice incorporated. And you know, because the students don’t, don’t feel that they have a voice in the classroom. So this is one of the strategies that I can use to be able to accommodate that [allowing student perspective into decision-making] for them within the school day.*

The project was based on empathy interviews Cierra conducted with students. The students, in turn, conducted empathy interviews with other members of the school community to determine the needs of the community. Students then used the information gathered and the science concepts learned to complete an engineering design project. The project called for remodeling the cafeteria in ways that would accommodate the needs of the school community while adhering to constraints outlined in the assignment. Cierra talks about the success of this leadership project:

*The students never did a project of this caliber. They never experienced something where they had to, where their voice was actually heard and they were actually speaking to administrators and administrators were communicating with them. These are students that are disenfranchised by the school because they are lower level science students. These are not the students that are on the*
student council and they are definitely not the ones that people go to [for school involvement]. These are the run-of-the mill, typical students that you [a teacher may] have. There were students who have special needs included in this. They were tracked in an elective and this is the majority of our student body.

It was a project that I led but with student input at different, at different aspects, different points in there. I felt that I did accomplish what I set out to do with them.

Cierra also indicates the project’s shortcomings:

It felt like a panel discussion in a way. The students did have questions that I pre-selected, um, in order to ask the administrator and the administrator gave very general answers that there was not a chance to go deep into the interview and see how does the administrator really feel, how does the administrator, what does the administrator think? So I think that there was kind of like a wall put up by the administrator, but that wasn’t, that was just the result of the interview.

While Cierra shared this project with other teachers outside of her school district, she was hesitant to share within her school. Cierra’s hesitation stems from some of her experiences at Pickles High.

Vision (Perceptions of equity).

Cierra recounts multiple encounters with microaggressions in collegial settings. When asked about an issue of equity that she encountered professionally, Cierra elected to share an aspect of her personal journal toward equity-mindedness. She recalls her own assumptions that led to combative interactions with a tall rambunctious African-American young man named Jake. Cierra believes her initial and perhaps unconscious supposition that children, particularly African-Americans boys, must be controlled and forced to submit to authority contributed to Jake’s repeated and escalating infractions. Cierra relied on her training in empathy interviews to establish
open communication with Jake and his mother about Jake's behavior. She worked to establish a trusting relationship with Jake and to adapt her instruction to include and engage Jake in science learning. She elaborates on the personal aspect of equity work:

*I remember there was a teacher that asked me, “Hey, what do you do with Jake and can I learn it?” And I said, “No, you can't.” I said, “No, I cannot teach you what I do for Jacob in order to get him to behave because it's not something that can be taught.” That's what I, that's what I told them. Because I basically had to look at my own biases about this student and about his race and about African-American boys and the way that we discipline them. In particular, and this was one of my White coworkers and I just thought it was just so heavy of, of a, of a, of a deep analysis that I had done in order to get this child to be on my side.*

In this excerpt, Cierra is pensive and highlights a major obstacle to leading for equity as a teacher: the lack of hierarchy and inconsistency of a teacher directing a personal journey for another teacher. Cierra does not believe that engaging in self-reflection with the aim of redressing an inequity can be taught. She continues to elaborate how enacting equitable practices is deeply personal:

*If I was to tell somebody, “Look, you, you can't kick him out, you have to do X, Y, and Z. And you have to really realize your own biases towards race,” that's a hard pill to swallow, to tell another coworker that this is the reason why he's not behaving because this is what we do to African-American boys. And I've done my own personal research on it and I've, I've seen it myself.*

Cierra’s comment implies that an equity lens imposed upon a teacher by another teacher is inadequate for addressing inequity. Cierra describes her equity lens as personal, “I've done my own personal research on it and I've seen it myself” and that such a lens requires personal examination, “And you have to really realize your own
biases toward race”. In the next section, I will examine Cierra’s educational practices and how those practices promote equity within the context of Case C.

**Case C: Analysis.**

Case C findings are based on three, in-depth interviews with Cierra and documentation of one of Cierra’s leadership projects (see Table 7). Table 7 illustrates which data sources converge on the equitable leadership practices and the different dimensions of social justice leadership.

**Table 7.** Summary of Case C findings related to RQs. An ‘X’ indicates evidence of the leadership practice. A (+) indicates evidence that corroborates the leadership practice. A (−) indicates evidence that contradicts the leadership practice.

<table>
<thead>
<tr>
<th>CASE C RQ 1: How do participants describe educational practices related to equity and inclusion?</th>
<th>Data Source</th>
<th>Reflecting</th>
<th>Examining</th>
<th>Promoting</th>
<th>Lobbying</th>
<th>Modeling</th>
</tr>
</thead>
<tbody>
<tr>
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<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>Interview with others</td>
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<table>
<thead>
<tr>
<th>CASE C RQ 2: How are participants’ equity practices related to “organizational structures and social norms”?</th>
<th>Data Source</th>
<th>Resistance enacted</th>
<th>Resistance faced</th>
<th>Resistance developed</th>
</tr>
</thead>
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<td>Lobbying (ELP #7)</td>
<td>Administration &amp; science teachers</td>
<td>External organizations</td>
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<td>Interview with others</td>
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<td>Artifact</td>
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</table>
Case C: Equitable leadership practices.

Evidence indicates Cierra’s equitable leadership practices Reflecting, Promoting, and Lobbying were prominent in her work (see Table 7). Cierra’s continual reflection on her practices coincides with Reflecting (see Figure 3) and those reflections lead to changes in a cyclical manner. Similar to the science teacher-leaders Pilar and Jazmin (Cases A and B respectively), Cierra concurs that equitable instruction involves modifications that are responsive to student needs. Cierra’s view of equity differs slightly in that Cierra draws attention to students’ assets to guide those modifications.

Cierra’s approach to classroom instruction reflects attention to Promoting. A careful examination of the artifact of Cierra’s leadership revealed empowering students to invest in their learning, in their school, and in their community as one of her leadership goals. The artifact consisted of the leadership project noted earlier. Cierra conducted empathy interviews with students to determine their needs. In terms of instruction, Cierra planned for an engineering design project in which students pitched their redesign of the cafeteria proposals to an administrator. She selected this project as an avenue for students to engage in a community project that connected their science learning to a pressing concern. Cierra identified the pressing concern using empathy interviews and prompted her students to base their engineering design projects on the results of their own empathy interviews.

In this way, Cierra is encouraging her students, in particular those students who expressed an awareness of being silenced in school-based decisions, to participate in the school community. In terms of leadership, Cierra shared this project with colleagues outside of her school. She relied on this project to encourage colleagues to incorporate
community-based projects into science instruction as one way to include student participation especially from those students who may have been previously marginalized. Her attentiveness to the voices of marginalized students, families, and communities is indicative of Lobbying (see Figure 3). Equitable leadership practice #7 is present when the leader works to influence the sociopolitical context. I will examine the ways Cierra enacts Lobbying using the social justice leadership framework.

**Social justice leadership framework.**

Here, I discuss Cierra’s leadership practices in terms of the resistance she “enacts”, “faces”, and “develops” to redress the marginalization of students based on race and language. Of the three educational practices described above, I use Lobbying (ELP #7) to illustrate one way that Cierra leads for equity and social justice. Cierra identified language and informal practices within her school that perpetuated the marginalization of students based on their race and their language and she worked to change school culture. She notes,

*In Pickles, I often heard derogatory statements towards the students and towards people of color. And, um, it’s very unfortunate, but the worst one that I ever heard was a co-worker say, these kids should be smarter. They crossed the border. I also heard a coworker say, the same coworker say, um, that this population has less gray matter in their brains than other populations, specifically talking about Hispanic students.*

Cierra was so disturbed by repeated derogatory comments that she reported a few of the instances to her administrators and college faculty with whom she worked. Some of the resistance Cierra enacted is as follows:
Whenever somebody would, would speak negatively about a student, or make negative comments towards their race or their ethnicity, or… I would, I would speak out. I would even report if I needed to. Um, and I think that, I think it’s a hard thing to do because you’re putting yourself, um, it feels like you’re ratting out on a colleague. But at the same time you’re also doing right by the student and you’re doing the right thing as a person.

In this excerpt, Cierra uses *Lobbying* (ELP #7) when she calls attention to the use of language to perpetuate inequitable power dynamics. Comments about the amount of gray matter in the brains of a population of students or relating intelligence with geographic location hint at prescriptive assumptions or biases that some teachers may hold. Cierra leads for equity by recognizing, publicly questioning these ideas, and challenging deficit thinking toward marginalized student groups.

Cierra also recognizes the professional risk involved in vocalizing viewpoints that differ from the prescriptive assumptions that may be dominant in this environment. In contrast with Case A, the resistance Cierra used to counter microaggressions weighed heavily on her:

*I don't want to be the speaker of all, of all, you know, students. But that's what you ended up becoming as a person of color in a professional environment. You end up being the speaker for, for your entire, you know, a community because you're there and it's a responsibility that it's… it's just, it's part of what's going… to be who you are, whether you like it or not.*

Cierra describes teacher leadership for equity as a ‘responsibility’ and a part of her identity as a teacher of color. Even as she advocates, Cierra questions whose interests her actions serves. She recognizes that her perspective is limited and does not encompass the perspectives of all of her students.
At the same time, Cierra feels responsible for adding her perspective as a teacher of color to influence instructional decisions within the department and encourage colleagues to examine their assumptions.

So as a teacher, in that community, in that environment, where that was being said behind my children's backs … That's why I became, and I think that's also part of why I had to become a leader. I had to..., at this..., there's not an option. There's not a, you know … You have to because you realize that it's wrong and that they [the students being talked about] need someone strong to stand up for them because they can't, they can’t stand up for themselves.

Contrary to the support that the other participating science teacher-leaders found within their schools, Cierra experienced isolation and separation from both her colleagues and administrators as she voiced concerns over the problematic language being used about students. While it is clear that Cierra feels obligated to voice her perspective on behalf of her students, the beliefs underlying her position that students “can’t stand up for themselves” seems counter to her work of promoting student participation. However, Cierra is referring to conversations taking place outside of the presence of students and the statement that students cannot voice their own perspectives should be interpreted literally.

Cierra expresses disappointment regarding her experiences with equity at Pickles High,

*My supervisor did not think enough to go and report any of this. And the reason that I think so is because I think that people in that school that are White, are accustomed to saying these things, and are accustomed to speaking in this way. And it's never been questioned or, or they might not be surprised by it or shocked*
by it as I was. Because it's like a norm, you know? And so, that was scary. And that was my first real experience with, with racism.

In the above excerpt, Cierra shares what she perceives as some of dominant views about normative language. Normative language is language deemed offensive, derogatory, and perceived by Cierra as perpetuating racism, while it also appears to be language that is dismissed as unremarkable by the other parties involved in the conversation.

Cierra develops two main strategies to support her leadership work for equity: journaling and external partnerships. Journaling allows Cierra to continue self-reflection and modeling equitable practices within her own classroom. Cierra looks to organizations and professional groups outside of her school and district to expand her repertoire of practices that could increase the number and diversity of students unfettered in their academic learning.

Case D

The Context.

McMan Commerce Academy (MCA) is a magnet public school located in an urban core district. Instructional leadership is similar to the structure at Crescent Middle School in Case A. It is less hierarchical than in the high schools of Cases B and C. The principal is the primary leader, followed by the assistant principal. Academic departments are divided by subject, however there is no department chair. The assistant principal evaluates science teacher performance and science instruction (see Figure 6). The science department consists of a team of five teachers. Craig, the science teacher-leader in Case D, has the most building seniority, whereas the teacher
newest to the department has the most teaching experience, and the remaining three science teachers have between four and seven years of experience in the teaching profession. The newest member of the science department has over 20 years of teaching experience, but little to no experience with NGSS and inclusive science instruction. Similar to Case B, the teachers at MCA join committees. Craig is a member of the Restorative Justice Committee (see Figure 6). Teachers could also form new clubs, for both faculty and students. Craig is a member of the faculty book club as well as a founder for two marine science initiatives for students (see Figure 6).

Figure 6. Organizational structure for Craig’s leadership within McMan Commerce Academy high school

Roles and Relationships.

Leader.

Much of Craig’s leadership work occurred prior to start of this study and outside of his school. For example, Craig worked to establish a relationship with an external
organization so that students interested in medicine would have opportunities for internships and exposure to medical professionals. Craig’s leadership is subtle. He describes his leadership as consistent with a distributed model:

*We’re all leaders in that we are united to make the moderation study [school-based assessment] and performance assessment work that we do effective. So in order for that to happen, we all need to pull, right.*

He is also an active member of an advocacy group that works to influence policy, educate the public, and secure funding in support of public schools within the district. North Highbridge School District has undergone a number of significant changes in recent years, including district leadership changes and budget cuts. The advocacy group is composed of community members, families, teachers, and students from North Highbridge who work collectively to monitor, analyze, and publicize decisions related to public education. The group exists as a grassroots response to the changes that were perceived as harmful to public education and continues its work to ensure democratic principles are upheld in the school district.

**Vision (Perceptions of equity).**

Craig defines equity in terms of democratic participation. The issue of equity that Craig confronts centers on maintaining privilege and how such a stance conflicts with equitable aims. Craig talks about the language used by privileged members of the community that reveal prescriptive assumptions about his students:

*Communities saying things and doing political…, making political moves that keep the system of privilege entrenched. Specifically when I talk with people about the children that I teach, depending on the community with which I’m talking, I get very different perceptions. I’ll say to somebody, you know, you*
know, [they ask:] where do you teach? [Craig responds:] ‘I teach in North Highbridge’. [Their response:] ‘Ooh, that must be hard’.

He goes on to talk about how those views impact his leadership work for support and resources for public education:

*I think when we make decisions about how we allocate resources and how we provide support to our neediest… I think we don’t necessarily make the equitable call, because equity for education and equity in schools means providing the system what it needs, right?*

Craig then talks about his work with the advocacy group. He describes one of the completed projects that involved the preparation of a public statement geared toward addressing the district’s fiscal challenges. Craig spoke of his commitment to remain involved with the advocacy group as a means to influence policies that could impact his teaching and his students.

**Case D: Analysis.**

**Table 8.** Summary of Case D findings related to RQs. An ‘X’ indicates evidence of the leadership practice. A (+) indicates evidence that corroborates the leadership practice. A (−) indicates evidence that contradicts the leadership practice.
### CASE D

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Resistance enacted</th>
<th>Resistance faced</th>
<th>Resistance developed</th>
</tr>
</thead>
<tbody>
<tr>
<td>STL Interview</td>
<td>Lobbying (ELP#7)</td>
<td>science teacher politicians business leaders</td>
<td>Individuals for support External organization</td>
</tr>
<tr>
<td>Interview with others</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td></td>
<td></td>
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<tr>
<td>Artifact</td>
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<td></td>
</tr>
</tbody>
</table>

Case D findings are based on three, in-depth interviews with Craig and field observations at McMan Commerce Academy (see Table 8). Table 8 illustrates which data sources converge on the equitable leadership practices and the different dimensions of social justice leadership.

**Case D: Equitable leadership practices.**

Evidence from the interviews indicate equitable leadership practices *Reflecting*, *Promoting*, and *Lobbying* are prominent in Craig’s work (see Table 8). Craig talks about leading for equity as a teacher:

> I find so many of us in this profession are just willing to sit in the background, right and watch. Maybe have a little parking lot conversation, maybe have a little coffee conversation, um, and not invest. And when I say invest, I mean sort of... And I recognize that the job is all consuming, and exhausting, and I get that. We all have lives and we have families...and all the issues that come along with... young families and seniors, parents and all these things... I get that. But at the same time, this work is to me..., and again, that’s the perspective I guess. Um, it’s... so crucial.
He is aware of his power as a White, male, teacher to implement change and he reflects on the willingness to act. Such a willingness goes beyond observing and talking and moves toward “work” for equitable aims in education and is consistent with Reflecting (see Figure 3).

Much of Craig’s equitable leadership practices are tied to classroom instruction. Craig explains his classroom environment as follows:

*I like to empower student voice as much as humanly possible. To that end, every one of these seven lab stations is labeled A through G: Ability, Bravery, Community, Dynamic, Energized, Family, and Generosity [values that were discussed with students as important]. And the children rotate through different seating assignments based on buddies that they pick. I do a little finessing of it, but in general, I rotate them on a regular basis to the different stations because I want them to talk. I want them to talk to each other and I want them to know everybody in this room and have multiple experiences throughout the entire year talking with each other.*

He describes the instructional strategies used to promote equity in his classroom which are consistent with Promoting (see Figure 3). Cooperative grouping and academic discourse are a few of the techniques to create an inclusive environment for students to take ownership of their learning. These practices are shared with colleagues during department meetings and informally during inter-classroom visits. Craig’s work of implementing culturally responsive strategies, gathering and providing feedback, as well as monitoring classroom practices using an equity lens are all consistent with Promoting.

Lastly, Craig advocates for local policy that is more socially just and aligns with the democratic aims of public schooling. During one interview, he states,
So some of my leadership work around equity is to make sure that we maintain a public-school system in North Highbridge. I really care deeply about that. I work with a group of about 20 other folks on a core leadership team for an advocacy group, which includes parents and teachers and interested community members. And we’ve actually made some serious waves. Um, we’ve done a lot of work around looking at the finances of the district [and] looking at how the Board of Education is appointed by the mayor. We actually just for the first time in history, had an appointee blocked because he was just terrible. He was not representing the district.

This advocacy work is consistent with Lobbying (see Figure 3), publicly advocating for socially just policy at the local level.

**Social justice leadership framework.**

Here, I discuss Craig’s community advocacy work to describe his leadership practices as they relate to the resistance he “enacts”, “faces”, and “develops”. Of the three educational practices described above, I use Lobbying (ELP #7) to illustrate how Craig leads for equity and social justice. Craig enacts resistance by advocating for more democratic participation in public schooling. One issue of equity Craig faces is:

*Communities saying things and doing political…, making political moves that keep the system of privilege entrenched.*

He responds through his civic engagement,

*I’m very active with some of the changes that are happening to the district. We have a new administration, again, urban district, [the] new administration is replacing the one that came in.*

Craig is aware of the risk associated with publicly advocating. When asked why he no longer participates in school board meeting, he responds:
I have decided to no longer attend those meetings because they're just, I have a hard enough time getting sleep as it is and layering those uncomfortable, contentious meetings on just is not… And I also don't want to have that high of a profile. Frankly, I'm scared at this point. We've had a very large number of teachers put on administrative leave somewhere between 20 and 30.

He counters the resistance he faces by working alongside like-minded individuals and groups, with those that share the view that democracy is strengthened through education and civil engagement. His work in the advocacy group is one example of how his equity focus is sustained through engagement with like-minded individuals.

**Findings related to the conceptual framework**

Based on these findings, I return to the conceptual framework and modify it to better capture prominent features that relate to science teacher leadership for equity. This study's focus is 'science teacher leadership for equity.' Equity is conceptualized broadly in the literature making it important to clarify what that means. Equity refers to targeted support for students who have been minoritized and marginalized in science, distinct from defining equity as equality and everyone having the same opportunities. The science teacher-leaders share this perspective on equity.

Initially, the conceptual framework was informed by the leadership for learning model (Hallinger, 2011) and the social justice leadership framework (Theoharis, 2007), as well as the extant literature on teacher leadership. The Leadership for Learning model indicates that leadership is directly impacted by the leaders’ individual aspects, i.e. beliefs, values, knowledge, and experience. I propose that the four teacher-leaders’ individual aspects shaped their vision for science instruction which is an added component that would greatly impact their leadership for equity. In addition, social
justice leadership is grounded in an understanding of institutional arrangements and norms that perpetuate the marginalization of some students. I proposed that the science teacher-leaders would engage in leadership work to address this issue.

This study’s findings support modifications to the original conceptual framework put forth in chapter one, starting with their views on equity. The science teacher-leaders’ perception of equity and their understanding of institutional arrangements that perpetuate disparities was often shaped by their experience. Pilar, “know[s] what it feels like to not have a need met while in school” and she worked at including students in decision-making. Jazmin was aware that “some of my perspectives on things is very different than [the perspective of] my students sitting in front of me” which shaped both her instructional and leadership practices. Their perceptions of an issue of equity and their experiences with an issue of equity informed their educational practices aimed at improving science teaching and learning for each student. The science teacher-leaders’ perception of equity was also shaped by their knowledge and values. Cierra recognized that “you have to really realize your own biases towards race, that’s a hard pill to swallow.” Craig believes community involvement is a component of public schooling and he “really care[s] deeply about that.”

‘Vision’ is too broad a term for a dimension of ‘science teacher leadership for equity’. This dimension could be more accurately described as an ‘equity lens’ to better reflect science teacher leadership for equity and illustrate the focal nature of their perspective on equity. ‘Equity lens’ is a term, both implicitly and explicitly, present throughout educational research (Carver-Thomas, 2018; Galloway & Ishimaru, 2015, 2017; Ishimaru & Galloway, 2014; Lindsey & Lindsey, 2016; Theoharis, 2007). The
participants are a unique subpopulation of leaders and the modified language is warranted to encompass their particular experiences. An ‘equity lens’ is two-fold, to recognize that inequities are historically rooted in systemic and structural issues and to recognize how current school policies and practices may work to maintain or reinforce existing inequities in the school and its community (Ishimaru & Galloway, 2014). Each of these science teacher-leaders understood that a portion of responsibility for promoting equity rests with each individual. Their identities and their understandings of issues of inequity shaped their views on equity and subsequently shape their educational practices, thus cementing ‘equity lens’ as a critical dimension of ‘science teacher leadership for equity’.

I drew upon the work of Ishimaru & Galloway (2014) to operationalize science teacher leadership for equity. Initially, seven of the ten high-leverage equitable leadership practices were selected based upon descriptions of teacher leader practices within the Teacher Leader Model Standards (Teacher Leadership Consortium, 2012). The educational practices identified in this study align with five of the ten high-leverage equitable leadership practices described by Ishimaru & Galloway (2014). However, the science teacher-leaders from cases A-D often incorporated language from the Teacher Leader Model Standards when describing their leadership work for equity. To better reflect their equitable leadership practices, the labels, Reflecting, Examining, Promoting, and Modeling, are unique descriptions of their teacher leadership for equity work. The term, Lobbying, reflects the science teacher-leaders’ advocacy work at the school level and beyond.
The revised conceptual framework is informed by the leadership for learning model (Hallinger, 2011), the social justice leadership framework, and extant literature on teacher leadership, as well as empirical data from this study. The first dimension, 'equity lens' encompasses the science teacher-leaders’ beliefs, knowledge, perception, and experience with equity. Their ‘equity lens’ provide a foundation for their leadership work. The second dimension, ‘role’ from the initial framework, remains unchanged. The findings from this study are consistent with the extant literature on teacher leadership in that ‘science teacher leadership for equity’ is also shaped by their role within their school community. The third dimension, ‘context' from the initial framework, also remains unchanged. However, the chapter 4 findings suggest that the equitable leadership practices implemented by the science teacher-leaders relate to the specific issue of equity facing the school community and the science teacher-leaders’ position in the school community. In the section that follows, I discuss the lessons learned from a
cross-case analysis of the four cases as well as some implications of science teachers leading for equity.

**Significance of leading for equity in science teaching**

These four cases reveal the complexities inherent in science teacher leadership for equity in secondary schools. One complexity exists in the institutional tension created as teachers engage in leadership work with colleagues. The second complexity involves the social tension of attempting to fulfill the two constraining roles of: an exemplary science teacher and legitimate leader advocating for greater equity within a school system.

**Institutional tension.**

The duality of being a teacher-leader appears to be both empowering and limiting. On one hand, science teachers are uniquely positioned to guide educational practices among their peers with greater authenticity than would be possible with a non-science administrator. For example, Jazmin’s teacher colleague, Bret (Case B), points out,

*[For] my NGSS coach, Jaz, it IS about the kids. It’s about the kids and can they [students] achieve a certain amount. Not so with admin and department leaders and downtown where it’s not. Where Jaz is [saying]: “can they [students] achieve a certain amount?” then, the higher ups is [are saying]: “did they achieve this [a certain amount]?” It’s not: “how did you [teachers] get them [students] to do it?”, it’s just: “did they [students] do it?”. They [administrative leadership] want results.*
Bret recognizes Jazmin as a teacher-leader committed to improving how other teachers provide instruction. To gain additional insight into how teacher-leaders function as instructional leaders within secondary schools, I apply Hallinger’s (2011) leadership for learning model.

One domain describes values in leadership as defining both the ends and the means by which leaders work. Across all four cases, the science teacher-leaders value inclusive classroom practices and are committed to improving science instruction in ways that support diverse student populations. The science teacher-leaders engage in Promoting (ELP #4). Case B demonstrates a clear example of how values relate to science teacher leadership for equity. In the above excerpt, Bret compares Jazmin to more traditional instructional leaders and has determined that the two have different goals. Jazmin, as the teacher-leader, is oriented toward instructional methods whereas the administrative leadership orients toward student scores as the salient outcome. Bret communicates that he values Jazmin’s leadership as influential to his instructional methods and that Jazmin’s role as a teacher adds credence to the methods Jazmin recommends. During the interview, he describes a form of comradery with which Jazmin persuades him, through Promoting (ELP #4), to alter his classroom practices. Across cases A, B, & D, the teacher-leader is valued by colleagues for the shared understanding of students and teaching responsibilities as well as for their suggestions of alternate instructional methods. The role of teacher-leader distributes authority over instruction to the study participants in cases A, B, and D in an effort to reform and improve science teaching.
The leadership for learning model (Hallinger, 2011) indicates that instructional practices are influenced by multiple leadership sources and that leadership practices are related to context. The adoption of NGSS or closely related standards are part of the changing circumstances for the science teacher-leaders in all cases. Administrative leadership influences classroom practices in all four cases and supports the teacher-leaders’ influence in three of the four cases. At Crescent Middle School (Case A), the principal embedded collaborative meeting times into teachers’ schedules that allow Pilar’s leadership to occur. Pilar meets with the science team at least monthly where she leads the adoption of inclusive instructional methods consistent with the Framework and NGSS expectations. Pilar engages in Examining (ELP #2). At Matador High School (Case B), Robin, the principal, created flexible staffing arrangements that included teacher coaching positions. Jazmin coaches colleagues, individually, through the adoption of inclusive instructional methods that are consistent with the Framework and NGSS expectations as well as the district’s equity goals. Jazmin engages in Promoting (ELP #4). At McMan Commerce Academy (Case D), the principal scheduled department meeting times to fall within the teachers’ contractual day, providing ample opportunities for Craig to meet with the science team regularly. As the senior member of the department, Craig guides the newest team member toward adopting inclusive instructional methods consistent with the Framework and NGSS expectations. Craig engages in Promoting (ELP #4). These teacher-leaders are positioned as leaders within their departments and among their colleagues. They work alongside their colleagues and their leadership is supported by their administration. And yet, it is Case C that
provides the strongest example of the institutional tension involved in being a teacher-leader.

In contrast to the other cases, Cierra did not receive administrative support for her leadership at Pickles High School. Reasons for the lack of administrative support are open to speculation based on the limited perspective reflected in the evidence for Case C. I propose that the organization of instructional leadership at the school, at least partially, inhibits Cierra’s influence on other teachers’ classroom practices. The organization of science instruction at Pickles High School does not formally acknowledge teacher or teacher-leader input (see Figure 5). Given that the science department at Pickles High School was structured so instructional leadership was under the sole purview of administrators, it is not surprising that Cierra felt constrained as a teacher-leader pushing for equity within the science department. Scholars have been wrestling with how to conceptualize teacher leadership in the U.S. despite a lack of consistent school organization for such a position (Eckert, 2019; Smylie & Eckert, 2017; Supovitz, 2015). Within Pickles High School, Cierra engages in Modeling (ELP #10), while, externally, she leads for equity by engaging in Lobbying (ELP #7). Next, I discuss a restriction of science teacher leadership as influential rather than authoritative leadership.

The position teacher-leader allows these professionals to model practices for their peers within their classrooms (i.e., Modeling, ELP #10) which lends credibility and legitimacy to the practices these teacher-leaders promote to their colleagues. This finding that teacher-leaders influence the classroom practices of other science teachers,
is also consistent with expectations for teacher leadership outlined in the Teacher Leadership Standards (Berg et al., 2013).

Although in greater proximity to classrooms, teacher-leaders are not afforded the organizational authority associated with administrative leadership. At McMan Commerce Academy (Case D), Craig does not coerce his new, more experienced colleague to change her classroom practices to align with Framework and NGSS expectations. Cierra could not coerce colleagues to change their deficit-language toward some student populations at Pickles High School (Case C). As teacher-leaders, Craig and Cierra lack the authority to overcome colleagues’ resistance to change by forcing colleagues to comply. Colleagues’ resistance to changing instructional practices may be expected in these two cases since the teacher-leader positions were not formally designated roles. Scholars have suggested that more organizational power granted to teacher-leaders, as well as strong coordination with formal administrative leadership, could strengthen their impact (Supowitz, 2018). Yet, a similar pattern of limited authority existed in the remaining two cases. Pilar could not coerce her colleagues at Crescent Middle School (Case A) to incorporate NGSS boards as a meaningful part of their instruction. Jazmin could not coerce Bret to change how he uses concept mapping in instruction at Matador High School (Case B). These teacher-leaders have some administrative power afforded by their formal positions within the schools, as well as through support from their administrators. This finding indicates that teacher leadership is distinct from administrative leadership. Teacher leadership relies on a different leadership structure, one that is influential, as opposed to dominant. The two cases involving Pilar and Jazmin (Cases A & B) suggest that changing teachers’
classroom practices is more complex than either providing teacher perspective through instructional leadership or depositing more authoritative power into the hands of teachers. Taken together, all four cases demonstrate that changing teachers’ classroom practices toward more equitable instruction and equitable student outcomes is a nuanced, gradual and iterative process. The tension experienced by teacher-leaders when they find themselves somewhere between being a teacher with a valued perspective versus being an instructional leader with limited, if any, authority over colleagues’ classroom practices has implications for science teachers who are leading for equity.

The institutional tension that arises between a teacher-leader’s credibility as a teacher and lack of hierarchical authority as an instructional leader, may be due, in part, to the ways in which teacher autonomy over classroom practices constrains science teacher leadership for equity. An equity focus involves iterative cycles of reflection and practice (Furman, 2012). The science teacher-leaders in cases A-D lead for equity by engaging in practices that promote equitable instruction (*Promoting*, ELP #4), practices that include students, who may have been marginalized in the past, in their own learning. Each of the four science teacher-leaders worked with an understanding of how their privileged identities as teachers and, in some cases their targeted identities, operate within the science department and the school as well as an understanding of their role in the democratic aims of science education. All of the science teacher-leaders engage in *Reflecting* (ELP #1) such that their work attends to issues of equity. Each of the four science teacher-leaders expressed a commitment to meeting the learning needs of each child. Each of the four science teacher-leaders incorporated equitable
instructional practices, such as providing student choice and leveraging students’ assets within their classrooms via *Promoting* (ELP #4) and *Modeling* (ELP #10). Nevertheless, just as these four teacher-leaders had discretion to adopt equitable instructional classroom practices, the same is true for their colleagues.

Colleagues may acknowledge the same disparity in student learning opportunities as identified by the science teacher-leader, and still adopt instructional practices other than the ones promoted by the science teacher-leader. We saw in Pilar’s case (Case A), a number of science teachers rejected Pilar’s push to use an NGSS board as a way to encourage student ownership over learning. Students within Pilar’s classroom refer to the NGSS boards daily as they monitor and evaluate their learning. The students articulate ideas, concepts, and/or practices that are unclear in relation to NGSS expectations and in this way, are empowered to seek help as needed. These students have a voice in their own learning. Pilar pushed for her colleagues to use NGSS boards to empower their students by providing students with the expectations being asked of them and instructing students on how to meet those expectations so that students can have a perspective on their own learning. The use of NGSS boards was a strategy to counter the large number of sixth- and seventh-grade students needing science remediation in the homework club. Pilar’s colleagues were receptive to providing sixth- and seventh-grade students with academic supports but rejected the use of NGSS boards as a means for empowering students in their learning. Instead, the colleagues complied with having the NGSS boards visible as a reference for students without explicit instruction on how to or why use them. An opportunity to provide more democratic participation in learning or participatory instruction loses its full potential.
In a similar vein, colleagues may adopt the instructional strategies promoted by the science teacher-leader yet resist examining their implementation for biases or assumptions. We saw in Jazmin’s case (Case B), Bret adopted concept mapping in his classroom but resisted a close examination of his assumptions that underlie implementation of the strategy. Bret shared his belief that the instructional changes would challenge his emotionally-disturbed students who respond negatively to challenge. However, Bret disengaged from the conversation at the point when his prescribed assumptions about this marginalized group of students were countered with Jazmin’s examples of models completed by students labelled as emotionally-disturbed. Jazmin engaged in *Examining* (ELP #2) with Bret as she was *Promoting* (ELP #4). Bret likely knew at least one of the student authors as one of his own students from the prior year (personal communication, March 25, 2019). His response was to disengage from the conversation that examined his assumptions and shift the focus of attention to an upcoming project that he was planning. Bret’s response may, unintentionally, perpetuate inequity given that privilege is often hidden, accepted as normal, and masks various forms of oppression. Sustaining an equity-focus requires both practice and reflection. While the position of teacher affords the science teacher-leaders’ credibility and legitimacy, it also constrains their leadership influence over their colleagues’ understanding of inequity, privilege, and classroom practices. A colleague’s compliance with equitable instructional practices is insufficient for sustaining an equity focus and ensuring reform.

Another leadership for learning domain describes the leadership focus as the indirect pathways through which leadership is linked to student learning. This study
does not include an examination of student learning. As an alternative, the leadership focus of the science teacher-leaders will be explored in the next section using the social justice leadership framework to understand how these science teacher-leaders lead for equity and how their work relates to teacher professional learning.

**Social tension.**

The social justice leadership framework (Theoharis, 2007) provides a leadership framework for examining social justice leadership from a teacher leader perspective. Teacher leadership is an integral component for improving science instruction and leading for social justice is an important aspect of science teaching. According to the Framework, the goal of science education is for all students to have sufficient knowledge of the practices, cross-cutting concepts, and core ideas to engage civically by the end of high school (NRC, 2012). Civic engagement falls under the umbrella of social justice in that teaching for social justice involves promoting the full participation of each student. Thus, the social justice leadership framework applied in this study revealed additional complexity embedded in adopting an equity stance as a science teacher-leader.

These cases highlight a social challenge inherent in fulfilling the role of an exemplary science teacher and social justice advocate. All four science teacher-leaders had to balance the responsibilities associated with being an experienced member of the teaching profession, from managing their teaching load to participating in committees or after-school programs with their leadership for equity duties that require additional commitment. That commitment involves continuous cycles of reflection and action, questioning and examining practices for consistency with an equity lens, as well as
managing resistance. Prior research into instructional leadership at the secondary level, indicates that teachers seek informal leadership to guide instruction based on expertise, formal authority, experience, resource access, physical proximity, and social connections (Supovitz, 2008). The challenge for these science teacher-leaders is finding the time, wherewithal, and social network required for fulfilling teaching duties, sustaining an equity focus, and providing informal leadership to colleagues in ways that are consistent with an equity focus.

The science teacher-leaders’ influence on colleagues match the characteristics of informal instructional leadership (Supovitz, 2008), except with regard to equity. This study’s findings indicate that an awareness of inequity does not equate with a willingness to redress it. Tabitha, a colleague of Pilar’s from Case A, expressed the view that modifying science instruction is separate and distinct from addressing issues of equity. Bret, a colleague of Jazmin’s from Case B, expressed similar views. He related the instructional practices promoted by Jazmin to aligning instruction with the new standards but separate from addressing issues of equity at the school. Neither of these colleagues shared personal practices for examining or addressing issues of equity, nor did they share any instances of attending to issues of equity or turning to leaders for help with attending to issues of equity. I interpret Tabitha and Bret’s willingness to share their views on equity and science instruction as an opportunity to engage in dialogue to build a deeper understanding of the historical and contemporary forces impacting NGSS reform. Similarly, the science teacher-leaders engage in equitable leadership practices to build a collective understanding around equity and science instruction.
All four science teacher-leaders possess a willingness to enact resistance and the adoption of an equity lens to guide their work. The science teacher-leaders challenge a dominant perspective in science classroom instruction that equates success with assimilation into dominant science culture (NRC, 2015). Across cases, the science teacher-leaders examine educational practices using an equity lens in ways that challenge institutional arrangements that perpetuate the marginalization of student groups. In cases A, B, and D, the science teacher-leaders used their positions as leaders to push colleagues to critically examine classroom practices for patterns of exclusion, i.e. Examining (ELP #2). The science teacher-leaders from cases A, B, and D promote instructional practices that allow for student participation in decision-making, i.e. Promoting (ELP #4). In cases A-D, the science teacher-leaders relied on their influence as teachers to model examining the assumptions and biases that underlie educational practices at the school. All four science teacher-leaders wrestle with whose perspectives are valued in decision-making and openly question the assumptions and biases that underlie decisions. The added work of adopting an equity lens, a lens that guides their practices both as teachers and as leaders, is taxing for these teachers.

For the most part, the four science teacher-leaders minimally spoke of social connections within their schools that supported their efforts at leadership for equity. The science teacher-leaders share their personal journey toward understanding how privilege and practices operate within their schools while influencing their colleagues to embark on a similar journey toward understanding. These science teacher-leaders are in the vulnerable position of demonstrating rather than directing an equity stance. The science teacher-leaders in this study tend to act alone in calling attention to issues of
equity and are left to figure out how to balance their duties as a science teacher with their commitments as teacher-leader for equity. Scholars have discussed how various competing interests introduce tensions in teachers’ relations with their colleagues as teachers are pressured to collaborate more and more (Little, 1990). All four science teacher-leaders wrestle with their position as teacher-leader in relation to their teacher peers.

Teachers are a social group within the organization of schools. Teacher receive systematic training in how to be a teacher, they are socialized into their teacher identities. With the reform effort in science education (NRC, 2012), there is a shift in what teachers are expected to know and be able to do (NASEM, 2015) which requires professional learning. Given what we know about how people learn (National Academies of Science, Engineering, and Medicine, 2000, 2018) some teacher professional learning will likely take place outside of formal structures, unintentionally, informally, and socially. This study illustrates how the equitable leadership practices of the four science teacher-leaders can facilitate this type of informal social learning. In these cases, the science teacher-leaders exercise peer influence aimed at building a shared understanding of equity and science instruction. Their equity lens shapes their teacher leadership, i.e. pushing colleagues to examine biases and assumptions. Their leadership confronts an issue of equity and promotes interpersonal change among colleagues. Their work challenges institutional arrangements regarding the implementation of the new science standards such that these science teacher-leaders place equity work at the center of science instruction.
Additionally, the vulnerable position of science teacher-leader for equity appears to be an added burden for the teachers of color involved in this study. The role of teacher-leader for social justice appears to distance teachers of color from their colleagues, while ‘distance between colleagues’ was not a factor discussed by the two White science teacher-leader participants. Pilar, a teacher-leader of color, reported that within Crescent Middle School (Case A),

*I think some of my colleagues have kind of pushed me away. We’re not as close as we used to be.*

Cierra, a science teacher-leader of color formerly at Pickles High School (Case C), also experienced isolation from her colleagues as she challenged colleagues’ use of deficit language. Cierra reflects on her relationships with the colleagues who used negative language:

*I never wanted tension to be created … between myself and colleagues at Pickles High School. But it was created, based upon things that they said and what I had told you [researcher].*

Research suggests that teachers of color contribute to tolerance and all students benefit from a diverse teacher workforce (as cited in Jorgenson, 2001; Albert Shanker Institute, 2015). Although some teachers of color may feel responsible for advocating for social justice on behalf of students, particularly those who have been marginalized, as seen in cases A & C, such a stance may tax their energy reserves and contribute to attrition by teachers of color. Research indicates that the greatest impediment to increasing the diversity of the teaching workforce is teacher attrition (Albert Shanker Institute, 2015). A future investigation could examine social networking for equity work for its impact on
attrition across teacher demographics. Such an investigation may yield insights into the types of social supports that may enhance science teacher-leaders’ influence with regard to issues of equity.

A long-term exploration of the ways in which professional relationships afford and constrain science teacher-leaders’ collaborative work of examining practices using an equity lens may be informative for professional development facilitators. The findings from this study suggest that social interactions are a key component of science teacher leadership for equity and this line of inquiry is another area for future research.

Chapter 5 Discussion

Summary of Findings

The current reform in science education acknowledges inequity and calls for significant changes to instruction (NRC, 2012; NRC, 2013). The purpose of this study was to investigate science teacher leaders’ educational practices as they worked to develop and sustain instruction that promoted the full participation of all students at the secondary level during a period of reform. This study addressed two research questions: (1) ‘How do participants describe science teacher-leaders’ educational practices for equity?’ and (2) ‘How are science teacher-leaders’ equitable practices related to organizational structures and social norms within secondary schools?’ A qualitative case study approach is used to describe the educational practices of science teachers as they attend, and influence others to attend, to issues of equity within secondary schools. The study involves four cases of science teachers leading for equity
in one middle school and three high schools. Two of the four teachers are formally positioned as teacher leaders within their schools.

Pilar (Case A), the first formally positioned teacher-leader, is the science facilitator at Crescent Middle School. Some of the participants in this case acknowledge that inequity exists yet describe inequity vaguely, while Pilar explicitly defines equity and actively targets inequity within the science department. She defines equity in a way that is consistent with the democratic purposes of education. She discusses equity as providing what is needed for each individual student to fully participate in learning. Within her classroom, Pilar works to empower students to take ownership of learning. Beyond her classroom, Pilar is thoughtful about whose perspective is excluded from instructional decision-making, whose perspective is valued, as well as who consistently benefits from the organization of academic supports at Crescent Middle School. In her role as a science teacher-leader, Pilar encourages colleagues to examine their instructional practices while reflecting on their biases and on who may be marginalized by these practices.

Jazmin (Case B), the second formally positioned teacher-leader, is the NGSS coach at Matador High School. Participants in this case acknowledge different ways that inequity is manifested within the school. Participants describe Jazmin’s role as crucial for supporting instructional change within science classrooms, as well as for implementing district initiatives which attend to inequity. The principal at Matador High School restructured physical space to create teacher collaboration centers; in addition, teacher and student schedules were modified to allow more student choice in course selection. The new schedule also permits Jazmin to visit and be visited by colleagues
for instructional support. In her role as a science teacher-leader, Jazmin encourages colleagues to examine their instructional practices for patterns of exclusion that may perpetuate if no changes are made. Jazmin also works to support colleagues as they work through dissonance between Framework/NGSS expectations and personal assumptions. She described her efforts toward leading for equity as implicit such as when she offered her colleagues alternatives to deficit thinking.

Cierra (Case C) is a member of her science department and informally leads by participating in science teacher leadership programs, as well as through advocating for student inclusion during decision-making at Pickles High School. The school’s science department is a traditional hierarchical model of instructional leadership, one that does not allow for teacher leadership as defined in this study. Cierra’s leadership for equity at Pickles High School occurs in an isolated manner that consisted of a style that one could consider disruptive and confrontational. In her informal role as a science teacher-leader, Cierra targets deficit-thinking and pushes colleagues to consider the ways that language perpetuates stereotypes and to question their assumptions even though such a stance created tension with colleagues.

Craig (Case D) is also positioned as an informal teacher-leader meaning that he does not hold a formal leadership title. At McMan Commerce Academy, instructional leadership is a hybrid between a traditional hierarchical model for evaluating teacher performance and distributed leadership for curriculum development and modifications. For example, the science department at McMan Commerce Academy worked collaboratively to design the curriculum with authentic assessments that allow student choice and, in some cases and where appropriate, community involvement. Craig’s
leadership work involves advocating for more support for public schools and his work typically occurs in the community surrounding the school. Craig’s leadership is similar to Cierra’s in that it mainly occurs external to the school. However, Craig’s leadership is unique in that he works to strengthen ties between the school and the surrounding community.

School organization for teacher leadership varies, nonetheless science teacher-leaders share common practices when leading for equity. Two science teacher-leaders, Pilar and Jasmin, occupy the formal roles of science facilitator and NGSS coach within their schools. The other two science teacher-leaders, Cierra and Craig, lack a formal leadership position within their schools. Yet, despite having different organizational structures, *Reflecting and Promoting* are prominent equitable leadership practices across the cases.

Science teacher leadership for equity is not without significant challenges. As teachers, these teacher-leaders are able to promote and model strategies for equitable instruction. As leaders, they create physical and intellectual spaces for examining practices using an equity lens. However, their leadership for equity is grounded in their personal understanding of different factors that impact equity in science instruction. Building a shared understanding of these factors and their relevance to current science instruction among colleagues is an implicit goal of their leadership. Yet, the findings indicate that this work strains existing relationships, the same collegial relationships necessary for their teacher leadership, and contributes an additional burden to the science teacher-leaders of color.
Discussion

This study highlights the need for organizational change that supports teacher professional learning around inequity and science education. This type of professional learning could support teachers as they attend to issues of equity within and beyond their classrooms. This study is also significant for its insight into peer influence among teachers. This examination of peer influence has implications for the preparation of teacher-leaders to lead reform for more equitable outcomes.

We know that teacher learning and teacher expertise are important for teacher effectiveness (Darling-Hammond & Ball, 1998). We also know that there are significant challenges facing teachers as they learn to teach to new standards (Loucks-Horsley & Matsumoto, 1999; NASEM, 2015). Complicating science teachers’ work are the expectations for instructional change toward equitable aims (NRC, 2013) and that this type of social justice work is dependent upon both context and organizational level (Gewirtz, 2006). The conditions surrounding NGSS implementation, as well as the issue of equity being addressed, vary among secondary schools.

This study demonstrates how individual views on equity relate to science teacher-leaders’ instructional and leadership practices as they work both to address an issue of equity and to implement NGSS-based reform. The science teacher-leaders presented in each case proactively challenge inequity based on their perception of racism in Pilar’s and Cierra’s cases (case A & C) or classism in Jazmin’s, Cierra’s and Craig’s cases (cases B, C, & D). The science teacher-leaders facilitate peer learning that centers on an issue of equity and its relation to science instruction.
Racism is a systematic, oppressive force that privileges White, Anglo-American individuals. Two of the science teacher-leaders work to address racism among educators. The bus incident, involving someone moving Pilar’s belongings when she refused to relocate, reminded Pilar of instances in which educators may overlook the needs of students from non-dominant and marginalized groups. The other educators on the bus failed to inquire about the needs of Pilar, a member of a non-dominant group, and prioritized the needs of a White, Anglo-American educator. Moving Pilar’s belongings without her permission was an aggressive act that Pilar challenged. Pilar enacted ‘Examining’ (ELP #2) as she openly questioned educators’ actions as well as the implications of those actions. She shared this experience with colleagues to facilitate conversations about race and inequity. Cierra also targets racism as an issue of equity within her school. Cierra witnessed derogatory remarks regarding students’ ethnicity. She challenged these racist remarks by reporting them and providing counter stories to influence school culture.

Pilar and Cierra’s leadership for equity involves raising awareness of the ways that actions can perpetuate the marginalization of students based on race. Both science teacher-leaders use their own experiences with microaggressions to draw attention to individuals whose perspectives are silenced or diminished, particularly during decision-making processes. By sharing experiences, they are increasing educators’ awareness of the perspectives of non-White, Anglo-American individuals, thereby facilitating socially-mediated learning (Brown, 1994; Lave, 1991; Wenger, 2011) about inequity.

In light of a racial issue that unfolded at Matador HS, Jazmin plans to lead her colleagues by facilitating conversations about race and inequity based on her
understanding of the experiences of non-dominant and marginalized groups. However, at the time of this study, Jazmin’s leadership for equity targeted classism. Classism in the U.S. is a systemic, oppressive force that privileges some groups of individuals based on economic, social, and cultural conditions. All of the science teacher-leaders express a keen awareness of how privilege operates within and around their schools and districts. Their leadership practice, Promoting (ELP #4), encourages evaluation for whose perspective is being privileged and the ways that instruction can be adapted to meet the needs of each student. The science teacher-leaders work to counter classism and promote inclusion in science learning.

Some teachers view equity as an important yet separate focus than NGSS-based reform. We see these views illustrated by science teachers from Crescent Middle School, Tabitha, and from Matador High School, Bret. Yet, the science teacher-leaders for equity did not share the same distinction. Their understanding of the historical and social contexts of inequity inform their teacher leadership practices. Specifically, the four science teacher-leaders’ understanding of how racism and classism are manifested in science education informs the practices they enact to target and address these issues. Their vision for science education is intertwined with their vision for equity.

The policy guiding NGSS-based reform states that by the end of twelfth grade, “all students have some appreciation of the beauty and wonder of science, possess sufficient knowledge of science and engineering to engage in public discussion on related issues, are careful consumers of scientific and technological information related to their everyday lives, are able to continue to learn about science outside school, and have the skills to enter careers of their choice” (NRC, 2012, p.1). This policy statement
reflects more equitable aims for science education compared to past reform. The Framework articulates a vision for science education that promotes inclusion and the application of science beyond the memorization of facts. This reform movement in science education has created pressure for a shared understanding among classroom teachers of these expectations for all of their students and subsequently, for their instruction.

NGSS Appendix D articulates some practical, research-based classroom strategies for implementation of NGSS with diverse student populations. The chapter is organized based on federal policy accountability categories and the cases represent instruction in different science disciplines and grade levels. One caveat is an understanding that diverse student groups could fall under multiple categories simultaneously. A main theme of NGSS Appendix D is that students from diverse backgrounds are capable learners who require opportunities to engage in cognitively demanding science instruction that is consistent with the vision for science education.

The science teacher-leaders from cases A-D share a collective goal of creating cognitively demanding instruction that attends to racism or classism and engages all students in learning. Of the five equitable leadership practices present, two of those practices, *Examining* (ELP #2) and *Promoting* (ELP #4), are explicit ways that these science teacher-leaders work to first, raise awareness of the issue of equity among their colleagues, and second, to collectively address the issue that contributes to the marginalization of some student groups within their schools or districts.

This study demonstrates that science teacher leadership for equity is purposeful work. Teaching is a “situated and relational” (Biesta & Stengel, 2016) endeavor. As a
profession, teaching is characterized by shared knowledge and practices (Louck-Horsley, Stiles, Mundry, Love, & Hewson, 2010). These science teacher-leaders are Examining (ELP #2), Promoting (ELP #4), and in some cases, Lobbying (ELP #7) to create a professional community that addresses inequity and the marginalization of some student groups within science education. Creating a professional community and developing others, leaders who reinforce that community is consistent with the conception of teachers as professionals (Berg, et al., 2013) and social justice work (Harro, 2000).

Teacher leadership is associated with teacher learning and professional collaboration (Louck-Horsley, et al., 2010; York-Barr & Duke, 2004). Developing teacher leadership is an ongoing process that involves reflective practice. Reflecting (ELP #1) is an equitable leadership practice common among the science teacher-leaders that both sustains their leadership for equity work and is a component of building their expertise. The science teacher-leaders’ equity and instructional work builds from their deepening understanding of the issue of equity facing science instruction at their school or district.

As indicated in chapter 2, social justice in education is also dependent upon the organizational level in which it is enacted (Gewirtz, 2006). This study provides empirical data that social position matters when influencing peers. Teacher-leaders occupy a distinctive role in the leadership organization of secondary schools. The peer-to-peer approach adopted by the science teacher-leaders is a unique method of leadership for addressing inequity.
Professional preparation and development that explicitly attends to issues of equity is not widespread (Cochran-Smith & Villegas, 2015; Kohli, 2019). Yet, these science teacher-leaders are influencing their peers and providing powerful learning experiences at the local level. All the science teacher-leaders had more than five years of teaching experience and are continually involved in professional learning. Each share some of the characteristics common among department heads (DeAngelis, 2013), but not all. While lacking formal graduate training for addressing issues of equity, these science teacher-leaders are able to lead for equity given their experiences and credibility among staff. Their leadership for equity can be, at least partially, attributed to school organization just as such work can also be inhibited when schools lack infrastructure for teacher leadership roles.

Infrastructure is a significant component in the design for comprehensive school improvement models (Cohen & Bhatt, 2012). Infrastructure is defined as structures or physical networks that facilitate the exchange of resources (Larkin, 2013) and includes resources for teaching and teacher improvement. A considerable amount of research supports the view that teacher leadership is an important factor for successful organizational change (Camburn & Han, 2015; Cooper et al., 2016; Rowan et al., 2004; Supovitz, 2018) and thus may provide networking that facilitates teacher improvement.

Instructional guidance and learning opportunities for teachers pave the way for teachers’ reflective practice and implementation of reform. Camburn & Han (2015) found that learning experiences involving social interactions with teacher-leaders in the context of instruction was strongly associated with teachers’ reflective practices. Additional research indicates that teacher-leaders, i.e. National Board Certified
Teachers, strongly influence other teachers and classroom practices more so than influencing change in schoolwide policy (Cannata, McCrory, Sykes, Anagnostopolis, Frank, 2010). The findings from this study adds additional support for the position that teacher-leaders are a key lever for instructional change. This study further attests to the teacher-leaders’ educational practices for exerting their influence among colleagues toward more equitable instruction.

The NGSS-reform movement is gaining traction. As of 2019, approximately 88% of states have adopted new science standards based on the Framework (NSTA, 2017).Addressing persistent gaps in educational opportunities are paramount to the reform in science education. Teacher leadership remains a critical lever for classroom-level changes that target inequity in science education. This study presents strong evidence of the value in uncovering mechanisms through which teachers work as leaders to address inequity.

Limitations

The leadership for learning model of instructional leadership was developed internationally based on urban elementary school settings. Hallinger (2011) calls for more research to link this model to different contexts. This study offers one such extension to secondary schools. The findings presented here are limited to the leadership of these four science teacher-leaders, their schools, and their communities and should not be generalized to encompass all science teacher-leaders.

Wenner and Campbell (2017) reported in their literature review on teacher leadership a mere 9% of studies have a focus on equity and diversity. This study has
been designed to contribute to our understanding of teacher leadership and issues of equity within an academic discipline, science.

Lastly, the qualitative methodologies selected in this study provided rich descriptions of teachers’ practices as those practices occurred within schools. The interpretations presented are limited to the perspectives of this study’s participants. Much of the evidence of the practices of the science teacher-leaders in cases A-D stem from interviews with the science teacher-leaders themselves rendering the findings more reflective of the science teacher-leaders’ perspectives than of alternative perspectives captured from colleagues and principals. Nevertheless, this case study allows for a deep understanding of these science teachers’ practices as they lead for educational equity.

**Recommendations for future research**

A broader understanding of how school conditions relate to science teacher leadership that is geared toward equity in science instruction may be useful to principals and organizations concerned with supporting teacher-leaders. These empirical findings describe the intersection of science teacher-leaders’ practices and school conditions as the science teachers pursue more equitable science instruction for each of their students, particularly those who may have been marginalized in the past, and even for students beyond their own classrooms. Future studies could also reveal additional mechanisms of action for teacher leaders to promote equitable instruction beyond their individual classrooms.

My contribution to the field of instruction is to broaden the theoretical understanding of the practices of science teacher-leaders and their impact on
educational equity. Additional investigations into how professional relationships among teachers impact individuals' values, beliefs, and assumptions are warranted to filter through some of the murkiness of the teaching profession. Future studies could investigate factors that moderate science teachers’ adoption of equitable classroom practices. An extension of this study may reveal how the equitable leadership practices of science teacher-leaders relate to student learning.

**References**


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https://doi.org/10.1177/1094670509353043


https://doi.org/10.1177/0013161X06293717


Appendix A: Equitable leadership practices

This table was constructed using Ishimaru & Galloway’s (2014) work on high-leverage equitable leadership practices. Ishimaru and Galloway (2014) identify 10 high-leverage equitable leadership practices of which I chose 7 for science teacher leaders. I acknowledge the Teacher Leader Model Standards, created by the Teacher Leadership Exploratory Consortium (2012), specifically address teacher leadership, however, they do not specify a social justice stance. Leadership practices that reflect a social justice stance are more suited to this study on science teacher leadership for equity. I denote possible connections between the selected high-leverage equitable leadership practices and the Teacher Leader Model Standards in the table below.

Connections between ELP and TLMS

<table>
<thead>
<tr>
<th>High-leverage Equitable Leadership Practice</th>
<th>Teacher Leader Model Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Engaging in self-reflection and growth for equity</td>
<td>Domain 6: Improving outreach and collaboration with families and community</td>
</tr>
<tr>
<td>Engage in personal &amp; intellectual work to understand how privilege, power, and oppression operate in school and society.</td>
<td>c) Facilitates colleagues’ self-examination of their own understandings of community culture and diversity and how they can develop culturally responsive strategies to enrich educational experiences and achieve high levels of learning for all students</td>
</tr>
<tr>
<td>Examine their own identities, values, biases, assumptions, and privileges.</td>
<td></td>
</tr>
<tr>
<td>Consistently enact core values of democracy, social justice, &amp; equity (has the will to act/takes risks)</td>
<td></td>
</tr>
<tr>
<td>2) Developing organizational leadership for equity</td>
<td>Domain 2: Accessing and using research to improve practice &amp; student learning,</td>
</tr>
<tr>
<td>Develop others as leaders and build their capacity to examine practices, underlying biases, and assumptions</td>
<td>a) Assists colleagues in accessing and using research in order to select appropriate strategies to improve student learning</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Dialogue, inquiry, and collaboration about equitable teaching and learning grounded in an understanding of disparities</th>
<th>c) Supports colleagues in collaborating with the higher education institutions and other organizations engaged in researching critical educational issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaborate to change educational practice &amp; provide high-quality education for each student</td>
<td>d) Teaches and supports colleagues to collect, analyze, and communicate data from their classrooms to improve teaching and learning</td>
</tr>
</tbody>
</table>

**Domain 4: facilitating improvements in instruction & student learning**

- b) Engages in reflective dialog with colleagues based on observation of instruction, student work, and assessment data and helps make connections to research-based effective practices.

<table>
<thead>
<tr>
<th>3) Constructing and enacting an equity vision</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop, in an inclusive process, an explicit vision of collective responsibility for the educational success of each student</td>
<td></td>
</tr>
<tr>
<td>Enact that vision</td>
<td></td>
</tr>
<tr>
<td>Model the vision</td>
<td></td>
</tr>
<tr>
<td>Employ strategies for countering resistance to sustain the vision</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4) Supervising for improvement of equitable instruction</th>
<th>Domain 3: Promoting professional learning for continuous improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support staff in improving equitable instructional practices</td>
<td>c) Facilitate professional learning among colleagues</td>
</tr>
<tr>
<td>Provide individualized feedback on instructional practices for equity</td>
<td>g) Provides constructive feedback to colleagues to strengthen teaching practice and improve student learning</td>
</tr>
<tr>
<td>Promote equitable instruction and equitable student access to content</td>
<td></td>
</tr>
<tr>
<td>Holds staff accountable for providing equitable access to content and meeting the learning needs of each child</td>
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<tr>
<td><strong>5) Fostering an equitable school culture</strong>&lt;br&gt;Build authentic relationships across the school community&lt;br&gt;Belief in and shared responsibility for each student's capacity to learn&lt;br&gt;Challenge deficit thinking</td>
<td>Domain 1: Fostering a collaborative culture to support educator development and student learning&lt;br&gt;d) Strives to create an inclusive culture where diverse perspectives are welcomed in addressing challenges</td>
</tr>
<tr>
<td><strong>6) Collaborating with families and communities</strong>&lt;br&gt;Develop and maintain meaningful, ongoing relationships with parents, families, and community leaders to in shaping the educational process &amp; school improvement for equity&lt;br&gt;Embed “funds of knowledge” and other resources in instruction</td>
<td>Domain 6: Improving outreach and collaboration with families and community&lt;br&gt;e) Collaborate with families, communities, and colleagues to develop strategies to address the diverse educational needs of families and the community</td>
</tr>
<tr>
<td><strong>8) Allocating resources</strong>&lt;br&gt;Collaborate with colleagues, leadership, families, and community members to equitably allocate resources</td>
<td>Domain 7: Advocating for student learning and the profession&lt;br&gt;c) Collaborate with colleagues to find opportunities to advocate for students, additional resources to support student learning, and to communicate with targeted audiences</td>
</tr>
<tr>
<td>7, 9 &amp; 10 have been omitted for this study</td>
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## Appendix B: Case Study Protocol

<table>
<thead>
<tr>
<th>Field Procedures</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overview</td>
<td>The purpose of this study is to investigate how local contexts relate to teacher leadership in science instruction geared toward educational equity. The study would illuminate the various ways organization and school culture relate to teacher leadership focused on educational equity in science education.</td>
</tr>
</tbody>
</table>
| Tentative timeline: | - 3 weeks to recruit science teacher leaders with an equity focus -(Jan)  
- 2 weeks to schedule observation periods & distribute questionnaire (Jan-Feb)  
- 3 months to conduct all interviews and begin preliminary analysis (Feb-Apr)  
- 5 months for continued analysis and writing dissertation findings (May-Sept)  
- 2 months for writing discussion section and finalizing dissertation (Oct-Jan) |
| 1. Recruitment of a purposeful sample: Talk with colleagues, former colleagues, science teachers, and professors to identify STL focused on equity |
| 2. Data Collection: Interview STL. Discuss STL’s views (vision & goals) on science instruction as well as equitable leadership practices. Identify 2-3 colleagues and invite to participate. Meet the principal and invite to participate. Identify opportunities for observations of STL’s enactment of ELPs |
| 3. Data Collection: Second interview of STL. Discuss conditions, observations, leadership PD, and equitable leadership practices. Listen as the TL reflects and shares their knowledge, beliefs/values, and actions/reactions |
| 4. Data Collection: Conduct 1:1 interviews with 2-3 colleagues. Discuss social interactions with the STL, conditions surrounding the interaction(s), the ways STL has influenced their pedagogy/practices/instruction |
| 5. Data Collection: Conduct 1:1 interview with principal. Discuss social interactions with the STL, conditions surrounding the interaction(s), the leadership role/expectations for STL, opportunities to develop/sustain STL’s leadership practices |
| 6. Data Collection: Observe STL’s enactment of ELP. Take ethnographic field notes (who is present, who participates, how is participation managed, how do participants interact with STL and each other, what are tasks, how are tasks managed, etc. Use SYMLOG Behavior sheet to summarize interactions, dimensions, and trends. |
| 7. Data Collection: Collect artifacts from science teacher leadership activity. Examine these artifacts as they relate to the enactment of equitable leadership practices. |
| 8. Data Collection: Collect documents/artifacts of schools’ internal organization (schedules, space, etc.). Examine this data along with interview and observation data to explore the organizational structures surrounding STL’s enactment of equitable leadership practices. |
| 9. Data Collection: Third interview with STL. Discuss conditions, observations, and equitable leadership practices. Listen as the STL reflects and shares their knowledge, beliefs/values, and actions/reactions. Share preliminary findings and elicit STL’s interpretations and feedback. Listen as the STL shares closing thoughts. |
10. Data Analysis: Share preliminary data. During the third interview, discuss TL’s perceptions and ask how the STL makes sense of ELP within the school setting. Iterative cycles of reading and coding the data to lead to a comprehensive interpretation of findings. Member checking for validation

<table>
<thead>
<tr>
<th>Case Study Questions</th>
<th>Level 1: <em>(Questions asked of interviewees. These questions will be included within the semi-structured interview protocol)</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- How do STL’s equitable leadership practices influence interactions within the group (department @ high school, or other collective setting)? - How do STL’s equitable leadership practices impact curricular decisions/implementation? --</td>
</tr>
<tr>
<td></td>
<td>- How does STL’s framing impact their equitable leadership practices? - How do roles and relationships influence STL’s use of equitable leadership practices?</td>
</tr>
</tbody>
</table>

|                      | Level 2: *(questions asked of an individual case-mental. These questions will be answered from my analysis of the data)* |
|                      | - How do organizational and social structures within this school relate to science teacher leaders’ enactment of equitable practices? |

|                      | Level 3: *(questions asked of the pattern across multiple cases. These questions will also be answered from my analysis of the data as I think about patterns across cases)* |
|                      | - How do organizational and social structures across schools relate to STLs’ enactment of equitable leadership practices? |

|                      | Level 4: *(questions asked of the entire study)* |
|                      | - What are the implications for STLs’ enactment of equitable leadership practices at the secondary level? - What are the implications for science teacher leadership for equity beyond science instruction? - Are tensions present in my analysis of STLs’ enactment of equitable leadership practices? If so, how do the tensions play out? |

|                      | Level 5: *(questions about policy recommendations and conclusions- “normative questions”)* |
|                      | - What are the implications for school and district leaders concerned with the teacher leaders’ role in leadership for equity? |

<table>
<thead>
<tr>
<th>A reminder for the Dissertation</th>
<th>Target audience:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dissertation committee</td>
</tr>
<tr>
<td></td>
<td>District leadership</td>
</tr>
<tr>
<td></td>
<td>Principals</td>
</tr>
<tr>
<td></td>
<td>Teacher leaders concerned with equity in science education</td>
</tr>
</tbody>
</table>
# Appendix C: Data Collection Table

<table>
<thead>
<tr>
<th>Case</th>
<th>Data Collection Tool</th>
<th>Observation period</th>
<th>Admin interview</th>
<th>Colleague Interview (2)</th>
<th>TL Interview 3</th>
<th>Artifacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>49:38 min transcript- pp. 1-19 [Pilar]</td>
<td>22 min transcript- pp. 1-9</td>
<td>1 week of field notes</td>
<td>email invite sent</td>
<td>C1_I1: 18 min transcript-pp. 1-9; C2_I1: 23 min transcript-pp.1-9</td>
<td>30 min transcript, 12 pgs</td>
</tr>
<tr>
<td>C</td>
<td>60 min transcript- pp. 1-14 &amp; 6:12 min transcript-pp. 1-3 [Cierra]</td>
<td>47:03 min transcript-pp. 1-12</td>
<td>None- no leadership in new school. Former school unaccessible.</td>
<td>email invite sent to former admin.</td>
<td>email invite sent</td>
<td>24:35 min transcript-pp. 1-7</td>
</tr>
<tr>
<td>D</td>
<td>47:48 min transcript- pp. 1-12 only.</td>
<td>47:48 min (PPT/EP?) meeting. Notes only.</td>
<td>shadowing 3 days</td>
<td>email invite sent to AP</td>
<td>None</td>
<td>40:36 min transcript-pp. 1-12</td>
</tr>
</tbody>
</table>
Appendix D: IRB Approval Form

<table>
<thead>
<tr>
<th>Type of Research:</th>
<th>Dissertation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study Title:</td>
<td>The Equitable Leadership Practices of Teacher Leaders in Secondary Science Instruction</td>
</tr>
<tr>
<td>Study Objective:</td>
<td>The purpose of the study is to investigate how structures and social norms within schools relate to teacher leadership for educational equity in science instruction. The study would illuminate how teacher leaders enact equitable leadership practices as they participate in decisions that shape science instruction for all students.</td>
</tr>
<tr>
<td>Student Investigator, Faculty PI and Correspondent Information:</td>
<td></td>
</tr>
<tr>
<td>Name:</td>
<td>Lataanya T Brandon</td>
</tr>
<tr>
<td>Department:</td>
<td>Human Rights Institute</td>
</tr>
<tr>
<td>Curriculum and Instruction:</td>
<td>Research Incentive Account</td>
</tr>
<tr>
<td>Preferred Phone #:</td>
<td>Faculty Start-Up Funds</td>
</tr>
<tr>
<td>Investigator Emergency Phone #:</td>
<td>Unfunded</td>
</tr>
<tr>
<td>Correspondent Name:</td>
<td>Investigator Out-of-Pocket</td>
</tr>
<tr>
<td>Are there additional key personnel to be listed on this study?:</td>
<td>No</td>
</tr>
<tr>
<td>Section II: Collaborating Institutions/Facilities and Other IRB Reviews:</td>
<td></td>
</tr>
<tr>
<td>Will the research be conducted only at Storrs and/or the five regional campuses, School of Law, or School of Social Work with no involvement of a collaborating institution?:</td>
<td>Yes</td>
</tr>
<tr>
<td>Section III: Funding</td>
<td>It is the responsibility of the Principal Investigator to notify the IRB via an Amendment (IRB-3) form if the funding source changes.</td>
</tr>
<tr>
<td>Departmental Funds:</td>
<td></td>
</tr>
<tr>
<td>External (including subawards):</td>
<td></td>
</tr>
<tr>
<td>VPA Research Excellence Program:</td>
<td></td>
</tr>
<tr>
<td>Graduate School DGF or EE Award:</td>
<td></td>
</tr>
<tr>
<td>Office of Undergraduate Research Award:</td>
<td></td>
</tr>
<tr>
<td>Total number of participants to be enrolled?:</td>
<td>35</td>
</tr>
<tr>
<td>If you are enrolling more than one population describe the total enrollment for each.</td>
<td>The primary focus of the study is on teacher leaders. I anticipate no more than 4 science teacher leaders will enroll in the study. A portion of the study involves an anonymous questionnaire. The science teacher leader participants will take an anonymous questionnaire and share a link to the questionnaire with other teachers in their science departments and other teachers, administrators, and staff outside of the department but with whom the science teacher leader may work and influence. I anticipate up to four science teacher leaders will agree to participate and up to 13 colleagues per science teacher leader will participate through the anonymous questionnaire and/or individual interviews. After accounting for attrition and incomplete questionnaires, I estimate a total sample size of no more than 35 respondents. However, no more than 4 science teacher leaders will be enrolled in the study as key informants and primary participants of the dissertation.</td>
</tr>
<tr>
<td>Participant Population(s):</td>
<td>Describe the participant population(s) including gender, ethnicity, income, level of education and age range. Teacher participants: will be female or male secondary teachers, minimum of a Bachelor’s degree, age 20-70, of various ethnicities and linguistic backgrounds. All speak English and some may be multi-</td>
</tr>
</tbody>
</table>
**Recruitment:**
Describe how participants will be identified and recruited. Attach copies of all advertisement/recruitment materials for IRB review. Who: I, the UConn student researcher, will recruit science teacher leaders with an equity focus for enrollment in this dissertation study.

When: Upon IRB approval, I will begin recruitment as soon as possible during the fall semester, ideally beginning in October 2018.

Where: Science teacher leaders will be approached during in-person meetings that I attend at various local and professional organizations. I will continue to contact science teacher leaders using word-of-mouth, email, and referrals from people in my social network.

How: I will identify and recruit equity-minded science teacher leaders from among friends, colleagues, and former colleagues, i.e., people connected to me personally and/or professionally as well as through my associations as a former secondary science teacher. Upon IRB approval, I will contact two science teacher leaders with an equity-focus from the pilot study. These two participants may refer two additional science teacher leaders with an equity focus to the study for a total of four science teacher leaders. I will share a detailed information sheet with potential participants. Science teacher leaders will be considered enrolled in the study once I obtain their written consent.

**Special Population(s):**
Identify any special participant population(s) that you will be specifically targeting for the study. Check all that apply.

- [ ] Minors
- [ ] Prisoners
- [ ] Pregnant Women/Neonates
- [ ] Developmentally Impaired
- [ ] UConn Students
- [ ] UConn Employees
- [ ] Economically/Educationally Disadvantaged
- [ ] Members of the Armed Forces
- [ ] Non-English Speaking
- [ ] Individuals Living with AIDS/HIV
- [ ] Other (Please identify):

* Will this study be monitored by a UConn physician? [ ] Yes [ ] No

**SECTION VII: Drugs/Devices, Genetic Testing, Radiation and Biological Samples**

**Drug/Device Use**
Does the study involve the use of any of the following (check all that apply)?

- [ ] An FDA approved drug or medical device
- [ ] An investigational/ unapproved drug, supplement or medical device
- [ ] A non-medical device
- [ ] A proprietary product
- [ ] A biological agent

**Biological Samples**

- [ ] Does the study involve the use of biological samples? (Either banked or prospectively obtained)

**Genetic Testing**

- [ ] Does the study involve the genetic testing of biological samples?

**Radiation or Radioisotopes**

- [ ] Does the study involve the use of radiation or radioisotopes?

**Treatment**

- [ ] Does this study offer treatment for the participants’ condition?

*Populations Selected (IRB Office Use Only)*

UConn IRB PROTOCOL H18-199 APPROVED January 3, 2019
**Appendix A — Personnel**

*Instructions:* The IRB must review and approve all changes to the Key Personnel, before implementation in the field. Submit this log at the time of initial review and at continuing review if changes are being made. Include the complete list of UConn Key Personnel and non-UConn Investigators. In addition, submit this form and an IRB-3 Amendment Request Form, to add or remove individuals to the protocol throughout the approval period.

**PI:** Brandon, Latanya T

**Protocol Title:**

The Equitable Leadership Practices of Teacher Leaders in Secondary Science Instruction

**UConn Key Personnel Engaged in Research** (i.e. enroll participants, conduct consent process, collect or review data/identifiable information from participants, intervene/interact by performing invasive procedures, have access to information that links participants’ names or other identifiers with their data, or act as authoritative representatives for the investigators) – Provide the following information for each person:

**Important:** Please be specific. For example, the term "Co-Investigator" is not sufficient. You must describe the specific role (e.g. "Co-Investigator - train confederates"). For student directed research, the role of the PI may be described as "PI - oversee/mentor student researchers." For full board and expedited studies, include the specific procedures (e.g. blood draws, interview, survey distribution, acting as a confederate) each person will perform and his/her experience/training with this procedure.
Interview Consent Form

University of Connecticut

Consent Form for Participation in a Research Study

Principal Investigator: Dr. John Settlage  Student researcher: Latanya Brandon

Study Title: The Equitable Leadership Practices of Teacher Leaders in Secondary Science Instruction

Introduction

You are invited to participate in a research study to investigate the leadership practices of science teacher leaders for equity. You are being asked to participate as a teacher leader in science education in a state that has adopted Next Generation Science Standards or other closely related standards.

Why is this study being done?

I am conducting this study for my dissertation on teacher leadership for equity in science education. I am studying teacher leadership, equity work, and science instruction. This case study allows me to explore teacher leadership practices for equity and science instruction at the secondary level.

What are the study procedures? What will I be asked to do?

Participation in this study is voluntary. If you choose to participate, you are free to withdraw from it at any time. The information in this consent form pertains to an in-depth study of your role as a teacher leader for equity in the form of interviews and observations. I will contact you via email to meet with you and discuss your ideas and work as a science teacher leader for equity. We will meet for a total of three individual, audio-recorded interviews. To understand and describe your leadership work, I will ask to meet 2-3 of your colleagues as well as your principal and invite them to talk with me once, individually, in an audio-recorded interview. Interviews may last from 30-60 minutes. To understand and describe your leadership work from a variety of perspectives, I will provide you with a link to an anonymous questionnaire that you may take and share with others involved in instruction. A separate information and consent form is provided with the questionnaire. To understand and describe the context of your leadership work, I will ask to observe you as you engage in your teacher leadership role. Observation length will vary depending on the context of your teacher leadership work. The purpose of observation is to gather information about how your equity work as a science teacher leader is situated within a secondary school. Any information obtained from interviews or observations will NOT be used to assess nor to evaluate.
What are the risks or inconveniences of the study?

I believe there are minimal risks associated with this study. However, one possible inconvenience may be the time it takes to complete the study. Another potential risk may be a breach of confidentiality. I will reduce this risk by using pseudonyms and by de-identifying personal information before sharing any findings.

What are the benefits of the study?

You may not directly benefit from this research. However, you may benefit from these collegial interactions and your responses will be informative to the education community, particularly in the areas of teacher leadership and equity in science instruction.

Will I receive payment for participation? Are there costs to participate?

You will not receive any compensation for participation. There are no costs to participate.

How will my personal information be protected?

The following procedures will be used to protect the confidentiality of your data. The researchers will keep all consent forms locked in a secure location at the university. Data shared with others will be de-identified and will contain pseudonyms to help protect your identity. Audio-recorded interviews will be sent to a third-party vendor, Temi, for transcription. Your confidentiality will be maintained to the degree permitted by the technology used. Specifically, no guarantees can be made regarding the interception of data sent via the Internet by any third parties. A non-disclosure agreement from Temi has been obtained. For analysis purposes, field notes, transcripts, and audio files of the interviews will be stored on a password-protected computer. All electronic files will be securely stored in a password-protected folder in cloud storage. Data will be kept for 5 years to allow the researcher to refer to it for accuracy, but after 5 years it will be discarded. At the conclusion of this study, the researcher may publish her findings. Information will be de-identified prior to dissemination, publications, or presentations. We will do our best to protect the confidentiality of the information we gather from you but we cannot guarantee 100% confidentiality.

You should also know that the UConn Institutional Review Board (IRB) and Research Compliance Services may inspect study records as part of its auditing program, but these reviews will only focus on the researchers and not on your responses or involvement. The IRB is a group of people who review research studies to protect the rights and welfare of research participants.

Can I stop being in the study and what are my rights?

You do not have to be in this study if you do not want to. If you agree to be in the study, but later change your mind, you may drop out at any time. You may agree to participate in all or a portion of the study. You do not have to answer any questions that you do not want to answer. There are no penalties or consequences of any kind if you decide that you do not want to participate.
Whom do I contact if I have questions about the study?

Take as long as you would like before you make a decision. We will be happy to answer any questions you have about this study. If you have further questions about this project or if you have a research-related problem, you may contact the principal investigator, Dr. John Settlage at (860) 230-7741 or the student researcher, Latanya Brandon at \[\text{[email protected]}\]. If you have any questions concerning your rights as a research subject, you may contact the University of Connecticut Institutional Review Board (IRB) at 860-486-8802.

Documentation of Consent

I have read this form and decided that I will participate in the study, The Equitable Leadership Practices of Teacher Leaders in Secondary Science Instruction, described above. Its general purposes, the particulars of involvement and possible risks and inconveniences have been explained to my satisfaction. I understand that I can withdraw at any time. My signature also indicates that I have received a copy of this consent form.

I agree to participate in the study as described above.

__________________________  __________________________  __________________________
Participant’s signature     printed name               signature date

__________________________  __________________________  __________________________
signature of person obtained consent    printed name               signature date
Appendix E: Semi-structured Interview Protocols

Introduction:
Thank you for participating in this study and for taking the time to talk with me about your work and experiences with science instruction in a secondary school. May I have your permission to record our interview using an audio-recording device?

Science teacher-leader (STL) Interview 1:

The goal of this interview is to understand your vision for science instruction, how you engage in equity work, and the conditions surrounding your equity work. I am interested in hearing about your role in leading for equity and/or equitable learning.

Identity/Recognition as a leader:
1. How do you identify?
2. How did you become a teacher leader here at ______?
3. Does your identity or any aspect of your identity impact your work here? Tell me about that.

Structures:
4. Let’s talk about the school & NGSS (new science standards). Thinking about how the adoption of NGSS may have impacted science instruction at ______.

Social Norms
5. Thinking about your work with colleagues, staff, & students…can you describe your leadership work?

Equitable Leadership Practices
6. For this study, I’m looking at equity in terms of inclusion, the full/active participation of marginalized groups in decisions. If you think about equity differently in your work, please tell me how. Can you describe your equity work?

Invitation to others
7. I’d like to invite your principal and 2-3 of your colleagues to participate in this study. Would you feel comfortable introducing me? Can you think of 2-3 colleagues who may be willing to talk with me for an interview?

Next Steps
I appreciate the time you spent talking with me. I’d like to return/visit and observe your work with others. Let’s schedule an observation and time for another interview.
Introduction:
Thank you for talking with me again. May I have your permission to record our interview using an audio-recording device?

Science teacher-leader (STL) Interview 2:
The goal of this interview is to gain insight into your leadership practices. Let’s start with (NAME the ELP observed/shared during prior interview or during observation) -

Actions (ELPs)/Reflection
1. Tell me about the aim of your work with others (name the situation). What are your thoughts about (name the situation)?

Conditions
2. How does the organization of (time, space, and instruction) affect your leadership practices (name the ELPs)?
3. How does your relationship with others affect your leadership practices (name the ELPs)?

Equitable Leadership Practices
4. Do any of these practices resonate with your work as a teacher leader? In what ways? Tell me more.
5. Discuss any situation/experiences the STL shares upon reflection on the ELPs. Probe for the structures and social norms surrounding the ELP in that situation. LISTEN CAREFULLY.

I’m grateful you’ve taken this time to talk with me and share your perspective. I will go through my notes and everything you’ve shared with me. Let’s schedule one last interview to talk and summarize how you lead science instruction in equitable ways.
**Introduction:**
Thank you for meeting with me one last time. May I have your permission to record our interview using an audio-recording device?

**Science teacher-leader (STL) Interview 3:**
The goal of this interview is to hear your thoughts and summarize how you lead science instruction in equitable ways.

*Reflection on equitable leadership practices within the structures and social norms of the school*

1. In our first interview, we defined equity as “BASE DEFINITION ON RESPONSE TO #6 in STL INTERVIEW 1”. Has that definition changed at all? If so, please explain
2. Share summary of responses from 1st interview (6 ii). Has your vision for science instruction changed or stayed the same?
3. Can you describe the relationship between your views and practices as a teacher leader and changes in science instruction post-NGSS statewide adoption?

I’ve learned a great deal from all that you have shared. I may reach out with a couple of clarifying questions and you can contact me if you have any questions or thoughts to add. I’m honored by your generosity. Thank you.
Introduction:
Thank you for participating in this study and for taking the time to talk with me about science teacher leadership for equity in your MS/HS school. May I have your permission to record our interview using an audio-recording device?

Principal Interview:
The goal of this interview is to understand your vision for science instruction, how the science teacher leader engages in leadership and equity work, and the conditions surrounding STL equity work. I am interested in hearing your perspectives on leading for equity and/or equitable learning.

Identity/Recognition as a leader:
1. How do you identify?
2. How long have you worked with STL at ______?

Structures:
3. Let’s talk about the school & NGSS (new science standards). Since the adoption of NGSS…

Social Norms
4. Can you describe the leadership model for this school?

Equitable Leadership Practices
5. For this study, I’m looking at equity in terms of inclusion, the full/active participation of marginalized groups in decisions. If you think about equity differently in your work, please tell me how. Can you describe equity work as departmentalized? Please explain

Closing
I appreciate the time you spent talking with me and I may reach out with a couple of clarifying questions. You can also contact me if you have any questions or thoughts to add. Thank you.
Introduction:
Thank you for participating in this study and for taking the time to talk with me about science teacher leadership for equity at your MS/HS school. May I have your permission to record our interview using an audio-recording device?

Colleague Interview:
The goal of this interview is to understand the vision for science instruction, how you engage with STL, and the conditions surrounding science teacher leadership for equity. I am interested in hearing your perspective on leading for equity and/or equitable learning.

Identity/Recognition as a leader:
1. How do you identify?
2. How long have you worked with STL at ______?

Structures:
3. Let’s talk about the school & NGSS (new science standards). Since the adoption of NGSS…
   i.

Social Norms
4. Can you describe the leadership model for this school?

Equitable Leadership Practices
5. For this study, I’m looking at equity in terms of inclusion, the full/active participation of marginalized groups in decisions. If you think about equity differently in your work, please tell me how. Can you describe equity work as departmentalized? Please explain

Closing
I appreciate the time you spent talking with me and I may reach out with a couple of clarifying questions. You can also contact me if you have any questions or thoughts to add. Thank you.
Appendix F: Recruitment Scripts and Emails

For recruitment of science teacher-leaders (STLs):

Hi __________,

For my dissertation, I am investigating the leadership practices of equity-minded science teacher leaders who work in secondary schools. Participation in this portion of the study would involve meeting with me for a total of 3 interviews. Next, I will ask to observe you as you engage in leadership for equity. Lastly, I will also ask to meet 2-3 colleagues you work with as well as your principal so that I can invite them to participate by talking with me, individually, for a single interview. An information sheet for this portion of the study has been attached for your review.

I would love to hear about your experience as an equity-minded science teacher leader and I hope you will consider participating. Interviews will take about 45 minutes to an hour and will remain confidential. No one but the research team will see interview transcripts.

Please reply with a couple of dates and times that might work for you. If you have any questions, feel free to contact me at ________ or the PI at ______________.

Thank you, __________

For recruitment of principal/colleagues:

Dear ______________,

I’m from the University of Connecticut and, for my dissertation, I am conducting research about equity-minded science teacher leaders. I have been working with (STL) to learn about equity and science instruction at your school. I would love to hear about your experience as a school leader/colleague who works with (STL). An information sheet with a detailed description of the research study has been attached for your review. Your participation would involve talking with me once, individually for 45-60 minutes. This interview will remain confidential and no one but the research team will see this interview transcript. Please reply with a couple of dates and times that might work for you. If you have any questions, feel free to contact me at _____, or the PI at ________.

Thank you, __________