"Can I just be a human with them?" Cultivating Equity-Mindedness for the Teaching and Learning of Elementary Mathematics

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Karen R. Colum

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Kathleen A. Cramer, Mark D. Vagle, Co-advisers

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Dedication

"The more that you read, the more things you will know. The more that you learn, the more places you'll go."

~Dr. Seuss

This dissertation is dedicated to my grandson, Mason Colum, who has paid close attention to me throughout this process and desires to become a "book doctor" like his Mimi. When asked why? He simply responded, "So I can help children learn to do math and read." Mason, follow your dreams wherever they may take you.

"If you can dream it. You can do it."

~ Walt Disney

Abstract

Equity has risen to a prominent position in mathematics education with some organizations such as the NCTM positioning it first of six principles for teaching mathematics. Additionally, much work has been focused on the development of effective mathematics teaching practices (NCTM, 2014), culturally relevant practices (Gay, 2000, Leonard, 2008) and developing social justice curriculum (Gutstein, 2006). However, what is still lacking is explicit attention to equity issues within the different academic disciplines in teacher preparation programs (Banks, 1993; Ladson-Billings, 1994). Many scholars argue that mathematics education courses need to have an explicit focus on equity and mathematics instruction to prepare teacher candidates for the realties in schools (Aguirre, 2009; Gutiérrez, 2012a; Martin, 2003). Therefore, this study addresses this problem outlined by the literature as it purposefully embedded issues of equity alongside the typical content contained in a mathematics methods course.

A phenomenological understanding of teacher candidates' perceptions as they experience becoming equity-minded in a mathematics methods course holds great potential to provide new insights into integrating equity into the teaching and learning of mathematics from an authentic, learner-centered perspective. To this end, the purpose of this study is to help teacher educators and teacher education programs understand more deeply how teacher candidates may experience cultivating an equity mindset for the teaching of elementary mathematics by addressing follow question: How might cultivating equity mindedness take shape with teacher candidates in an elementary mathematics methods course? This qualitative study utilized a post-intentional research

design (Vagle, 2014) to investigate a group of teacher candidates' lived experiences of cultivating equity-mindedness while enrolled in a face-to-face, undergraduate, mathematics methods course. For sixteen weeks following the conclusion of the course, qualitative methods were used to collect data from the teacher candidates' accountings of their experience shared through individual interviews and written course assignments. Iterative cycles of phenomenological data analysis using Vagle's (2014) whole-part-whole approach captured tentative manifestations of the phenomenon of cultivating equity-mindedness as it was experienced while revealing itself in shifting and changing ways. Five tentative manifestations were produced through data analysis: (1) metacognitive awareness; (2) struggles with power; (3) knowledge of students; (4) multiplicity in practice; and (5) discourse of equity. Further analysis occurred during construction of the phenomenological text that involved drawing on specific theoretical concepts, Gloria Anzaldúa's (1987) notion of *nepantla* and Foucault's (1980) theory of *power/knowledge* as well as the mathematics education literature in order to open up tentative manifestations. These tentative manifestations also suggest particular dynamics that influenced the lived experience of cultivating equity-mindedness, including conceiving equity as a "tool" to "fix" students, tensions with multiple realities, and what it means to "know" students. The insights gained from this study were used to make recommendations for teacher educators and teacher preparation programs for practices that help promote and foster the growth of equity-oriented mindset for the teaching and learning of mathematics.

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CHAPTER ONE

INTRODUCTION

"Equity is not an easily definable quality that if we name it we can put into our classrooms. It is a struggle of finding the balance between all of these key concepts."

~Olivia

This study explores the meanings of cultivating equity-mindedness as experienced by teacher candidates enrolled in an elementary mathematics methods course. In order to better understand the nature of cultivating equity-mindedness and the ongoing, dynamic tensions that might exist, attention was given towards capturing the different ways in which equity-mindedness tentatively manifested through the experiences of teacher candidates. Thus, a phenomenological investigation was used to explore the tentative meanings of the phenomenon.

In order to make a case for this study, a discussion of the growing cultural gap between teacher and students is presented. Then some challenges faced in preparing teacher candidates for the present realities of schools will be examined. Followed by a discussion of the ways in which teacher education has worked to prepare candidates for the realities of schools. Ending with the presentation of the research questions used to guide this study, as well as, an outline of the study and the rest of this dissertation.

Research Problem

Growing cultural gap between teachers and students. Teacher candidates seldom enter teacher education courses with any notions of, interests in, or concern about, cultural and racial diversity (Milner, 2006). Studies with teacher candidates have shown

that examining issues of equity and diversity, particularly as it relates to race, culture, and language is challenging and often met by teacher resistance. Often, teacher candidates have very limited prior knowledge and understanding of the realities that people from diverse races, cultures and social classes experience. The majority of teacher candidates are White European American middle-class monolingual women (Gay & Howard, 2000) living in a society where their culture is privileged. Inevitably, this has kept many teacher candidates from relating to or even thinking about how issues of race, culture and class influences teaching and learning (Sleeter, 2001). Milner (2006) maintains that they often adopt color/culture-blind beliefs about teaching. This belief assumes that color, race and ethnicity should not be considerations for explaining how people are treated and as a result excuses the teacher from the responsibility of explicitly addressing issues of race, culture and social class in their classrooms. This lack of awareness and understanding leads to continued marginalization of students whose race, culture and class are different from that of their "White" teacher.

It is imperative that these issues be addressed, as there is a growing cultural gap between teachers and students as student populations in schools are shifting to where the ethnic minorities will soon make up the majority of the population (Sleeter, 2001). According to the U.S Bureau of the Census (2014), the U.S. is already nearly a majority-minority nation. It is projected that by 2060, 64 percent of children under the age of 18 will belong to racial and ethnic minorities. Additionally, the percentage of public school children in the U.S., who are English language learners, has increased form 8.8 percent for the school year 2003-2004 to 9.3 percent for the school year 2013-2014 (National

Center for Education Statistics, 2016). Diversity in range of academic abilities with classrooms has growth to include more students with exceptional needs in the mainstream classrooms. The percentage of special education students who spent most of their school day (i.e., 80 percent or more of time) in general classes in regular schools increased from 33 percent in 1990–1991 to 62 percent in 2013–2014 (National Center for Education Statistics, 2016). This was a sharp increase over the last two decades.

These quickly changing student population carries new challenges for teachers and teacher educators trying to provide equitable learning opportunities for all students (Banks, 2008; Darling-Hammond & Bransford, 2005). In the same way, they need to develop an understanding into the ways in which culture, language, race, social class, gender, and exceptionalities influence learning, in order to, effectively teach students with backgrounds different from their own. For that reason, all teachers must be prepared for an "equity pedagogy" (Banks, 1993, p.5) that takes into account the diverse identities, backgrounds, experiences and academic needs of a wide range of students as they plan, enact and assess academic learning.

Positioning of equity within teacher education. Teacher preparation programs are being held accountable through accreditation to produce teacher candidates who demonstrate competencies to meet the needs of all students. The Interstate Teacher Assessment and Support Consortium (InTASC) as part of the Council of Chief State and School Offers (CCSSO) has developed a set of core teaching standards, which have been widely used in the revision of teacher education programs. InTASC's model core teaching standards state that teachers must recognize that all learners bring varying

experiences, abilities, and prior learning, language, culture and community/family values to their learning (CCSSO, 2011). Furthermore, these standards call for teachers to embrace their students' diverse backgrounds and knowledge as assets to foster student learning and provide multiple approaches to learning.

In many higher education settings across the nation, attempts to educate teacher candidates in racial, cultural and social class diversity most often happen within a single multicultural education course. Many times, these multicultural courses are often separate and disconnected from the rest of methodological or content pedagogical courses in teacher education. Positioning such courses to the peripheral can be troubling for teacher candidates learning. Often resulting in cognitive dissonance as well some level of resistance. While the multicultural education literature emphasizes issues of cultural and linguistic diversity and equity, they do so with little consideration of the specific demands of the different academic disciplines (Banks, 1993; Ladson-Billings, 1994). For this reason, it is important to understand the nuances to equity that are inherent in each of the different academic disciplines.

Perceptions of mathematics. Attempts to educate teacher candidates to the nuances involved with racial, cultural and social class diversity can be especially troubling for mathematics teacher candidates. One challenge inherent to mathematics is strong societal perspectives of what constitutes mathematics instruction. Such perspectives conceive mathematics in the more traditional sense, in that, students should be taught mathematics through memorization of facts, formulas, and procedures and then the skills are learned though repeated practice. This view perpetuates the traditional

lesson structure (i.e., review, teacher modeling, and independent practice) and is still widespread in many classrooms (Banilower et al. 2006; Weiss and Pasley 2004). Consequently, many teacher candidates have experienced this type of mathematical learning in their schooling and are convinced that these established practices are most effective for student learning (Barkatsas and Malone 2005; Wilken 2008). Further complicating matters are cultural beliefs about the teaching and learning of mathematics (e.g., mastery of basics fact, focus on procedures, speed, and efficiency). Such practices often limit students from make sense of mathematics, especially for students of the nondominant culture (Martin, 2003; Nasir et al., 2008).

Another issue that is problematic to mathematics is the perception that mathematics is a "neutral" subject free from influences of culture, class, gender and social values. Such notions of mathematics as being universal, transcending across all cultures, are still prevalent in the vast majority of classrooms. As Gutstein and Peterson (2005) contend, teaching is not a neutral activity. Rather, everything a teacher does is embedded in contexts that are political, social, and cultural in nature. These contexts that teachers choose shape the way students experience schooling. Mathematics, like all other forms of knowledge, is situated within cultural contexts (Lave & Wenger, 1991; Nasir, Hand, & Taylor, 2008). Rosa and Orey (2011) insist, "There is no sense in regarding mathematics learning as abstracted and culture-free because the learning process cannot be abstract and context free, that is learning cannot be free of societal influences" (p. 34). It is essential that educators are aware of the role that culture, class, and gender play in the development of mathematical ideas and concepts. Treating mathematics as neutral

and culture-free can have some costly implications particularly for students of color and other marginalized students.

Preparing teacher candidates for realities of teaching mathematics in schools. In spite of the challenges presented, the critical task remains of preparing teacher candidates to teach mathematics for the realities of today's schools. In efforts to meet this challenge, much work has been done within the field of mathematics education to prepare teacher candidates. The National Council of Teachers of Mathematics (NCTM) has a long-standing commitment to equity and has been at the forefront promoting efforts to reform mathematics teaching and learning through the development of standards, guiding principles and most recently complied a set of effective mathematics teaching practices. The word equity first made its appearance in the NCTM's 1995 Mathematics Assessment Standards and has since them moved to a prominent position of first of six foundational principles intended to guide mathematics educators in making instructional decisions contained in their 2000 *Principles and Standards for School Mathematics* publication.

In efforts to improve the mathematics teaching for all students, the NCTM's (2014) most recent publication, *Principles to Actions: Ensuring Mathematical Success for All*, describes a core set of practices that are seen as essential teaching skills. These practices are compiled from over the last two decades of research-based learning and mathematics teaching and are seen as effective practices that help students access the mathematics content. Therefore, it is necessary that teachers be skilled at using instructional practices that are effective in developing mathematics learning for all students.

At the same time, there have been concerted efforts within mathematics education to prepare teachers to be culturally responsive in mathematics. For some scholars, there are really no set of universal or "best" teaching practices, as Gay (2009) argues, such practices are meaningless without regards to the students' cultural backgrounds and experience. Decontextualizing mathematics from students' backgrounds, knowledge, experiences, culture, language, and ethnicity minimizes their chances of fully reaching their achievement potential (Gay, 2000; Gutiérrez, 2012). For this reason, *culturally relevant teaching* seeks to make the mathematics curriculum more appropriate for diverse learners by utilizing their prior experiences, cultural knowledge, and learning styles (Aguirre, 2009; Ladson-Billings, 1994; Gay, 2000; Gutiérrez, 2001, 2012; Leonard, 2008, Nasir et al., 2008). Thus, preparing teacher candidates to be responsive to the identities of students requires explicit attention to the multiple identities of students and understanding the link between culture, language and other forms of out-of-school knowledge to mathematics thinking, understanding, and learning.

More recent measures to prepare teachers for the realities of today's mathematics classrooms have involved taking a social justice approach to teaching. In teaching mathematics for social justice, students utilize mathematics to critic inequitable situations in their community. This affords students opportunities to see the role mathematics plays in their world and the power mathematics has in shaping their world (Gutstein, 2006; Martin, 2003). Scholars call for developing commitments to social justice by engaging students to use mathematics to examine and power relations and social injustices and inequities that are present within their communities.

Many scholars believe that practices do not go far enough in efforts to provide equitable mathematics instruction. Rather, what is essential is having a critical knowledge. Critical knowledge calls for engaging in self-reflective action that attempts to identify and remedy issues of power, agency, privilege, and participation that are in operations within the mathematics classroom (Apple 1992; D'Ambrosio, 1990; de Freitas, 2008; Frankenstein, 1990, 1994; Gutiérrez, 2007; Gutstein, 2003; Martin, 2003). It is important for teachers to interrogate practice by asking questions that expose structures of power, privilege and participation (Parks, 2010). As this self-reflective action can help teachers towards remedying inequities within the mathematics classroom.

The field of mathematics education has made great strides in defining and conceptualizing practices that will help prepare teachers and teacher candidates to be better prepared for the realities they will face in teaching mathematics. The next section will provide an overview of how specifically mathematics teacher educators have attempted to prepare teacher candidates for teaching diverse populations with an explicit focus on equity and mathematics.

Mathematics methods courses. Preparing teachers to provide equitable educational opportunities requires teacher educations programs to create opportunities for candidates to understand the implications of the intersection of culture, race, social class and mathematics teaching and learning (Gay & Howard, 2000; Banks & Banks, 2001; Ladson-Billings, 1995). This can be particularly challenging for instructors of mathematics methods courses as most courses contain an overwhelming amount of content to be learned over the course of one semester. Despite this fact, efforts have been

made to integrate matters of equity into the mathematics classroom by scholars. Scholars have taken-up studying equity by focusing on the impact of particular instructional activities, or interventions, within a mathematics methods course. Such studies have included: (1) teacher candidates abilities to incorporate students' funds of knowledge and social justices issues with mathematics lessons (Gutiérrez, 2012; Nicol & Crespo, 2006; Garii & Appova, 2013); (2) drawing on research methods to assist teacher candidates in critical reflection (de Freitas, 2008; Neumann, 2014); (3) developing instructional models to assist teacher candidates in developing skills (Aguirre, del Rosario Zavala, & Katanyoutanant, 2012; Roth et al., 2014; Turner et al., 2012); and (4) developing strategic partnerships to facilitate equity-orientations (Gutiérrez, 2012).

The majority of research studies on equity matters embedded within a mathematics methods course focused on the developing intervention activities and reporting the impact of such interventions on teacher candidates. In fact, most research has not examined mathematics methods courses in their entirety. However, some prominent mathematics equity scholars have developed conceptual frameworks for their mathematics methods courses that simultaneously values equity and mathematics. Eric Gutstein (2006) designed a framework that is a characterization of three important knowledge bases necessary for teaching mathematics, which are: classical mathematical knowledge, community knowledge and critical knowledge. The idea is to facilitate teacher candidates' development of all three bases of knowledge and their interrelationships. Other scholars have adapted Gutstein's framework within their methods courses. Most notable is Julia Aguirre's adaption of Gutstein's work. Aguirre

(2009) has added two spectrums to highlight teaching for social justice. The first, emphasizing equity and mathematics requires both a pedagogy of access and one of transformation. The second being a problem "solving/problem posing pedagogy" embraces the critical knowledge needed to analyze the world within multiple contexts.

Other scholars have offered up guiding principles to teacher educators as a way to assist with a focus on matters of equity within a methods course. Koestler (2012) has developed five guiding principles that frame her mathematics methods course, which was built on the existing teacher education for social justice literature. Those are: (1) doing mathematics is a sense-making activity; (2) all peoples can and do engage in mathematics; (3) students bring informal (mathematics) knowledge to school that teachers can build on, and it is important to assess and use this knowledge; (4) mathematics is not neutral, and therefore, teaching mathematics cannot be neutral. Teaching is a political act; and (5) it is important to continually and critically reflect as we teach and learn so that we begin to recognize and understand the cultural, social, and political contexts in which our work takes place (p.89). Arguably, such frameworks and principles can be of great value to the mathematics teacher education community as they can assist in the construction of methods courses, yet, none of these frameworks have been investigated in their completeness for their impact on preparing teacher candidates for teaching mathematics with explicit focus to matters of equity.

Purpose of Study

Given the complexities of preparing teacher candidates to attend to teaching increasingly diverse populations of students and the limited consideration given to the

specific demands of the different academic disciplines may require for addressing issues equity, warrants further investigation. Therefore, this study is an attempt to address this problem outlined by the literature as it purposefully embedded issues of equity alongside the typical content contained in a mathematics methods course. Examining how cultivating equity-mindedness manifested through the experiences of teacher candidates within an elementary mathematics methods course provided a way to begin.

The purpose of this study is to articulate and illuminate the experiences of educating one group of teacher candidates as they develop an equity-oriented mindset for the teaching and learning of elementary mathematics. Such an investigation offers deeper insights and understandings of the actions, tensions, decisions, successes, challenges, and resistances involved in educating teacher candidates to teach elementary mathematics in an equitable manner. For this reason, these insights may help teacher educators and teacher preparation programs better understand how teacher candidates learn to teach mathematics with an explicit focus on equity by specifically addressing the following research questions.

Primary Phenomenological Question:

1. How might cultivating equity mindedness with teacher candidates take shape in an elementary mathematics methods course?

This question serves as a guide to uncovering the phenomenon under investigation, which is, cultivating equity-mindedness. The following research questions are designed to address the bodies of knowledge that are seen as essential for cultivating

equity mindedness with teacher candidates. The purpose of these secondary research questions was to help focus data collection toward the primary research question.

Secondary Research Questions:

1. In what ways, if any, do teacher candidates demonstrate understanding of mathematical knowledge for teaching and commitments to utilizing high-leverage mathematical practices?
2. In what ways, if any, do teacher candidates demonstrate understanding of utilizing students' backgrounds and experiences for the teaching and learning of elementary mathematics?
3. In what ways, if any, do teacher candidates demonstrate critical understanding for the teaching and learning elementary mathematics that includes examining issues such as power, privilege and agency?

Overview of Study

This post-intentional phenomenological study explored the experiences of teacher candidates as they begin to develop ideas about what it means to teach elementary mathematics in an equitable manner. The objective is to better understand the nature cultivating equity-mindedness and the ongoing, dynamic tensions that might exist. Tentative manifestations of the phenomenon cultivating equity-mindedness were pursued in order to reveal the partial, shifting, and fleeting nature of this phenomenon as well as the intentional relationships or the meaningful connections between cultivating equity-mindedness and teacher candidates. As post-intentional phenomenological methodological approach (Vagle, 2014) was used to investigate teacher candidates lived

experiences with the phenomenon while enrolled in a sixteen-week, undergraduate, face-to-face elementary mathematics methods course. Personal accounts, shared through individual unstructured interviews and written artifacts created in the methods course, were collected and analyzed to provide insight into the experiences of teachers candidates as they engaged with the phenomenon.

The aim of the inquiry was to capture tentative manifestations of the phenomenon of cultivating equity-mindedness and associated intentional relationships as they were revealed in different ways through the teacher candidates' experiences. Iterative cycles of phenomenological data analysis using a whole-part-whole approach captured tentative manifestations (Vagle, 2104) of this phenomenon. Followed by crafting text to portray the image of the tentative manifestations of cultivating equity-mindedness in its multiple, partial and varied contexts (Vagle, 2014).

Overview of the Dissertation

In the following chapters, this post-intentional phenomenological study on investigating how teacher candidates experienced cultivating equity-mindedness in a mathematics methods course is presented. This includes a review of the relevant literature, the methodology and methodological approach, tentative manifestations of the phenomenon, and implications. Chapter two presents a review of the literature including, an overview of the main conceptions of equity, practices aimed at supporting equity in mathematics education, and ways in which equity pedagogies have been embedded within mathematics methods courses. Chapter three presents the methodology used for this study which involves situating post-intentional phenomenology within the origins of

phenomenology as a philosophy and the history of phenomenology as a methodology in order to set a foundation into understanding the nuances of this variant form of phenomenology. Additionally, an overview of the philosophical underpinnings for post-intentional phenomenology is explained. Chapter four provides a detailed description of the methodological approach used in this research study, which includes an accounting of the participants, recruitment, data gathering, and textual analysis. Chapter five presents the crafted text that captures the five tentative manifestations of significance of the phenomenon of cultivating equity-mindedness in its multiple, partial and varied contexts (Vagle, 2014). And chapter six presents a brief overview of this post-intentional phenomenological and a summary of five tentative manifestations that were produced as they relate to the primarily phenomenological research question that guided this study. Followed by, a discussion of the broader implications drawn from the tentative manifestations and suggestions for future research studies that resulted from this study.

CHAPTER TWO

LITERATURE REVIEW

The purpose of this study is to explore the meanings of cultivating equity-mindedness as experienced by teacher candidates in an elementary mathematics methods course. Investigating how teacher candidates experienced cultivating equity-mindedness can give teacher educators the chance to consider the complexities of cultivating commitments to equity in for mathematics teaching. Thereby, gaining new insights into the challenges faced and developing a better understanding in ways to prepare and support teacher candidates in developing an "equity pedagogy" for the teaching and learning of elementary mathematics.

The purpose of the literature review is to situate the phenomenon under investigation, which is cultivating equity-mindedness, within the field of mathematics education. To understand the how equity might cultivate this review of the literature begins by providing an overview of the main conceptions of equity and practices aimed at supporting equity in mathematics education. Due to the many different ways scholars and educators perceive equity, this study needs to provide a description of how equity has been conceptualized in the context of mathematics education. Subsequently, three distinct bases of knowledge most evident for equitable teaching of mathematics essential for cultivating equity-mindedness are presented. Followed by an outline of the most relevant studies in the literature specially related to how teacher education has embedded equity pedagogies within mathematics methods courses. This chapter concludes with a

discussion on how this study furthered the scholarship on preparing teacher candidates to attend to matters of equity for teaching mathematics.

Conceptualizing Equity in Mathematics Education

Equity in the field of mathematics is a raising concern among education researchers and practitioners. It is a complex construct that is hard to define. Part of the challenge in defining equity is due its ambiguous and ill-defined nature. As Gutiérrez (2002) argues, "Because *equity* is a value-laden term and requires human judgment, we have had fewer examples of what equity might mean empirically. That is, how might we know it if we saw it?" (p. 148). Heeding Gutiérrez's words, this section begins by presenting the ways equity has been conceptualized. Equity can be studied at a number of different levels, such as, within a classroom, school, district, state, nation and world. However, for the purposes of this study, equity is examined in the context of pedagogical practice at the classroom level. These conceptions helped to provide a vision of equity, which guided the design of the mathematics methods course and data analysis. Before turning to those pedagogical practices, clarity on understanding equity is required. In the next section, the ways in which equity has been defined in the mathematics education literature is presented.

Equity as equality. One of the first steps in defining equity is to distinguish it from ideas about equality. Some of the first issues of equity were brought to the attention of mathematics education research through the seminal work of Elizabeth Fennema's gender equity (Fennema, 1974; Fennema & Sherman 1977; Fennema & Leder, 1990). Much of this early research centered on unequal treatment, experiences and educational

outcome for females in mathematics achievement and participation. Despite the fact that the mathematics education community has been examining equity for several decades, equity continues to be misconstrued with equality. Even though equity means *fairness* or *justice*, it is often misinterpreted with equality, which means *sameness*. Equality usually refers to providing all students the same access to materials, the same methods of teaching, the same amount of instructional time, and the same supports for learning (Gutiérrez, 2002; NCTM, 2014). Whereas, equity does not mean that every student receives identical instruction, but that appropriate and reasonable accommodations should be made to promote access and achievement for all students (NCTM, 2014). Historically, in mathematics education equity has been framed as equality, that is the same treatment of students, the same resources and the same outcomes or achievement. As a result, much of the early equity related literature in mathematics education focused on reaching sameness by narrowing of the achievement gap between minority populations (i.e., Blacks and Native Americans) and their White and Asian counterparts. This perspective reinforces the view of "whiteness and middle-to-upper income as a norm" (Gutiérrez, 2008, p.359).

Although examining such gaps in achievement between groups of students has raised awareness for equity in education, caution is needed when focusing on achievement gaps between race, class, and gender of students as it encourages deficit thinking and negative narratives about marginalized students. Gutiérrez (2008) contends that 'gap-gazing' (p.358), or viewing marginalized groups of students, as somehow deficient in mathematical skills is problematic. Instead educators should be looking at the

conditions that lead to such outcomes and the changes needed to make mathematics more accessible to marginalized students (Leonard, 2008). Negative narratives are often created for students who do not do well on standardized tests. They are seen as lacking in intelligence, ability, or skill needed to succeed in school resulting in teachers giving up on changing instructional methods to reach those students. In deficit thinking, emphasis is placed on the student conforming to the mathematics curriculum rather than teachers rethinking and adjusting their instructional practices. Gutiérrez (2008) argues that focusing on the achievement gap support practices that often are against the best interest of marginalized students. She insists the little has been done to broaden the public's notions of mathematical literacy, in part because closing the achievement gap suggests that nothing is wrong with the system.

Four dimensions of equity. Gutiérrez (2012) is a well-known mathematics scholar who is dedicated to equity research. She provides a framework for conceptualizing equity in mathematics education that could provide further focus for examining practice through the lens of equity. She contends that equity is comprised of four dimensions: access, achievement, identity and power (Gutiérrez, 2012). Gutiérrez refers to access and achievement at the dominant axis because they often reflect what is valued by society. Access refers to the tangible resources such as high-quality mathematics teachers, rigorous curriculum and adequate technology and other tools. Achievement involves participation in class, standardized test scores, and participation in higher-level mathematics courses. The next two dimensions, identity and power, are what make up the critical axis (Gutiérrez, 2012). Identity involves understanding that

mathematical is cultural as well as students being able to "see" their background, culture, and language as part of the mathematics curriculum. Power involves who gets to talk in the classroom, opportunities for students to use mathematics to examine social justice issues, and other ways of knowing. Furthermore, these four dimensions could provide greater focus or clarity when applying the equity lens to research.

Equity as a process. Also, important to defining equity in mathematics education is understanding that equity is not a stable notion rather it is an evolutionary process that needs continual work to refine and redefined. For Gutiérrez (2002) equity is not a goal of arriving at equal outcomes, rather equity is a process, which involves:

> The (a) erasure of the ability to predict students' math achievement and participation based solely on race, class, ethnicity, sex, beliefs and creeds, and proficiency in the dominant language, (b) erasure of the ability to predict among students the practice of mathematics to analyze, reason about, and especially critique knowledge and events in the world based solely on characteristics, and (c) erasure of inequities between people, math, and the planet. (pp. 153-165)

Equity is achieved when there is the inability to predict patterns of mathematical achievement across different groups. Thereby resulting in a balance of power where no group dominates or is oppressed by another, hence an equitable situation (Freire, 2000b) The process of equity, as defined by Gutiérrez, moves past providing equal treatment and closer towards creating a just society.

Martin (2003) further contributes to the discussion of equity. He argues there are slight yet significant differences in achieving equity, as in obtaining a goal, and

eliminating inequity, which requires an ongoing process. Conceiving equity as a goal "assumes that there is a point to be reached when all is well and the hard work of getting there can cease" (p. 14), however, the problem with this perspective is that it disregards the changing demographics which will challenge the ways in which equity has been defined. Martin contends politicians and mathematics educators have set goals for equity in mathematics with very little input from marginalized populations' viewpoints. Whereas, conceptualizing equity as a process recognizes its evolving nature and requires a high degree of vigilance, hard work and sustained attention to ensure that definitions of equity remain responsive to the needs, backgrounds and experiences of marginalized students. Martin argues that even though these goals for achieving equity maybe well-meaning, they still may contribute to the inequities of marginalized students due to the lack of focus to process. However, there is a danger that can results from a focus on outcomes. If marginalized students do not reach set goals, they are often viewed from a deficit perspective which views students as the source of the problem as well as viewing their circumstances as all encompassing rendering them powerless to act or resist. Therefore, marginalized students must have opportunities to use mathematics to change the power relations and structural obstacles that continually work against their progress in life.

Aguirre (2009) also defines equity as an evolving process that is never a finished product. To her equity means, "all students in light of their humanity-personal experiences, backgrounds, histories, languages, physical and emotional well-being-must have the opportunity to support to learn rich mathematics that fosters meaning making,

empowers directions making, and critiques challenges, and transforms inequities/injustices" (p.296). This perspective goes beyond strictly conceptualizing equity as access and opportunity to learning mathematics to include using mathematics for empowerment, social transformation and change. For Aguirre, equity and mathematics encompass a powerful dialectic. Continuously interweaving the demands of mathematics content and teaching practices with the humanity of children to create a meaningful mathematics-learning environment.

Notably, all three of these scholars conceive equity as a process. For them, equity is not a stable concept (i.e., a goal with results in an outcome) but one that is always in the process of becoming (i.e., empowerment and transformation). Their definitions call for the elimination of inequities and injustices within mathematics education. Each scholar, in different ways, calls for the concept of equity itself to be responsive to an ever-changing society.

Working definition of equitable instruction for this investigation. Although equity can be described in many different contexts, understanding the relationships between teaching and learning at the classroom level is paramount for cultivating equity-mindedness with teacher candidates. For example, Allexsaht-Snider & Hart (2001) propose a definition of equity that includes necessary requirements for working towards equity. They write,

> Our definition of equity begins with the premise that all students, regardless of race, ethnicity, class, gender, or language proficiency, will learn and use mathematics. A second premise is that all of the people who are involved with

> and interested in the education of children must become aware of the social, economic, and political contexts of schooling that can either hinder or facilitate mathematics learning for underrepresented students. Equity in mathematics education requires: (a) equitable distribution of resources to schools, students, and teachers, identifying it throughout the research process (b) equitable quality of instruction, and (c) equitable outcomes for students. (p. 93)

The purpose of this investigation is to examine the process of cultivating equity-mindedness with teacher candidates. Therefore attention to equitable quality of instruction in Allexsaht-Snider & Hart's definition was essential and is the focus of this literature review. For purposes of this study, equity-mindedness is conceived as a continual process that recognizes and tries to understand the cultural, racial, class, gender, and political identities of students. Also, equity requires knowing that mathematics learning should not occur for students apart from their identities. Therefore, teachers must plan rich, meaningful opportunities for learning mathematics that embraces their students' identities and empowers their students to develop their own mathematical identity as well as critiques their own instructional practice for places where power, privilege and marginalization might be present.

Summary. This section presented some ways mathematics education scholars have defined the concept of equity. Scholars have made distinctions between equity and equality and many have conceived equity as a process that continues to evolve. A working definition of how equitable mathematics instruction is taken up in this study was presented. The next section will review the necessary bases of knowledge needed by

teacher candidates for addressing equity matters in teaching and learning mathematics as identified through a review of the mathematics education literature.

Equity Instruction in Mathematics Teacher Education

A synthesis of the literature on equity pertaining to mathematics instruction revealed three distinct bases of knowledge needed for working towards equity in mathematics teaching and learning. The three knowledge bases are: (1) knowledge for teaching mathematics, (2) knowledge of students' multiple identities, and (3) critical knowledge. Having these bases of knowledge and understanding the ways in which they work together are essential for cultivating equity-mindedness with teacher candidates. Knowledge for teaching mathematics consists of providing students opportunities to attain proficiency in mathematics by ensuring students have access to high-quality mathematics instruction, particularly for students who have been historically underrepresented in this area. Knowledge of students' multiple identities entails attending to the backgrounds and experiences of students in order to make the mathematics curriculum more relevant and inclusive. Critical knowledge involves understanding of how issues of power, privilege and participation impact the teaching and learning of mathematics. This literature is critical because understanding the bodies of knowledge necessary for equitable teaching in mathematics affords the opportunity to compare and connect the manifestations of the phenomenon in this study.

Knowledge for teaching mathematics. One of the ways equity has been addressed in the mathematics education literature centers on the belief that all students must have access to learning mathematics with understanding (Carpenter et al., 1997).

For Carpenter and colleagues (2015), opportunities to lean mathematics with understanding is first and foremost a matter of equity and denying any student such opportunity is considered an injustice. Similarly, the NCTM's (2014) vision of equity is that all students attain mathematics proficiency. Based on cognitive and mathematics education research from how children learning mathematics, mathematics proficiency has been defined as encompassing five interwoven strand that include: (1) having conceptual understanding; (2) carrying out procedures fluently, (3) being strategic when problem solving, (4) being adaptive with reasoning, and (5) having a productive disposition towards mathematics (NRC, 2001). In order to provide students opportunities to learning mathematics with understanding and attain proficiency in mathematics, teachers must have knowledge for teaching mathematics and skill in utilizing practices that are most likely to positively impact student learning.

Learning to teach mathematics with understanding requires a specialized type of knowledge that includes knowing specific mathematics content as well as the skill and insights of being able to make mathematics content useful for teaching (Ball & Forzani, 2010; Ball, Thames, & Phelps, 2008). This is specialized type of knowledge is referred to as *mathematical knowledge for teaching* (MKT). MKT requires teachers to know and unpack mathematical topics and to reexamine them through the lens of learners that possess unique backgrounds, interests, culture, and learning needs. Just knowing how to do mathematics alone is insufficient for teaching. Teachers must be able to explain terms and concepts to students, make sense of students' mathematical ideas, examine students' work, ask purposeful questions to uncover mathematical understanding, choose effective

representations and examples that will advance students' understanding, determine what counts as an indicator of students' mathematical thinking, determine sequences of instruction, and evaluate textbooks for treatment of particular topics (Ball, Hill & Bass, 2005; Hill, Rowan, & Ball, 2005). Additional mathematical insight and understanding is required for teachers to be able to do these things. This demands a depth of understanding surpasses the knowledge needed to carry out a procedure accurately (Ball, Hill & Bass, 2005).

Over the last several years, researchers have argued that one of the most important resources for improving student learning is improving teacher knowledge. Teachers' mathematical knowledge for teaching has a profound effect on instruction and has been directly linked to gains in students' achievement in mathematics (Ball, Hill & Bass, 2005; Cohen, Raudenbush, & Ball, 2002; Hill, Rowan, & Ball, 2005; Shulman, 1987). Regrettably, other studies indicated that students from poverty students (rural or urban) and students struggling with mathematics often had teachers that possessed less MKT (Hill & Lubienski, 2006; Hill, Rowan, & Ball, 2005; Loeb & Reininger, 2004). Thus, the quality of instruction available to students can be an obstacle to achieving equity.

Mathematics Instructional Approaches. A critical aspect of MKT encompasses having an understanding of mathematical teaching practices that facilitate a deep conceptual understanding of mathematics and help students attain mathematical proficiency. The NCTM (2014) maintains closing existing learning gaps requires ensuring that all students have access to high-quality instruction that supports meaningful mathematics learning. For over twenty years, research has focused on studying

instructional approaches that facilitate conceptual understanding of mathematics. Such approaches have often been referred to in the literature in different ways, such as, standards-based instruction (NCTM, 2000), reform-based curricula (Boaler, 1997, 2006), problem-based instruction (van de Walle, Karp, & Bay-Williams, 2016), and ambitious teaching (Cobb & Jackson, 2011). While there are nuanced meanings to each term, in general these instructional approaches engage students in the five processes of mathematics (i.e., problem solving, reasoning and proof, communication, connections, and representation) described in the *Principles and Standards for School Mathematics* document (NCTM, 2000, 2002). These process standards refer to the mathematical processes, or ways of thinking, through which students acquire and use mathematical knowledge. Therefore, the mathematical processes are considered integral components of mathematics learning and teaching.

Reform-based instruction requires that students engage in the mathematical processes by sharing their reasoning and making arguments about mathematical ideas as compared to traditional mathematics where the teacher or the textbook serve as the sole authority that determine right and wrong solutions of which there is often only one solution. In reform-based classrooms, students serve as their own authority to evaluate their understanding and make mathematical arguments. These shifts in the distribution of authority and participation in problem solving and may have implications for the participation of low-income and or minority students (Nasir et al., 2008). As students are no longer passive, empty depositories waiting for the teacher's deposits of knowledge (Freire, 2000a) but rather active co-creators of mathematical ideas and understandings

when engaged in using mathematical processes standards. In the next section, I will highlight two longitudinal empirical studies that have been influential for the use of reform-based instructional approaches as a means of increasing achievement particularly for low-income minority students.

The Quantitative Understanding: Amplifying Student Achievement (QUASAR) project (Silver & Stein, 1996) was a five-year longitudinal study that examined the impact of reform-based instruction with ethnically, racially and linguistically diverse middle school students from economically disadvantaged communities. Researchers developed and implemented mathematics instructional programs based on three essential principles—that all students can (1) learn a wide range of mathematical content, (2) develop a deeper and more meaningful understanding of mathematical concepts, and (3) demonstrate proficiency in mathematical reasoning and complex problem solving. One significant work that resulted from the study included the development of a *Mathematical Tasks Framework* as a way to analyze classroom lessons. This framework identifies four levels of cognitive demand: memorization, procedures without connections, procedures with connections, and doing mathematics. Appendix A provides a description of each level. The *doing mathematics level* is the highest level of cognitive demand and is closely related to the strands of strategic competence and adaptive reasoning as described by the NRC (2001).

The results of this study clearly indicated that the reform-based instruction had a positive impact on students' mathematical performance. All students showed improvement in mathematical understanding, reasoning and problem solving. Compared

with 1992 NAEP eight grade mathematics assessments, QUASAR students performed significantly better than demographically similar representative national sample. Furthermore, QUASAR students outperformed students from the NAEP sample in all mathematics content areas and showed significant difference in constructed response tasks and tasks that assessed conceptual understanding and problem solving.

Researcher, Jo Boaler (1997, 2006) longitudinal studies on impact of mathematics instruction in the US and UK has identified positive links between reform-based instruction and student achievement. Boaler and Staples (2008) examined the impact of reform-based curricula in a five-year longitudinal study of approximately 700 students at three different high schools. Two of the schools used traditional approaches to teaching mathematics and one school, Railside, used reform-based curricula, which included engaging students in solving high-cognitive demand tasks and participating in meaningful discussions where students analyzed and compared their mathematical ideas. Researchers found that the students at Railside, which was an ethnically and economically diverse urban high school, demonstrated greater gains in achievement as compared with the other two schools as well as had higher overall achievement on a number of different measures. Furthermore, achievement gaps among various ethnic groups at Railside that were present on pre-assessments disappeared in nearly all cases by the end of the second year.

Mathematics Teaching Practices. Efforts continue to further refine and illuminate the reform-based instructional practices that were employed by the teachers in the two empirical studies previously presented in this chapter. Attention to particular practices, of teaching and learning that are enacted into the classroom, are important to

promoting equity. “Ball and other researchers (e.g., Ball et al., 2009; Grossman et al., 2009; Lampert, 2010; McDonald, Kazemi, & Kavanagh, 2013) argue that the profession of teaching needs to identify and work together towards the implementation of a common set of high-leverage practices that underlie effective teaching” (NCTM, 2014, p.8). Hence, the NCTM (2014) provides a research-informed framework of teaching practices that are necessary to promote deep learning of mathematics. Table 2.1 reflects this work. It is beyond the scope of this study to undertake a review of the literature on each of the mathematical practices. Rather the focus of this study is on how the collective use of such practices amounts to greater access to mathematical understanding and equity.

These practices allow for a broader cross-section of society can engage in meaningful mathematics by providing them with an increased number of entry points and pathways to access mathematical ideas. Additionally, several of the practices support multiple ways of knowing, provide opportunities to problematize mathematics in a way that is meaningful, distribute authority to students, afford opportunities for students to develop and evaluate their own mathematical methods, support students in exercising agency over the development of their mathematical understanding, and hold students’ accountable to each other’s mathematical thinking (Boaler, 1997, 2003; Boaler & Greeno, 2000; Chazan & Ball 1999; Cobb, Gresalfi, & Hobb, 2009; Heibert et al., 1997; Lampert, 2001; Yackel & Cobb, 1996). Thus, as a result, greater equity in the kinds of students who identify with mathematics and participate in school mathematics might manifest when such practices are enacted (Boaler & Greeno, 2000; Boaler & Staples, 2008). In spite of all the benefits these practices offer, dominant cultural beliefs about the

teaching and learning of mathematics continue to be obstacles to the acceptance and enactment of effective teaching practices (Handal, 2003; Philipp, 2007). Therefore, much work is still needed to help with enactment of effective practices for mathematics instruction.

Table 2.1
NCTM's Mathematics Teaching Practices and Research-Base

Mathematics Teaching Practices	*Research-Base*
Establish mathematics goals to focus learning. *Effective teaching of mathematics establishes clear goals for the mathematics that students are learning, situates goals within learning progressions, and uses the goals to guide instructional decisions.*	Clements & Sarama, 2004; Haystead & Marzano, 2009; Hiebert et al., 2007; McTighe & Wiggins, 2013; Sztajin et al., 2012
Implement tasks that promote reasoning and problem solving. *Effective teaching of mathematics engages students in solving and discussing tasks that promote mathematical reasoning and problem solving and allow multiple entry points and varied solution strategies.*	Boaler & Staples, 2008; Hiebert et al., 1997; Stein, Grover & Henningsen, 1996; Stein et al., 2009; Stigler & Hiebert, 2004
Use and connect mathematical representations. *Effective teaching of mathematics engages students in making connections among mathematical representations to deepen understanding of mathematics concepts and procedures and as tools for problem solving.*	Cramer, 2003; Cramer, & Wyberg, 2009; Fuson, Kalchman & Bransford, 2005; Lesh, Post, & Behr, 1987; Marshall, Superfine & Canty, 2010; Pape & Tchoshanov, 2001; Tripathi, 2008
Facilitate meaningful mathematical discourse. *Effective teaching of mathematics facilitates discourse among students to build shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments.*	Engle & Conant, 2002; Hufferd-Ackles, Fuson & Sherin, 2014; Smith & Stein, 2011
Pose purposeful questions. *Effective teaching of mathematics uses purposeful questions to assess and advance students' reasoning and sense making about important mathematical ideas and relationships.*	Boaler & Brodie, 2004; Chapin & O'Connor, 2007; Herbel-Eisenmann & Breyfogle, 2005
Build procedural fluency from conceptual understanding. *Effective teaching of mathematics builds fluency with procedures on a foundation of conceptual understanding so that students, over time, become skillful in using procedures flexibly as they solve contextual and mathematical problems.*	Carpenter, Franke & Levi, 2003; Carpenter et al., 1999; Fuson, Kalchman & Bransford, 2005; NCTM, 1989, 2000; National Research Council, 2001
Support productive struggle in learning mathematics. *Effective teaching of mathematics consistently provides students, individually and collectively, with opportunities and supports to engage in productive struggle as they grapple with mathematical ideas and relationships.*	Hiebert & Grouws, 2007; Stein et al., 2009; Stigler & Hiebert, 2004
Elicit and use evidence of student thinking. *Effective teaching of mathematics uses evidence of student thinking to assess progress toward mathematical understanding and to adjust instruction continually in ways that support and extend learning.*	Carpenter et al., 1999; Wiliam, 2007; Clements & Sarama, 2004; Jacobs, Lamb & Philipp, 2010; Sztajin et al., 2012

Note. Mathematical Teaching Practices taken from *Principles to Actions: Ensuring Mathematical Success for All* (NCTM, 2014)

Summary. An overview of the review of the literature for the knowledge needed teaching mathematics was presented. The research indicates that teacher candidates need to understand what constitutes mathematical proficiency and they need to develop the knowledge and skills necessary to provide students' opportunities to attain proficiency. This requires having an understanding of MKT as well as knowledge and skill to apply effective teaching practices. The next section will review the mathematics education literature regarding knowing the academic and personal (i.e., community, cultural, racial, ethnic, linguistic, gender, classed) backgrounds to design and implement equitable instruction.

Knowledge of Students' Multiple Identities. "An equity-based approach includes attending to the multiple identities-racial, ethnic, cultural, linguistic, gender, mathematical, and so on-that students develop and draw on as they learn and do mathematics" (Aguirre, Mayfield-Ingram, & Martin, 2013, p.9). Access alone to high-quality mathematics instruction that utilizes effective teaching practices is not enough to achieve equity especially for marginalized populations. Equity demands attending to and understanding the multiple identities of students in the context of their lived experiences. Decontextualizing mathematics from students' backgrounds, knowledge, experiences, culture, language, and ethnicity minimizes their chances of fully reaching their achievement potential (Gay, 2000).

Equity requires understanding the link between culture, language and other forms of out-of-school knowledge to mathematics thinking, understanding, and learning. There is a body of research that illuminates the everyday or informal mathematical practices

and its transfer (or failure to transfer) to the classroom. Researchers have studied a wide range of out-of-school mathematics practices, including shopping in grocery stories (Lave & Wenger, 1989), laying carpeting (Masingila, 1994), money exchange (Brenner, 1998; Guberman, 1996; Taylor, 2004), selling candy (Saxe, 1991), and goods on the street (Carraher, Carraher, & Schliemann, 1985; Nunes, Schliemann, & Carraher, 1993), playing basketball (Nasir, 2000, 2002), and math at work (Hall, 2000; Hoyles, Noss & Pozzi, 2001). These studies support the notion that mathematical knowing is a cultural activity.

Additionally, there is a great deal of evidence that shows the effectiveness of integrating students' cultural, linguistic, and community backgrounds in the teaching and learning of mathematics (Ladson-Billings, 1995; Leonard, 2008; Lipka et al., 2005; Moses & Cobb, 2001; Nasir, 2000, 2002). There have also been a number of studies that reported the benefits of contextualized word problems among students of ethnically and racially diverse backgrounds, who were often from poverty or working-class backgrounds (Ladson-Billings, 1995; Leonard et al., 2005, Leonard & Guha, 2002; Lipka et al., 2005; Nasir, 2002, 2005; Strutchens, 2002). In one well-known study, Lipka and colleagues (2005) implemented a culturally based mathematics curriculum designed for Alaskan Yup'ik (Native Eskimo) students. Findings from this study showed significant statistical differences in achievement for students using the culturally based curriculum as compared with students using the regular mathematics curriculum. However, other benefits resulted from the use of this curriculum, such as, positive changes in relationships among teachers and students and between the classroom and community,

pride in culture and identity and ownership of knowledge, and historically silenced Indigenous peoples (Yu'ik) knowledge privileged alongside mathematics knowledge.

Studies like the ones previously mentioned support the notion that students, particularly marginalized students, must be afforded the opportunity to see themselves, as well as, their personal worlds, in relation to mathematics (Aguirre et al., 2013; D'Ambrosio, 1990; Leonard, 2008; Ladson-Billings, 1994; Nasir, Hand & Taylor, 2008). According to Martin (2003), minorities must receive instruction that builds on their cultural knowledge base and value system. This includes *culturally relevant teaching* in which school curriculum is made more appropriate for diverse learners by utilizing their prior experiences, cultural knowledge, and learning styles (Ladson-Billings, 1994). Other theorists use the terms *Culturally Responsive Teaching* or *Culturally Responsive Pedagogy* to describe teaching that recognizes the diversity of students' learning styles and the relationship learning has to the backgrounds, languages, family structures, and cultures of students (Gay, 2000; Villegas & Lucas, 2002).

Drawing on cultural, linguistic, community backgrounds and experiences of students provides access the dominant mathematics and affords opportunities to see themselves in the mathematics (Aguirre, 2009; Gay, 2000; Gutiérrez, 2012; Ladson-Billings, 1994; Martin, 2003; Nasir et al., 2008). This includes drawing on *funds of knowledge*, which is recognizing the cultural and cognitive resources that students bring from their household interactions, traditions, and activities (González, Moll, & Amanti, 2005; Moll & González, 2004). When teachers draw on students' funds of knowledge, students' lived experiences become validated as a source of knowledge in the

mathematics classroom. As a result, students develop a positive sense of themselves as mathematical and cultural learners (Boaler, 2002; Martin, 2009). Learning becomes a part of a student's sense of identity leaning to increased engagement and motivation in mathematics (Aguirre et al., 2013; Boaler, 1997; Hogan, 2008; Middleton & Jansen, 2011) thus leading to a positive disposition for mathematics (NRC, 2001).

Ladson-Billings (1995) argues, "all students can be successful in mathematics when their understanding of it is linked to meaningful cultural referents and when the instruction assumes that all students are capable of mastering the subject matter" (p.141). The NCTM (2014) asserts that effective mathematics instruction leverages the multiple identities of students to support and enhance mathematics learning. Thus, teachers need to understand how they can utilize students' funds of knowledge, contexts, culture, conditions and language to support the teaching and learning of mathematics (Berry & Ellis, 2013; Cross et al., 2012; Kisker et al., 2012; Moschkovich, 2011; Planas & Civil, 2013).

> Without question, the best curricula and instructional materials are only as good as the teachers who implement them, Teachers who are not adequately prepared to understand and do culturally responsive teaching are at a major disadvantage in today's schools with respect to the effectiveness of their teaching, as well as the quality and level of learning for the increasingly diverse student populations in U.S. schools. (Gay, 2009, p.191)

Summary. The purpose of this section was to present an overview of the review of the literature regarding utilizing prior academic and personal (i.e., community,

cultural, racial, ethnic, linguistic, gender, classed) background knowledge of students to deign and implement equitable mathematics instruction. This requires explicit attention to the multiple identities of students and understanding the link between culture, language and other forms of out-of-school knowledge to mathematics thinking, understanding, and learning. The next section will review the mathematics education literature for developing critical knowledge

Critical Knowledge. For Aguirre (2009) having critical knowledge means having "the mathematical knowledge required to analyze the power relations, social injustices and inequities that affect our individual community and global lives" (p.300). It is knowledge beyond mathematics to understand various sociopolitical contexts and practices that create equity and inequity in the world. de Freitas (2008) contends, "Addressing social justice issues should be a primary goal of all education – including mathematics education"(p.43). Efforts to develop mathematics instruction for marginalized populations take an approach that is more explicitly critical and political. Critical and political perspectives on equity are becoming more common in mathematics education literature (Aguirre, 2009; Frankenstein, 2012; Gutierrez, 2002; Gutstein, 2003; Martin, 2003). Such perspectives are often rooted in Paulo Freire's (2000a) theories of liberatory pedagogies. Freire is regarded as the founder of critical pedagogy through his famous work *Pedagogy of the Oppressed* in 1968. Throughout much of Freire's writing, themes of self-empowerment and social transformation are evident. For this reason, teaching is viewed as a political undertaking that liberates others and influences society (hooks, 1994; Ladson-Billings, 1994). Critical and political perspectives conceive equity

as empowering students and communities to understand and use mathematical knowledge and literacy to uncover power imbalances that occur among dominant and marginalized groups (Apple, 1992; D'Ambrosio, 1990; de Freitas, 2008; Frankenstein, 1990, 1994; Gutstein, 2003; Martin, 2003). For many scholars, equity is as matter of social justice.

A critical or social justice perspective seeks to expose the myth that mathematical knowledge is neutral (i.e., value and culture free product). Rather, this perspective believes that it is not possible to teach mathematics in a neutral manner. Even though teachers may think otherwise, no teaching of any kind is actually *neutral*. Historian Howard Zinn (1990) noted, "In a world where justice is maldistributed, there is no such thing as a neutral or representative recapitulation of the facts" (p.24). Knowledge does not exist apart form how and why it is used and in whose interest (Frankenstein, 2012).

Some researchers argue, "reform-based practices lack in that they do not position students to consider power issues in society" (Gutiérrez, 2007, p.39). In teaching mathematics for social justice, students utilize mathematics to critic inequitable situations in their community. This affords students opportunities to see the role mathematics plays in their world and the power mathematics has in shaping their world (Gutstein, 2006; Martin, 2003). Gutstein (2006) is credited to bringing this application to the classroom level. He explored social justice issues related to his students' lives. In Gutstein's classroom the students used mathematics as a tool to understand power imbalances in society. They explored many themes such as global distribution of wealth; racial profiling (randomness and probability) and racism as a factor in the difficulties African Americans and Latino/as have in obtaining mortgages in Chicago. His efforts sought to connect

students' exploration of social justice issues, culturally relevant pedagogy, and the development of mathematical skills and concepts.

Primarily, social justice focuses on developing awareness on various inequalities and injustices, gaining in-depth knowledge on those issues, and preparing students to raise their voices in closing achievement gaps using various subject matters (specially mathematics) in classroom. Consequently, the direct benefit of exploring social justice issues the mathematics classroom may not be evident by way of achievement on standardized assessment. But as evidenced from Gutstein's (2003) work, for example, teaching mathematics using social justice pedagogy is a very powerful tool to learn and actually understand mathematics. Gutstein (2003) also observed that his students "performs adequately" on the tests even thought the intention was never there to pass the standardized tests. Gutstein (2003) presents a student's comment in his paper:

> Yes, I learned math in your class. I learned it in a different way of course but I still learned it. I realized that we were learning a lot of math concepts from different mathematics sections. Meaning, in our work, I learned some trig, calculus and others, while still using it to complete our goals of the class. (p. 72-73)

Other researchers have found similar results in their students' performance, as well as teachers' expectation, when examining social justice issues in mathematics (Bartell, 2013; González, 2009; Leonard et al., 2009). Similarly, Peterson (2002) found that his students' interests in mathematics increased as well as their understanding of basic mathematics concepts and problem solving abilities. His students gained a greater

understanding of society structures and could offer opinions to improve current social policies.

It is critical to understand that the purpose of such practice is not to raise the scores on tests, rather to seek equity and justice through mathematics. The indirect effect, nevertheless, is better knowledge and performance of students on assessments. By using social justice in classroom, educators can make students aware of their situations and have them build a positive orientation towards learning.

Furthermore, social justice conceptions of equity aim to disrupt and challenge dominant societal narratives about who can participate in mathematics. There are ideologies running through society framing what it means to be a knower and doer of mathematics. Labels and categories, such as " at-risk" or "limited English", frame the way educators think about who can do mathematics (Aguirre et al., 2013; Gutiérrez, 2008, 2013). These deficit views are often the cause of underachievement by these students (Aguirre et al., 2013). Frankenstein (2012) argues, "To create a just society, everyone needs to realize that his or her intellectual activity counts" (p.51). Such ideologies perpetuate the belief that effort is unrelated to mathematical competence and that failure is an individual consequence (Apple, 1992; Frankenstein, 1990).

Having critical knowledge also calls for engaging in self-reflective action that attempts to identify and remedy issues of power, agency, privilege, and participation that are in operations within the mathematics classroom. Examining instructional practice for how teachers position students is critical for achieving equity. Boaler & Greeno (2000) contend that teachers in mathematics classrooms often placed students in the role of the

passive receive of knowledge. Similarly, Horn (2008) found that how students are perceived in the mathematics classroom impacted their participation. Esmonde & Langer-Osuna (2013) examined how race, gender, language positioned students and impacted their participation.

Interrogating practice by asking questions that expose structures of power, privilege and participation help work towards remedying inequities within the mathematics classroom (e.g., Whose knowledge gets privileged in the classroom? Who benefits from this knowledge? What purposes does this serve? Who generates the mathematical ideas that get discussed? Which students get to explain their own ideas and respond to ideas of others in a meaningful way? What opportunities did students have to explain their own and respond to each other's mathematical ideas?). Opening up practice by critically examining it, is precisely what Parks (2010) does through her study of mathematical discussions. She found that the use of questions such as "Why?" and "What do you notice?" privileged some students and marginalized other students. Students who shared the same culture and language as the classroom teacher were often the ones who were privileged, whereas, marginalized students had to interpret the teachers' intentions, goals, language, and cultural practices therefore inhibiting their confident in responding. Parks reports that teacher questions that were more specific to the mathematics allowed for a wider variety of students to participate competently in the discussion. Teachers play a crucial role in deciding which students will or will not have access to powerful mathematics therefor it is critical to examine what implicit and explicit messages are being send to students through instructional practices.

Summary. Having critical knowledge is essential for providing equitable instruction in mathematics. It is important for teacher candidates to interrogate practice by asking questions that expose structures of power, privilege and participation. As this work can help towards remedying inequities within the mathematics classroom. Furthermore, many scholars call for developing commitments to social justice by engaging students to use mathematics to examine and power relations and social injustices and inequities that are present within their communities.

Summary of the knowledge bases necessary for equity. The purpose of this section is to provide an overview of the three knowledge bases (i.e., mathematical knowledge for teaching, knowledge of students' identities, and critical knowledge) identified in the mathematics education literature important for providing equitable instruction. Having mathematical knowledge for teaching affords students greater opportunities and access to learn and understand mathematics. Knowledge of the multiple identities of students, acknowledges and values the role that cultural and community knowledge, language and prior experiences play in students' mathematics learning and used such knowledge to make mathematics relevant for students. Having critical knowledge assists in making visible issues power, agency, and privilege within the mathematics classroom. Returning to the question posed by Gutiérrez (2002) at the beginning of this section (i.e., how might we know if we saw equity), the three bases of knowledge presented are illustrative of the nature of equity in mathematics instruction. Such knowledge helped identified the tentative ways equity manifested. In the next

section, an overview of the ways different scholars have researched equity within mathematics methods courses is presented.

Equity-Oriented Pedagogies in Mathematics Teacher Education

Sleeter (1997) insists that most teachers fail to recognize the connections between equity issues and mathematics teaching and learning by themselves. She proposes multicultural education coursework can be the starting place for understanding the impact that culture, race, language, class, and gender have on student learning. However, deliberate connections must be made between mathematics and matters of equity and diversity to support teacher candidates in developing an equity mindset for the teaching and learning of mathematics.

Upon a survey of the literature of how equity is taken up within mathematics methods courses, the research has focused primarily on examining the impact particular instructional activities, or interventions, within a mathematics methods course. The overall goal of these activities was to help change teacher candidates' deeply held conceptions and practices and broaden perspectives about teaching for diversity. Thereby, facilitating a productive disposition for teaching for equity within the mathematics classroom.

Incorporating students' funds of knowledge and social justice issues. Some mathematics education scholars examined ways in which teacher candidates incorporated students' backgrounds, experiences, culture/community/language knowledge (i.e., funds of knowledge) or social justice issues into their mathematics lesson plans (Gutiérrez, 2012; Nicol & Crespo, 2006; Garii & Appova, 2013). Although the findings from these

studies varied in degrees, the overall consensus was that teacher candidates made superficial connections to students' funds of knowledge or social justice issues when creating mathematics lessons.

Utilizing research methods for critical reflection. Other scholars used research methods, such as transcription, coding, auto-ethnography and discourse analysis to help teacher candidates critically reflect and analyze their mathematics teaching (de Freitas, 2008; Neumann, 2014). Using research methods as instructional practices to foster critical reflection appears to be promising based on the findings from these studies. These practices were successful and various degrees in engaging teacher candidates in critical self-examination of their mathematics teaching. Neumann (2014), found teacher candidates recognized inequitable practices, with gender, in their student-teacher interactions after this systematic analysis of their teaching. Whereas, de Freitas (2008) found that teacher candidates were successful at identifying discourse patterns in the mathematical discussions particularly noticing the social structuring and power relations among gender but not race. Additionally, de Freitas reports the auto-ethnography caused teacher candidates to reflect upon power and privilege that is associated with success in school mathematics. The teacher candidates saw how the identity of mastery model served them well in school mathematics and how it is important to trouble that identity in order to reach diverse students.

Developing instructional models. The development of instructional models for facilitating teacher candidates' knowledge, dispositions, and practices for equity-oriented mathematics teaching has been the focus of research for some scholars (Aguirre, et al.,

2012; Roth et al., 2014; Turner et al., 2012). The culturally responsive mathematics teaching tool was developed to support teacher candidates in analysis of culturally responsiveness within mathematics teaching (Aguirre et al., 2012). Findings indicated that teacher candidates had a strong openness to supporting academic language for ELL students and integrating cultural funds of knowledge into mathematics lessons. However, findings for integrating social justice into mathematics lessons were mixed with the majority of teacher candidates open to embracing social justice on an ideologically level but not able to incorporate it on a pedagogical level. Overall, their findings suggest teacher candidates need additional support to focus on and integrate culturally responsive pedagogies into their practice.

Turner and colleges (2012), used research conducted in preK-8 mathematics methods courses to conjecture a learning trajectory that describes teacher candidates' movement toward the integration of children's mathematical thinking, and children's cultural, home, and community-based knowledge, which they refer to as multiple mathematical knowledge bases, in instruction. Three key phases were identified: (1) initial practices (attention, awareness, eliciting), (2) making connections among the knowledge bases (emergent, meaningful), and (3) incorporating (incorporating multiple knowledge bases in instruction). They argue that the conjectured learning trajectory is a tool for making sense of and planning for the development of dispositions, knowledge, and practices that develop not only during methods coursework, but also throughout early career teaching.

Developing partnerships to facilitate equity-orientations. Gutiérrez (2012) created a one year "partnership project" between 23 teacher candidates in her

mathematics methods course, a first year teacher, whom taught at a local alternative urban high-school and his students. The goal of the project was to engage teacher candidates in the types of practices that effective teachers of marginalized students employ on a regular basis. This study resulted in teacher candidates' identification of issues of access (to a high-quality curriculum and teacher), identity and power. Interestingly, Gutiérrez found that the teacher candidates only able to abstract ideas and strategies about equity matters from the things that they observed or participated within the partnership. Through this project, the teacher candidates moved from a position of limited awareness of equity issues to a greater awareness of how others experience mathematics. They moved from perceiving one reality to being able to perceive multiple realities.

Gaps in the literature. The majority of research studies on equity matters embedded within a mathematics methods course focused on the developing intervention activities and reporting the impact of such interventions on teacher candidates. None of the studies reviewed sought to uncover the meanings of the lived-experience of cultivating equity-mindedness or look at it holistically over the entirety of a mathematics methods course. Previous work many have shared a similar goal to impact the ways of thinking about mathematics teaching and learning, however these studies examined the impact of prescribed activities in isolation from the methods course. The goal of this study was to describe the holistic process of cultivating equity-mindedness with teacher candidates in an elementary mathematics methods course.

It is also worth noting that all of the studies reviewed were qualitative case studies in nature with a few incorporating some quantitative data, such as surveys. In all of these studies, the intervention (i.e., the prescribed activities) was the unit of analysis. The existing literature is void of utilizing phenomenological methods that examined equity-mindedness (i.e., the phenomenon itself) as the unit of analysis.

Summary of equity-oriented pedagogies in mathematics teacher education. This section surveyed the literature for the ways in which scholars have researched equity within mathematics methods courses. Scholars have taken-up studying equity by focusing on the impact of particular instructional activities, or interventions, within a mathematics methods course. Such studies have included: (1) teacher candidates abilities to incorporate students' funds of knowledge and social justices issues with mathematics lessons; (2) drawing on research methods to assist teacher candidates in critical reflection; (3) developing instructional models to assist teacher candidates in developing skills; and (4) developing strategic partnerships to facilitate equity-orientations. The next section presents the conceptual framework developed for this study based on the review of the literature.

Chapter two summary. The purpose of this chapter was to situate the phenomenon, cultivating equity mindedness, in the existing scholarly work in mathematics teacher education. It was necessary to consider the ways mathematics education scholars have defined the concept of equity by beginning with common ways equity has been conceived as equality and making distinctions between equity and equality. Recent conceptions of equity focus on defining it as a process that continues to

evolve. There were three main bases of knowledge (i.e., mathematical knowledge for teaching, knowledge of students' identities, and critical knowledge) that were identified in the mathematics education literature that seemed to be important foundational knowledge needed to be able to employ equitable instruction.

In the area of mathematics teacher education, scholars have taken-up studying equity by focusing on the impact of particular instructional activities, or interventions, within a mathematics methods course. Such studies have included: (1) teacher candidates abilities to incorporate students' funds of knowledge and social justices issues with mathematics lessons; (2) drawing on research methods to assist teacher candidates in critical reflection; (3) developing instructional models to assist teacher candidates in developing skills; and (4) developing strategic partnerships to facilitate equity-orientations.

Next, chapter three will present the methodology used for this study which involves situating post-intentional phenomenology within the origins of phenomenology as a philosophy and the history of phenomenology as a methodology in order to set a foundation into understanding the nuances of this variant form of phenomenology. Additionally, an overview of the philosophical underpinnings for post-intentional phenomenology is explained.

CHAPTER THREE

METHODOLOGY

Phenomenology serves as an appropriate and guiding philosophical and methodological orientation for a study focused on exploring how cultivating equity-mindedness takes shape with teacher candidates as they develop orientations and commitments toward equity within the teaching and learning of elementary mathematics. Phenomenology seeks to foreground the lived experiences of individuals to provide explanation and illumination of a particular human phenomenon (e.g., cultivating equity-mindedness). Through a commitment towards openness, phenomenology allows researchers to move "beyond initial assumptions and preconceptions so that the phenomenon and its meaning can show itself in a way that we do not expect it to" (Dahlberg, Dahlberg, & Nyström, 2008, p. 112).

This chapter begins by situating the origins of phenomenology and intentionality from early phenomenology along with philosophical understandings and a brief history of two distinct approaches of phenomenology. Ending with a focus on post-intentional phenomenology by addressing the theoretical underpinnings, providing a rationale for using this methodology and presenting two theoretical notions used to open up the phenomenon. Chapter four provides a detailed description of the methodological approach used in this research study, which includes an accounting of the participants, recruitment, data gathering, and textual analysis.

Origins of Phenomenology

"Phenomenology is the study of human experience and of the way things present themselves to us in and through such experiences" (Sokolowski, 2000, p.2). Simply put, phenomenology, in its early form, can be described as the study or science of *phenomena.* German philosopher, Martin Heidegger, explains that the term phenomenon originates from a derivative of Greek word *phainomenon*, which signifies "to show itself" (1998). Thus, Heidegger posits, phenomenon means that which manifests itself to us. Dahlberg, Dahlberg, & Nystrom (2008) explain that a phenomenon can be understood as an object, a matter, a thing or a part of the world, as it presents itself to, or, as it is experienced by a subject (Dahlberg et al., 2008).

Early phenomenology is concerned with uncovering and articulating the structure of the phenomenon experienced from a subjective (first-person) point of view. It seeks to describe the object of experience (e.g., not just physical objects, but also values, feelings, time, truth, etc.), the acts of human consciousness (i.e., thinking, perceiving, feeling, imagining, doubting, questioning, loving, hating, etc.) and the relationship between the object and the acts of consciousness.

A phenomenon has qualities about it that can be talked about as something that belongs to a particular lived experience (van Manen, 1990). There is something that gives this experience a particular feature or an identifiable structure. For example, there are qualities about the experience of being 'in-love' that makes it unique and different from other experiences like being 'in-hate'.

Intentionality. Central to phenomenology is the notion of *intentionality*. This notion should not to be confused with the Western conceptions of intention, as an aim or a goal. *Intentionality* originates from the Latin word *intendere* [*in* (toward) + *tendere* (to stretch)], which means to turn one's attention. Literally it means to strain, stretch out, or extend from (Merriam-Webster). For descriptive phenomenologists, consciousness 'reaches out' to an object and it is this quality of 'reaching out' is a distinctive activity of consciousness. Thus, *intentionality* can be described as orientation of the mind to its object-that is directing one's attention toward an object or about an object. The central structure of a lived-experience is its *intentionality*-the way it is directed through its content or meaning towards a certain object in the world. It is in these *intentional relations* one looks to find meaning. *Intentionality* is not located in a particular place but is running throughout one's actions with the world (Vagle, 2014).

In the next section, I provide a brief history of the philosophical underpinnings of phenomenology and outline two most distinct approaches to phenomenology. It is important to situate phenomenology within its historical context as this context provides a rich source of information, which aids the understanding of phenomenological methodologies and implications for research.

History of Phenomenology

The term phenomenology appeared as a concept in philosophy around the eighteenth century as a branch of science that deals with how things manifest or appear. It is a philosophical discipline and is sometimes referred to as a philosophy of the mind. According to Moran (2000), "phenomenology is best understood as a radical, non-

traditional style of philosophizing, which emphasizes the attempt to get at the truth of matters" (p.4). At the time, phenomenology was a departure from Cartesian philosophy that dominated Western thought. According to Cartesian thought, the mind and things of the world were believed to be separate entities. The mind was considered an enclosed sphere with knowledge being locked within its own confines. Things were acknowledged as psychological, that is, they were believed to be mental representation of or a mere copy of what exists outside the mind (Moran, 2000). Therefore, what we think about a thing in the world is a property or feature of the thing itself, as we only know our ideas or interpretations of the objects in the world. However, in phenomenology, things are perceived as ontological. The things (pictures, words, symbols, perceived objects, states of affairs, other minds, laws, and social conventions) are all acknowledged as truly being there, capable of appearing according to their own unique properties (Sokolowski, 2008). In other words, things have their own properties and features that exist outside of our own consciousness.

The two most distinguishable phenomenological approaches are descriptive (i.e., describe an experience found in our lived experience) and interpretative (i.e., interpret experience by relating it to relevant features of context). Additionally, there are many variant approaches to phenomenology that have stemmed from these two approaches. However, the purpose of this section is to briefly explore descriptive and interpretative phenomenology through the lens of Edmund Husserl and Martin Heidegger, the two most prominent early phenomenologists.

Descriptive phenomenology. While phenomenology can be traced back to the time of Aristotle, Plato, Kant and Hegel, Edmund Husserl (1859-1938) is attributed with being the father of modern phenomenology. Through Husserl's work, a new way of understanding the world and our experience of it emerged. Husserl was concerned with the natural sciences being the ideal method for acquiring absolute truth (i.e., a focus on positivism). "Husserl warns that cultivating the scientific ideal of positivism would sever science from the everyday world; ultimately resulting in the dehumanization of society rather than producing the anticipated benefits that scientific knowledge were expected to bring about (Dahlberg et al., 2008, p.30).

Husserl desired to restore the human world as the foundation of science and saw phenomenology as a methodology that had the potential to explore the true meaning of human experience. He claims that the subjective domain cannot be separated from the domain of the natural world as science has done. His solution was to return "to the things themselves" (Husserl, 1970). This means to return to the world as we first experienced it before we have reflected upon it rather than starting from existing interpretation, unexamined assumptions, scientific knowledge and theory (van Manen, 2014). Furthermore, Husserl believed human beings perceive the things themselves and that consciousness if always conscious 'of something' and not a mere representation as conceived in Cartesian thought.

Husserl considerably refined and modified his method into what he called "transcendental phenomenology". Scholars often refer to his phenomenology as a descriptive approach. While all phenomenology is descriptive in the sense of aiming to

describe rather than explain, Husserl's approach focuses on identifying the essential meaning structures of a phenomenon by describing and clarifying human experience. For Husserl, phenomenology is epistemological (i.e., what it is to know) that is a form of knowing based on determining essences.

Husserl contends humans perceive reality in terms of what he calls the *natural attitude*, which is the everyday ordinary way of living or being in the world. It is the way we think and do things before thinking about why we do them. Dahlberg and colleagues (2008) elaborates the idea of the *natural attitude* as:

> The everyday immersion of one's existence and experience in which we take for granted that the world is as we perceive it, and that others experience the world as we do. In this natural attitude we do not critically reflect on our immediate actions and response to the world, we just do it, we just *are*. (p.33)

However, Husserl calls for the philosopher to put aside the *natural attitude* and scientific knowledge and theory and enter into a new way of thinking by adopting a *phenomenological attitude* in order to let the essential structure, or essence, of the phenomenon to become visible and manifest. This process involves a suspension of scientific knowledge and theory and the *natural attitude* where objectivity is constituted out of subjectivity (Finlay, 2008). Husserl refers to the process of suspension as *bracketing*, the setting aside the *natural attitude* by enclosing it in 'brackets'. Interestingly, Husserl was a mathematician therefore he used *bracketing* as a metaphor for the act of setting aside the natural attitude.

Husserl refers to this practice as *reduction*. Through a rigorous series of reductions (also known as eidetic reduction), the philosopher will draw out the invariable and essential components that make the phenomenon what it is (i.e., to arrive at the essence of the phenomenon). This process returns one to phenomena (i.e., the things themselves) as they are lived and experience, from a subjective viewpoint, instead of beginning with scientific knowledge and theory. Finlay (2008) summarizes:

> While Husserl referred to the reduction in various ways throughout his long career, he was clear that a fundamental change in way of seeing—akin to entering a new "realm"—was required. Turning the tables on the traditional scientific understanding of reduction as a narrowing or abstracting process, Husserl saw the reduction as a movement towards perceiving and reflecting in more complex, layered, expansive and all-encompassing ways. (p. 7)

Notably, toward the end of Husserl's career he shifts toward exploring the *Lifeworld*, which is the totality of the world as experienced by human beings, including the social and inter-personal spheres.

Interpretative phenomenology. Martin Heidegger (1889-1962) is considered one of the greatest and most important philosophers of the twentieth century (Moran, 2000, van Manen, 2014). He was a student of Husserl and succeeded Husserl in the prestigious chair at University of Freiburg. Heidegger extended Husserl's work of getting back to the 'things themselves' through the role of interpretation (Moran, 2008). Husserl himself predicted that Heidegger's phenomenological ideas would succeed his own work in phenomenology (Dahlberg et al., 2008). Husserl contended that phenomenology

should be researched by means of pure description of the knowledge of the phenomena whereas Heidegger insists that an understanding of ontology (nature of being) was foundational for human science research (Dahlberg et al., 2008; Moran, 2000; van Manen, 1990).

Again, Husserl calls for a *bracketing* of the *natural attitude* (i.e., personal opinions, conceptions, and assumptions) through the process of reduction to reveal the essence of the phenomenon under investigation. In contrast, Heidegger believed it was impossible to negate our experiences related to the phenomenon under study, for he believed personal awareness was essential to phenomenological research. According to Moran (2000), "Heidegger then is seeking to replace the traditional view of knowledge as a kind of concernful dealing with the world" (p. 235-6).

In his seminal work, *Being and Time*, Heidegger speaks of being-in-the-world, which means mutual interdependency between human existence and the world. In other words, there is no such thing as a world apart from our experience of it anymore than that our experience is separable from our social and natural world context in which we live. Therefore, we do not study our activities by *bracketing* the world, rather we interpret our activities and the meaning things have for us by looking to our contextual relations to the things in the world. As Dahlberg et al. (2008) explain:

> Heidegger's philosophy asserts that human existence is a more fundamental notion that human consciousness and human knowledge. He makes it clear that the essence of human understanding is hermeneutic; that our understanding of the everyday world is derived from our interpretation of it. All new things

> encountered in the lifeworld are related to earlier experiences. We do not use a pen without first recognizing it as something to write with, or a knife without understanding that it can cut. (p.73)

It is through the process of through interpretation that the world shows itself. Being is the manifestation of the lifeworld and interpretation is the way in which we understand. For Heidegger, we must distinguish beings from their being and we begin our investigation of the meaning of being in our own case, examining our own existence in the activity of being-in-the-world. Thus, this understanding of beings and their being comes through phenomenology.

Variant approaches to Phenomenology. Over the years there have been many other variations of phenomenology with nuances of focus as there is not a singular approach to phenomenology. Heidegger (1927) warns:

> There is no such thing as the one phenomenology, and if there could be such a thing it would never become anything like a philosophical technique. For implicit in the essential nature of all genuine method as a path towards the disclosure of objects is the tendency to order itself always toward that which it itself discloses. (p.467)

These variations in approaches from phenomenological scholars have provided a rich source for methodological and substantive insights. For example, Merleau-Ponty developed a rich variety of phenomenology emphasizing the role of the body in human experience. Hans-Georg Gadamer emphasizes the role of interpretation and sees it is only

through one's pre-understandings that understanding is possible. Amedeo Giorgi modifies Husserl's philosophical method for use in conducting human science research.

In more recent years, Karin Dahlberg, Helena Dahlberg and Maria Nyström crafted the idea of the reflective lifeworld approach to research. The lifeworld approached is characterized by openness and understanding that pre-understandings cannot be completely cut off (i.e., in Husserl's bracketing of the natural attitude) rather they can be *bridled* from controlling understanding. Max van Manen adheres to a hermeneutic, interpretive approach to phenomenology with strong commitment to thoughtfulness when identifying phenomenon. Mark Vagle has established a unique approach to phenomenology that has a post-structural commitment to viewing knowledge, which will be explained later in this chapter.

History of Methodology

As a research methodology, early phenomenology (i.e., descriptive and interpretive) is used to study lived experience in its pre-reflective state without reflecting, categorizing, measuring or abstracting it. These methodological approaches to phenomenology aim at gaining insights and a deeper understanding of the nature or meaning of our everyday experiences in the lifeworld. "The special strength of phenomenological research is the way it can capture some of the ambiguity, poignancy, complexity, and richness of the lived experience, allowing readers to see the worlds of others in possibly new and deeper ways" (Finlay, 2008, p.480). Hence, this qualitative methodology is designed to look closely at the meaning of a phenomenon.

A descriptive phenomenologist studies structures of a lived experience, as experienced from a subjective or first-person viewpoint along with its *intentional relations* (the subject's directed attention toward a certain object in the world). As Vagle (2014) indicates, interpretive phenomenologists study the ways these *intentional meanings* are brought into being by embodied subjects (i.e., people). According to van Manen (1990), the value of phenomenological research, writ large, is that it prioritizes how human beings experience the world. In this way, phenomenological studies, drawing on descriptive and interpretive traditions, seek to reconstruct reality and meanings of an experience by asking: What is it like to experience this phenomenon?

Across all phenomenological approaches, phenomenologists attempt to uncover, describe and interpret these intentional meanings. They are interested in trying to slow down the evolving understandings and open up how things are experienced in order to see the phenomenon (Dahlberg et al., 2008; Vagle, 2014; van Manen, 1990). A distinguishing characteristic of phenomenological research is how the notions of research and theory are utilized. Phenomenologists use research and theory after identification of the intentional meanings to illuminate and clarify the phenomenon and less so before as to inform. Vagle (2014) notes that phenomenologists try "to contemplate and theorize the various ways things manifest and appear in the through our being in the world" (Vagle, 2014, p.22).

Phenomenologists are not studying particular individuals but how a particular phenomenon manifests and appears in the lifeworld (Vagle, 2014). Therefore the unit of analysis in a phenomenological study is the phenomenon. Issues of validity and reliability

are taken-up through engagement in the *phenomenological attitude* in a phenomenological investigation. Wertz (2005) describes how the researcher enters into the *phenomenological attitude*:

> The researcher strives to leave his or her own world behind and to enter fully... into the situations of the participants. The researcher empathically joins with participants ("coperforms" participant's involvements) in their lived situation(s). This sharing of the experience is the basis for later reflection on meanings and experiential processes. This attitude involves an extreme form of care that savors the situations described in a slow, meditative way and attends to, even magnify, all the details. This attitude is free of value judgments from an external frame of reference and instead focuses on the meaning of the situation purely as it is given in the participant's experience. (p. 172)

In order to engage in the *phenomenological attitude*, one must enter into a process of self-reflection to become open and sensitive to the phenomenon. As Finlay notes (2008)

> I value researchers' critical self-awareness of their own subjectivity, vested interests, predilections and assumptions and to be conscious of *how these might impact on the research process and findings* specifically in terms of how they may close down avenues of understanding. (p. 17)

It is through the reflective process that the researcher steps away from initial pre-assumptions and pre-understandings to gain enough distance from which to critically and reflexively interrogate them. This reflexive act of distancing allows the true meaning of the phenomenon to fully emerge (Gadamer, 1995). Dahlberg and colleagues (2008) warn,

"Researchers who are not aware of their pre-understanding and neglect its associated problems risk obtaining results that are primarily a reflections of their past experience or unrecognized beliefs" (p.135). It is through this reflexive analysis of entering into the *phenomenological attitude* that issues of validity and reliability in phenomenology can be best addressed.

Scholars have developed different methods or approaches to assist in entering into the *phenomenological attitude*. As mentioned earlier, Husserl crafted the process of *bracketing* (also known as *reduction*) which involves a putting aside or suspension of previous knowledge about the phenomenon so that it doesn't influence one's understanding of the phenomenon. *Bridling* is the approach Dahlberg & colleagues (2006) developed in efforts to move away from *bracketing. Bridling* is more of a process of restraining of one's pre-understandings as to remain open to understanding the phenomenon, actively bridling throughout the study, and looking forward as to limit the influence of the present. Bracketing and bridling are two of the most prevalent approaches that phenomenologists use to help enter into the *phenomenological attitude*

In the end, phenomenological researchers aim to construct a text that is an expression of human actions, behaviors, intentions, and experiences in the lifeworld (van Manen, 1990). It offers plausible insights that bring us in more direct contact with the lifeworld and seeks to articulate various aspects of the human experience.

Summary of history of phenomenology and methodology. The purpose of this overview, into the origins of phenomenology as a philosophy and history of it as methodology, was to situate post-intentional phenomenology within the context of

broader phenomenology. The overall aim of this overview was to help provide a foundation to better understand the nuances inherent to post-intentional phenomenology. The next section will address the phenomenological methodology of choice utilized for this study.

Post-Intentional Phenomenology

This section will explain the philosophical underpinnings of post-intentional phenomenology. Followed by a rationale for this using this methodology to uncover the phenomenon cultivating equity-mindedness. This section will conclude by explaining the two main theoretical notions that were utilized to help open up the phenomenon under investigation.

Philosophical underpinnings for post-intentional phenomenology. Building on post-structural notions and the use of *intentionality* (one's relationship to the things of this world), Vagle (2014) has developed an approach to phenomenological research in which he refers to as post-intentional phenomenology. Post-intentional phenomenologists enter into the research process with a belief and understanding of the entangled (Delueze & Guatarri, 1987) and highly contextual nature of researching lived experience. This approach aims to uncover the typically ignored perspectives of a lived experience and notice the tentative and fleeting nature of the phenomenon as it is lived and experienced.

Vagle (2014) posits that *intentional meanings* are never stable and constantly in the process of becoming. In other words, *intentional meanings* are always in motion (i.e., they are shifting, circulating, fleeting, constructing, and deconstructing) among the researcher's relationship, participants' relationship with the phenomenon, as well as in

the contexts, situations that the phenomenon occurs. This is in contrast to descriptive phenomenology where *intentional meanings* are often conceived as having stable essential structure or quality about them (i.e., that make a particular thing or experience what it is and not something else).

Post intentional phenomenology acknowledges the tentative nature of meanings and does not try to center meaning to essential qualities that remain fixed (Vagle, 2014). For this reason, post-intentional phenomenologists examine how various forms of meaning are appearing, showing, manifesting, being, becoming through being in the world. They attempt to locate, grasp or come to understand as what Vagle (2014) refers to as *tentative manifestations* or particular aspects of the phenomenon. When looking for the *tentative manifestations*, post-intentional phenomenologists look for some "salient, partial, fleeting, temporary, unstable *intentional* meanings" (Vagle, 2014, p.41). Vagle (2014) contends that *intentionality* is not directed from one source but from multiplicity of sources that include difference and partially. This idea is borrowed from post-structural notions in which multiplicity and pluralism are privileged and binary oppositions that constitute structure are interrogated.

Critical to post-intentional phenomenology is Deleuze and Guattari's (1987) post-structural conception of "lines of flight". The premise behind the "lines of flight" is that all things are connected in all sorts of unstable, changing, partial and fleeting ways. "This conception helps phenomenologists conceptualize things as fluid, shape-shifting assemblages continually on the move in interacting with the world rather than perceiving them as stable essences" (Vagle & Hofsess, 2014, p.1). Therefore, the primary job for

post-intentional phenomenologists is find the potential openings in the *intentional relations* and follow these "lines of flight" to see what the phenomenon might become. By utilizing philosophies, theories and other conceptions as well as putting them in dialogue with one another is a way to follow the lines of flight to help open up the phenomenon under investigation. As Vagle (2014) contends, phenomenologists try to "contemplate and theorize the various ways things manifest and appear in and through our being in the world" (p.22).

Also essential to post intentional phenomenology is post-reflexion, as it is through this process that phenomenologists begin to uncover the phenomenon. Post-reflexion is similarly to bracketing and bridling in that it is a way for one to enter into the phenomenological attitude (i.e., a critical self-awareness). Whereas, bracketing calls for a putting aside of past knowledge of the phenomenon in order to see the phenomenon and bridling involves restraining pre-understandings so that one might be able see the phenomenon differently. For Vagle (2014), post-reflexion involves seeing ones frame of reference about the phenomenon. This process helps phenomenologists "to uncover underlying, shifting changing knowledges that are at work in all intentional relations" (p.132) by constantly interrogating assumptions, beliefs, perceptions, opinions about the phenomenon. This is not done by setting pre-understandings aside or restraining them, rather, post-intentional phenomenology acknowledges that it is impossible for phenomenologists to separate themselves from their histories with the phenomenon. Therefore by engaging in post-reflexion, phenomenologists can begin to see what frames

their thinking so that they can see the ways in which the phenomenon takes off thereby following its lines of flight.

Rationale for using post-intentional phenomenology. This study explores the experiences of teacher candidates as they learn to become mindful of equity matters and practices within the teaching and learning of elementary mathematics. Post-Intentional phenomenology is particularly suitable for this study as it explores the teacher candidates' viewpoint while illuminating the meanings of such experience. While there are many qualitative methodologies that allow for a first-person accounting of an experience, such as ethnography or case study, however, phenomenology is the preferred methodology because the participants are not the unit of study rather the phenomenon as it is lived through the participants' experiences. More specifically, post-intentional phenomenology is the methodological approach utilized in this study (Vagle, 2014). This methodology recognizes that the manifestations or appearances of the lived experienced are not constant but in a perpetual state of evolution. It should be expected that as teacher candidates are becoming aware of equity matters and learning to employ equity-practices their intentional relationship will continue to change, particularly as contexts change and human predicaments occur. This study uncovers and open ups the tentative meanings, which were produced through the intentional relationships between the teacher candidates, instructor/researcher and the phenomenon of cultivating equity-mindedness. The purpose of this study is to illuminate understanding of the phenomenon of cultivating equity-mindedness by showing a richer, deeper, more nuanced appreciation of the phenomenon.

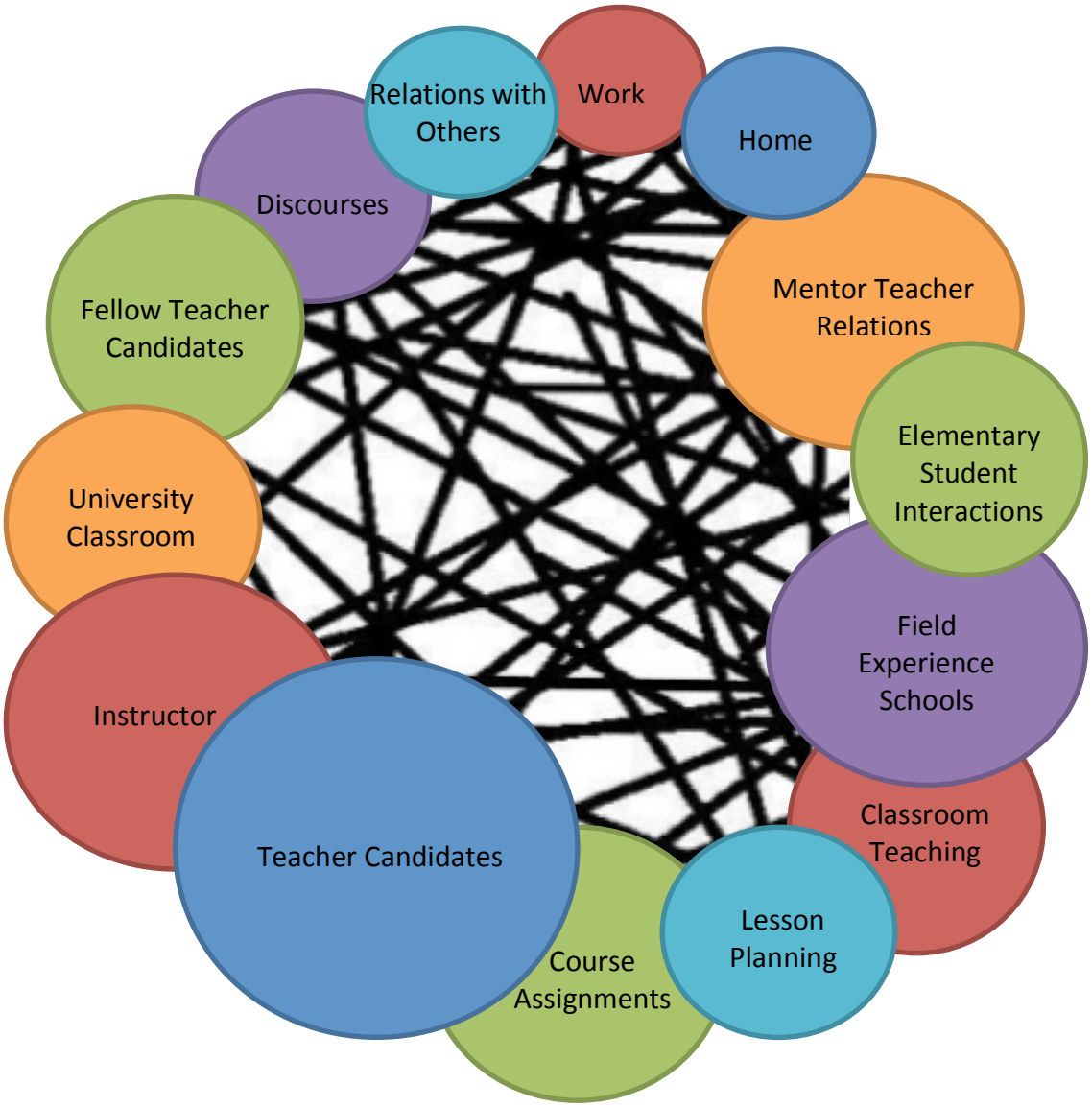

Figure 3.1. Illustration of Research Study.

Figure 3.1 provides an illustration of this study. The illustration depicts the connections and relationships (i.e., the intentional relationship) of the phenomenon, cultivating equity-mindedness. The circles describe some of the contexts and situations that the intentional relations might appear. The different sized circles represent the different intensities of the phenomenon present within those particular contexts. The lines

in the center of the circles characterize the connections as these relations should be seen as intertwined, entangled and not neatly confined to the individual circles as this 2D figure illustrates. In addition, this 2D figure does not portray the movement of the phenomenon, cultivating equity-mindedness. In post-intentional phenomenology, the phenomenon travels through the different relationships.

Theoretical Framings

As stated earlier, the primary job for post-intentional phenomenologists is find the potential openings in the *intentional relations* (i.e., the meaning link) and follow these "lines of flight" to see what the phenomenon might become. This is done through a process of utilizing philosophies, theories and other conceptions as well as putting them in dialogue with one another as a means to follow the lines of flight by opening up the phenomenon under investigation. As Vagle (2014) contends, phenomenologists try to "contemplate and theorize the various ways things manifest and appear in and through our being in the world" (p.22). Explain here how the two theories were used to illuminate the phenomenon

Similarly, Jackson and Mazzei (2012) call such work as "thinking with theory" (p.1). They borrow the phrase "plugging in" from Deleuze and Guattari's *A Thousand Plateaus* to describe their process of "thinking with theory". For Jackson and Mazzei, the process for plugging in theory involves drawing on specific theoretical concepts and using them to open up, expand, stretch, and even distort meanings. They adhere to post-structural notions that view meanings as temporary and can be transformed at any given moment. They, like Vagle, posit that meanings can be made and unmade, which involves

resisting fixed notions of meanings/knowledge. Rather "thinking with theory" involves a "plugging in" of the vocabulary and concepts to push data in order to produce knowledge and meaning differently.

In this dissertation, two theories were particularly helpful for opening up and interpreting the intentional meanings being produced through teacher candidates' experiences with cultivating equity-mindedness, those were Gloria Anzaldúa's notion of *Nepantla* and the path of *conocimiento* in dialogue with Michel Foucault's theories of the workings of power/knowledge. They provided theoretical tools to help open up and think about the ways in which equity-mindedness was taking shape. Both theories offer ways to think about how knowledge gets constituted for people. In the next section, each theory is explained along with a brief overview on how it applies and was used for this study.

Construction of knowledge: Nepantla. The concept of *nepantla* was particularly helpful for understanding how to cultivate a mindset for equity in mathematics teaching and learning. *Nepantla* provides a language to describe the transformation of knowledge in learning to teach mathematics for equity. Keeping in line with Vagle's (2014) post-intentional approach to phenomenological research, as stated in the introduction, the idea of *nepantla* (Anzaldúa, 1987) contributed to thinking and understanding the lived meaning of the phenomenon cultivating equity-mindedness. In *nepantla*, ways of knowing are tentative in nature and always in the process of becoming as humans are in relations with others. Similarly, in post-intentional phenomenology the structure of the phenomenon is temporary manifesting itself and shifts within various contexts and situations.

Drawing upon the notion of *nepantla* brought forth by Gloria Anzaldúa (Anzaldúa, 1987, 2002), Gutiérrez (2012) conceptualizes a framework for how knowledge might materialize and be transformed. Anzaldúa was a Chicana feminist scholar who drew on indigenous ideas, from Aztec and Nahuatl mythologies, to help theorize about her uncomfortable struggles of never truly belonging somewhere. As a mestizo (mixed race) Chicana lesbian growing up in a border community she was never fully accepted by her Chicano community, that typically outcasts gays/lesbians, her Spanish heritage, or the White community. According to Anzaldúa (2002),

> Nepantla is the site of transformation. The place where different perspectives come into conflict and where you question the basic ideas, tenets, and identities inherited from your family, your education, and your different cultures. Nepantla is the zone between changes where you struggle to find equilibrium between the outer expression of change and your inner relationship to it. Living between cultures results in "seeing" double, first from the perspective of one culture, then from the perspective of another. Seeing from two or more perspectives simultaneously renders those cultures transparent. (p. 548-549)

Anzaldúa's notion of *nepantla* (translation "neither her nor there") developed from the concept of *conocimiento*, a Spanish term which literally translates to into the English word "knowledge". However, the English word "knowledge" does not convey the full meaning of *conocimiento*. *Conocimiento* is a connected/embodied way of knowing that comes from the "verb "*conocer*" which means to know someone or be familiar with something as if you have met or had an experience with another person or

thing" (Gutiérrez, 2012, p.34). It is a knowledge that recognizes a connection with others and dependence upon others. Anzaldúa also draws on the Spanish word *nosotras* (the feminized version of the word *we* or *us*) to further conceptualize the notion of *Nepantla*. However, she uses a slash between the *nos* and *otras* (*nos/otras*) to illuminate the fact that two different (or multiple) perspectives are present within one word. The slash in the middle allows us to see ourselves along side of others (i.e., the *nos* means *us* and the *otras* means *other*) connected but still acknowledging our differences (Gutiérrez, 2012). Whereas, the single word *nosotras* our unique identity is subsumed (Anzaldúa, 1987, 2002).

As we become aware of the "other" and their perspectives collide with ours we enter into *nepantla*, as described above by Anzaldúa. It is in this space tensions arise at the possibilities of multiple realities. If we choose to recognize these multiple realities new knowledge is generated. However, if we refuse to acknowledge that other realities/perspectives can coexist alongside ours "we can erase the slash in the word and resort back to a previous framing of the world based only on our own view" (Gutiérrez, 2012, p.35). Anzaldúa refers to this act as *desconocimiento*, which involves distancing oneself and can be interpreted as refusing to know. Gutiérrez has illustrated the path of *conocimiento* below in figure 3.2.

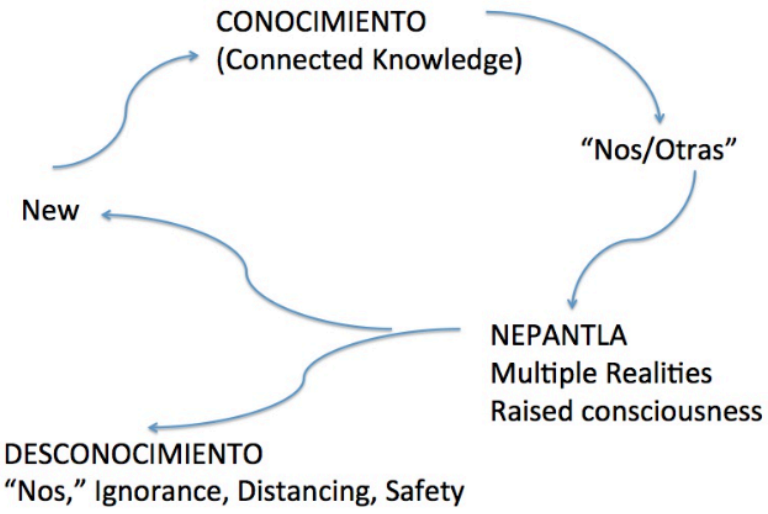

Figure 3.2. The Path of Conocimiento. This figure illustrates the path to construction of knowledge and the tensions involved. Taken from Gutiérrez (2012, p. 36).

This theory has particular relevance to this study because cultivating equity mindedness with teacher candidates involves a negotiation of multiple bases of knowledge intersecting with one another as well as completing with our personal biases, assumptions and perspectives. Particularly when dominant notions of mathematical teaching and learning are often at odds with the new knowledge teacher candidates are learning. *Nepantla* helps describe the tensions that occur and make teaching for equity in mathematics a complex process. Moreover, in *nepantla* multiple bases of knowledge can contradict one another. For example, focusing on the achievement gap can help illuminate inequities however it can also perpetuate negative narratives about minority groups.

There is no simple solution to teaching mathematics for equity as it is a messy process filled with tensions and feelings of uneasiness. *Nepantla* describes knowledge as a process that can never be complete or fixed as it is depended upon the influence of

other knowledge bases and other perspectives. In many ways, *nepantla* resembles post-intentionality in how they both view knowledge. In post-intentionality, the phenomenon is social not belonging to an individual. Vagle (2014) posits individuals are not experiencing the phenomenon in isolation or in a vacuum (p. 42). Comparably, in *nepantla* knowledge is always in the process of becoming and transforming as one is in relations with others. Individual knowledge is troubled when one becomes aware of the differing viewpoints of others. In post-intentionality, meanings shift, circulate and change over time. They are partial, fleeting, temporary and unstable in nature. As Vagle states, there is not one way to come to know. Similarly, in *nepantla* knowledge transforms as multiple realities are embraced. However, the main difference is *nepantla* is a notion of how new knowledge is constructed and transformed in relations with others, whereas, post-intentionality seeks to describe the ways meanings "come-to-be" in relations between the subject and object. Therefore, putting post-intentional phenomenology in dialogue with the notion of *nepantla* offers a slightly different way of reading of the phenomenon under study.

Foucault's power/knowledge discourse. Foucault (e.g., 1977, 1980, 1982, 1984) provides a framework and language for opening up and exploring the ways in which meaning are produced through the lived experiences of teacher candidates learning to teach mathematics through a lens of equity. Much of Foucault's work explores the relationships between knowledge, truth and power and the effects of these relationships on us and on the institutions we create. This section introduces the concepts of truth, discourses, power/knowledge, surveillance, normalization and dividing practices all of

which are central to Foucault's theories on power relations. These discourses operate in conjunction with one another and are not meant to be stand-alone concepts. However, for the purposes of this dissertation they will be defined separately.

Truth or regimes of truth. Foucault describes *regimes of truths* as a set of practices within a field of knowledge (e.g., psychology or education). Truths are institutionally produced and they generate an authoritative about what needs to be done in that field and how it should be done (Gore, 1993). These truths govern and regulate thinking and behaviors. They produce in us "tact and discretion" (Foucault, 1984, p.301) about where, when and how we talk.

Discourses. Foucault's idea of discourse is not just limited to spoken language but is broad as it includes, written text, symbolic language, as wells as people's thoughts and actions. It is through these discourses (or discursive practices) that words are created, categories are established and ideas developed. Discourses play a key role in the social construction of reality as they generate truths and are the vehicle though which knowledge and people are created. They have power to convince people to accept things as true and reveal things about people and their implied relationship to others. Discourse diffuses and produces power, reinforces it, as well as undermines and exposes it making it unstable and possible to obstruct (Foucault, 1978, p.100-101).

Power/Knowledge. Power is of prevailing interest to Foucault. In *Discipline and Punish* (1977), he developed the themes of governmentality (i.e., enforced obedience to rules that are presumed to be for the public good), surveillance, and normalization to explore the workings of power. Foucault argues that power is inextricability linked with

knowledge, hence his creation of the term power/knowledge. What we know is a way of exercising power and what we know is a product of the ways that power has been exercised in the past. Power produces knowledge and knowledge produces power.

For Foucault (1980), power is not just negative and coercive and operates from a centralized location and distributed from top down. Rather, Foucault has a modern take on the workings of power as he conceived it productive, dispersed and dynamic. He explains:

> If power were never anything but repressive, if it never did anything but to say no, do you think one would be brought to obey it? What makes power hold good, what makes it accepted, is simply the fact that it doesn't only weight on us as a force that says no, but that it traverses and produces things, it induces pleasures, forms knowledge; it produces discourse. It needs to be considered as a productive network, which runs through the whole social body, much more than as a negative instance whose function is repressive. (1986, p.61)

Power is "everywhere" and "comes from everywhere" so in this sense is neither an agency nor a structure (Foucault, 1998, p.63). From this perspective, power is seen as relational, as it is always moving and circulating among and between people (Jackson & Mazzei, 2012). Inherent within these power relations is the possibility of resistance as there cannot be relations of power unless subjects are free to produce forms of resistance. Foucault (1978) posits, "Where there is power, there is resistance, and yet, or rather consequently, this resistance is never in a position of exteriority in relation to power" (p.95). Like power, resistance also manifests in a multiplicity of forms.

Surveillance. For Foucault (1988) the practice of surveillance makes "it possible to qualify, to classify, and to punish. It establishes over individuals a visibility through which one differentiates them and judges them" (p.184). Surveillance practices are important because they suggest practices of monitoring are also practices used for defining and regulating people. Therefore, it is an instrument or a practice of power that is used to monitor actions and behaviors so that judgments can be made about actions and behaviors based on discourses of normalization.

Normalization. Normalization is the device that classifies people into normal and abnormal. Surveillance brings about normalization through what Foucault calls the *normalizing gaze*. This can be done through some sort of examination or dividing practice, in which institutions have constructed as appropriate measures to determine normality. Additionally it can be done through discourse or systems that people have created to define as what constitutes as normal.

For Foucault, normalization and surveillance represent dual mechanisms of disciplinary power as it is used to train and normalize individuals. It is not a confrontation between two adversaries like sovereign power, but a matter of guiding one to a desired outcome. Foucault used the term *subjectification* to describe the positive process that involves a willingness to be transformed though disciplinary power, surveillance and normalization.

Dividing Practices. Dividing practices are a wide range of practices that operate across social situations that categorize, separate and label people in order to make distinctions between them. Foucault (1984) defines it as the process in which, "the

subject is objectified by a process of division either within himself or from others" (p.208). These practices have to power to shape the way people think about others and how they think about themselves.

Summary of Foucault's power/knowledge discourse. By bringing Foucaultian discourse to bear in this study allowed for a more nuanced reading of the intentional meanings bring produced through cultivating equity-mindedness. Particularly, Foucault offers much insight into the working of power in relations and how knowledge gets constructed for teacher candidates in the teaching and learning of elementary mathematics. Discourses, whether they are from the methods course, institutional spaces, mentor teachers/supervisors or from previous experiences, powerfully organize thinking and experience and play a part in constituting equity-mindedness. Equity-mindedness was (and is ongoing) constituted and negotiated within contexts of ongoing power/knowledge relations.

Chapter three summary. The purpose of this chapter was to situate post-intentional phenomenology within the origins of phenomenology as a philosophy and methodology as to help provide a foundation to better understand the nuances of this variant form of phenomenology. Additionally, an overview of the philosophical underpinnings for this particular methodology was explained. Next, in chapter four, the methodical process of post-intentional phenomenology utilized for this study is described in detail.

CHAPTER FOUR

METHODOLOGICAL PROCESS

This chapter begins with a detailed explanation of the methodological process used for data analysis for this post-intentional phenomenological study of cultivating equity-mindedness. Post-intentional data analysis included ongoing attention to post-reflexion throughout the study to assist with researcher reflexivity and iterative cycles of the whole-part-whole analytic process (Vagle, 2014). This process allows the researcher to uncover and open up the tentative manifestations that were produced through the intentional relationships between the teacher candidates, instructor/researcher and the phenomenon of cultivating equity-mindedness. This chapter will end with a brief overview of the outcomes of data analysis and tentative manifestations that were identified. A more detailed representation of the tentative manifestations is presented in chapter five of this dissertation.

Methodological Process

For this dissertation, I followed Vagle's (2014) methodological process for conducting post-intentional phenomenological research process, which includes the following five components:

1. Identify a phenomenon in its multiple, partial, and varied contexts.
2. Devise a clear, yet flexible process for gathering data appropriate for the phenomenon under investigation.
3. Make a post-reflexion plan.
4. Read and write your way through your data in a systematic, responsive manner.

5. Craft a text that captures tentative manifestations of the phenomenon in its multiple, partial, and varied contexts. (p.121)

It is important to note that this methodological process should not be rigidly followed in a linear fashion but rather with a commitment to openness and responsiveness to the moving nature of the phenomenon. Additionally, the process should be revisited over and over throughout the research study (Vagle, 2014). The five components are touched on to some degree in this chapter. Components two, three, and four are fully addressed, part of component one was addressed in chapter one and two, and component five is completely addressed in chapter five of this dissertation.

In the next section, part of component one is addressed by situating the phenomenon within the context of the study by describing the elementary mathematics methods course and identifying the participants that experienced the phenomenon. Next, component two is addressed by explaining process used for data gathering and textual analysis. Followed by component three, which presents how post-reflexion was used in this study, including a statement that, describes my role as researcher, my assumptions, beliefs, perspectives, and background that is related to the phenomenon of cultivating equity-mindedness. Next, component four is addressed through a detailed explanation of the whole-part-whole analytic process. This chapter concludes by addressing component five with an explanation of how the text for capturing the tentative manifestations was constructed. Chapter five presents the final crafted text that represents the tentative manifestations produced in this research study.

Component One: Identify the Phenomenon in its Multiple, Partial and Varied Contexts

The first component is comprised of several parts, including a statement of the research problem, a partial review of the literature, an explanation of the philosophical approach in phenomenology, and a statement of the phenomenon in the form of research questions. Each of these components have been addressed in chapters one, two and three of this dissertation. The remaining two parts of component one, context and participant selection are addressed in this section.

Research question. The first action for this research study was to identify a phenomenon. Based on my role as a mathematics methods teacher educator, I have first-hand experience with the challenges and difficulties involved in preparing teacher candidates to teach elementary mathematics in an equitable manner. This first-hand experience has caused me to turn to the literature (see chapters one and two) to identify an important question to investigate. For this study, I chose to explore the experiences of teacher candidates as they learn to become mindful of equity matters and practices within the teaching and learning of elementary mathematics. Therefore, *cultivating equity-mindedness* became the phenomenon that was investigated during this study. Since "phenomena appear in our intentional relationships with others and things in the lifeworld" (Vagle, 2014, p.122), this led me to develop a primary phenomenological question of: *How might cultivating equity-mindedness take shape with teacher candidates in an elementary mathematics methods course?* This question became the foundation as it

guided me in every decision that was made beginning with the design of the study, data analysis process, and to the final crafted text.

The primary goal of post-intentional phenomenology is to capture tentative manifestations of the phenomenon as it is lived. Therefor this study uncovers and open-ups the tentative manifestations, which were produced through the intentional relationships between the teacher candidates, instructor/researcher and the phenomenon of cultivating equity-mindedness. Next, a description of the context in which the phenomenon, cultivating equity-mindedness, was situated.

Contexts. Since phenomena are always shifting and changing, the contexts in which they reside are varied. This study would occur within an elementary mathematics methods course yet within that space there are moments and situations in which the phenomenon can shift and change (See figure 3.1 for an illustration of the contexts). The phenomenon was produced and traveled through class discussions, peer-to-peer interactions, student-instructor interactions, and written assignments. Additionally, the phenomenon resided in a field experience, which ran concurrently with the mathematics methods course. Many instructional activities for the course were applied in the field experience classroom and school. Therefore, the phenomenon was produced in interactions with mentor teachers, elementary students, administration, and families. Next, a description of the context of the mathematics methods course is provided followed by the context of the program where the phenomenon was situated.

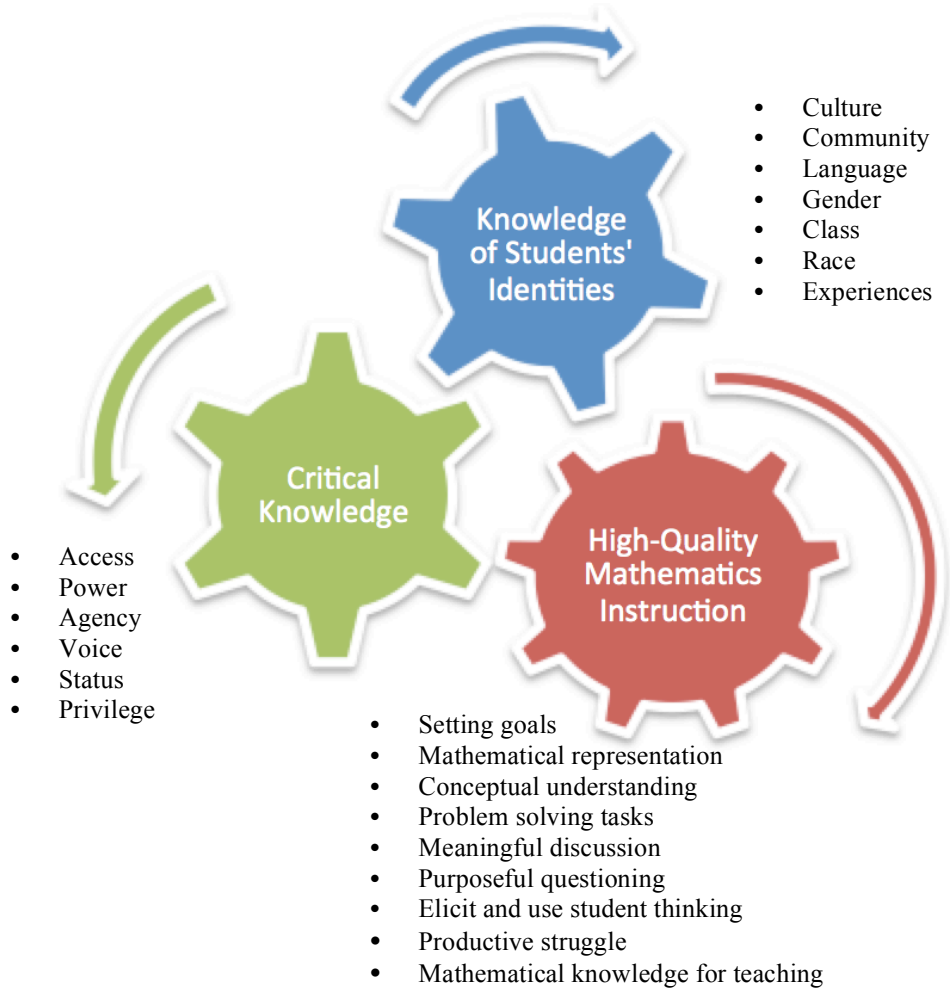

Figure 4.1. Working Conceptual Frame for Mathematics Methods Course.

Working conceptual framework for mathematics methods course. Figure 4.1, depicts my working conceptual frame for mathematics teacher preparation that simultaneously values equity and mathematics. It strongly influenced ways in which equity has been conceptualized in the mathematics education literature: access to high quality mathematics curriculum, responsiveness to students, social justice and equity as a process (see chapter 2 for a description of each conceptualizations). My framework consists of three commitments to developing knowledge bases that are critical for

teaching mathematics: *high-quality mathematics instruction, responsiveness to students' identities,* and having a *critical mindset*. These commitments are represented as gears to signify that equity is a continuing process, constantly in motion. The three commitments (gears) are not independent of one another. They need to work in conjunction with one another in order to facilitate teaching and learning mathematics for equity. Additionally, this framework is considered a "working" framework because it reflects a commitment to being responsive to the context of classroom instruction as well.

The idea is to facilitate teacher candidates learning in all three areas, as well as, develop understanding that equitable teaching and learning is an evolving process. *High-quality mathematics instruction* means supporting teacher candidates learning of effective instructional practices as outlined in the NCTM's set of eight mathematics practices. The eight practices are presented in chapter two in figure 2.1. Substantive time is spent on learning about each mathematical practice and learning how to apply them in instruction. Another critical component of *high-quality mathematics instruction* is teacher candidates' knowledge of mathematics for teaching. Mathematical knowledge for teaching (MKT) goes beyond understanding how to do the mathematics but is a specialized content knowledge that is unique to the skill of teaching (Ball et al., 2008). MKT requires the ability to unpack mathematical concepts by "making features of a particular content area visible to and learnable by students" (Ball et al., 2008, p. 400). Teacher candidates need to be able to reason through and justify why certain procedures and properties hold true, to talk about how mathematical language is used, to choose and use mathematical representations effectively, to see the connections between mathematical ideas and to

understand how they build upon one another. Additionally, MKT is foundational for teacher candidates to effectively employ the NCTM's eight mathematical practices.

The commitment to *responsiveness to students' identities* necessitates embracing the diversity of students and understanding of how their various backgrounds and experiences shape their mathematics learning. In order to support the teacher candidates understanding of developing a responsive stance, considerable time is spent on understanding the role that culture, community, language, gender, class, race, and experiences play in students' mathematics learning. Teacher candidates learn to consider students' diversity as an asset and strength in the classroom rather than a challenge that they must overcome. Furthermore, teacher candidates need to be able to see the incorporation of cultural perspectives as a necessary educational commitment. The focus is not just on understanding, but an emphasis on learning how to use such knowledge in order to help students develop intellectual skills to succeed mathematically.

Developing *critical knowledge* entails understanding that equity is ultimately about the distribution of power, in the classroom, future schooling, one's everyday life, and in a global society (Gutiérrez, 2002). The purpose is for teacher candidates to learn to examine inequities in mathematics teaching and learning by using a critical lens to uncover power relations such as agency, voice, status and privilege. Teacher candidates are asked to critically examine the explicit and implicit messages they send to students. As well as interrogate their backgrounds, beliefs and assumptions about mathematics teaching and learning that may contribute to inequities and often unwittingly perpetuate the cycle of reproduction (de Freitas & Zolkower, 2009; Leonard et al., 2009).

Additionally, having a critical knowledge includes incorporating a social justice approach, in which mathematics is used to understand and to expose sociopolitical inequities in the communities where students reside (Gutstein, 2006).

The elementary mathematics methods course outline. This working conceptual framework played in integral part in the structure of the methods course (see Appendix B for course outline). The methods course ran for ten consecutive weeks from August 27 through October 29 of 2015. It was important for students to see the gears of mathematical knowledge for teaching, knowledge of students' identities, and critical knowledge working together in each class session. Therefore, components from each of the gears knowledge of students' identities and critical knowledge each week (i.e., an explicit focus on equity) with mathematical knowledge for teaching (i.e., mainly one to two practices of the eight mathematical practices) were integrated within each class session. For each session, there was an additional focus on MKT in a particular content area (e.g., place value, computation, fraction concepts, algebraic concepts).

Most of the information on equity (i.e., knowledge of students' identities and critical knowledge) was acquired through the use of the book *The Impact of Identity in K-8 Mathematics: Rethinking Equity-Based Practices* by Julia Aguirre, Karen Mayfield-Ingram and Danny Bernard Martin and various research articles on specific equity topics such as using social justice issues in teaching mathematic. These texts were used to introduce and engage teacher candidates in critical reflection and discussion around equity matters and instructional practices. Particular attention was given to the five equity-based practices complied by Aguirre, Mayfield-Ingram and Martin. These

practices, as shown in table 4.1, served as common language for the class to discuss equity concerns and evaluation of classroom mathematics practices.

Table 4.1

Five Equity-Based Practices

1) Going deep with mathematics. Developing deep understanding of mathematics is a major goal of equity-based mathematics teaching practices (Aguirre, 2009; Gutstein, 2006). Lessons include high cognitive demand tasks that support and strengthen student development of the strands of mathematical proficiency, including conceptual understanding, procedural fluency, and problem solving and reasoning (National Research Council, 2001; Stein & Smith, 2012).
2) Leveraging multiple mathematical competencies. Recognizing and positioning students' various mathematical backgrounds and competencies is a key equity-based practice (Featherstone et al., 2011; Horn, 2012; Turner et al., 2012). All students have different mathematical strengths that can serve as resources for learning and teaching mathematics.
3) Affirming mathematics learners' identities. A positive, productive mathematics learner identity contributes to the mathematical learning of a child (Berry, 2008; Boaler, 2002; Martin, 2000, 2009; Stinson, 2008). Instruction that values multiple mathematical contributions, provides multiple entry points, and promotes student participation in various ways (teams, groups, and so on) can aid the development of a student's mathematical learning identity.
4) Challenging spaces of marginality. Traditionally, mathematics learning has been an independent and isolating experience with a focus on lecture and seatwork. Further, students who do not perform well in this traditional classroom setting are often marginalized, ignored, or positioned as "dumb" (Boaler, 2002; Jackson, 2009). Practices that embrace student competencies, diminish status, and value multiple mathematical contributions are essential to cultivate (Aguirre et al., 2012; Featherstone et al., 2011; Horn, 2012).
5) Drawing on multiple resources of knowledge. Equity-based teaching depends on the capacity to recognize and intentionally tap students' knowledge and experiences—mathematical, cultural, linguistic, peer, family, and community—as resources for mathematics teaching and learning. Drawing on this knowledge and experience includes helping students bridge everyday experiences to learn mathematics, capitalizing on linguistic resources to support mathematics learning, recognizing family or community mathematical practices to support mathematics learning, and finding ways to help students learn and use mathematics to solve authentic problems that affect their lives (Aguirre, 2009; Aguirre et al., 2012; Civil, 2007; Brenner & Moschkovich, 2002; Gutiérrez, 2002; Gutstein, 2006; Moschkovich, 1999; Simic-Mueller, Turner, & Varley, 2009; Staats, 2009; Turner et al., 2012; Turner & Strawhun, 2007).

Note. The following five equity-based teaching practices are taken from Aguirre, Mayfield-Ingram, and Martin (2013, p. 43-44).

Principles to Actions: Insuring Mathematical Success for All was the primary source for the eight mathematics teaching practices. In this landmark publication, the NCTM (20014) identifies and illustrates a core set of high-leverage practices that are essential to promote deep learning of mathematics, which are: (1) establishing mathematics goals; (2) implementing tasks that promote reasoning and problem-solving; (3) using and connecting mathematical representations; (4) facilitating meaningful

mathematical discourse; (5) posing purposeful questions; (6) building procedural fluency from conceptual understanding; (7) supporting productive struggle in learning mathematics; (8) elicit and using evidence of student thinking. These non-negotiable practices are viewed as a framework for strengthening the teaching and learning of mathematics for all students. The teacher candidates' engaged in learning the criteria of each practice, how to plan for and implement them over the ten class sessions. These eight practices were essential to lesson planning.

MKT instruction included attention to conceptual development of the content area through the study of children's progressions of learning identified in the research. The primary source for this information was from the text *Elementary and Middle School Mathematics: Teaching Developmentally* by John A. van de Walle, Karen Karp and Jennifer Bay-Williams. This text is widely used in mathematics methods courses across the country. The text synthesizes the mathematics education research on how learning progresses in children for the major content areas. In addition to the content area learning progressions, teacher candidates engaged in doing a problem-solving task similar to what they would be expected to teach in an elementary mathematics classroom. Moreover, teacher candidates examined examples of children's thinking, either in the form of student written work or video episodes that were specific to that content area. Appendix B presents a table that provides an overview of the ten sessions in the course.

In addition to the working conceptual framework for this course, I drew upon Milner's (2006) developmental typology of interactions for the ways in which I would employ the conceptual framework. Milner's typology consists of three essential and

necessary interactions that seemed to have made a profound difference in teacher candidates' curricula and pedagogical decisions in learning to teach for diversity. The interactions are: (1) cultural and racial awareness and insight, (2) critical reflection, and (3) the bridging of theory and practice. It is important to note that these interactions were based on Milner's study of preparing teacher candidates to teach in urban school. Therefore, the interactions required some modification to fit the specific needs of the surrounding rural area in which most of the field placements occurred.

The first interaction, cultural and racial awareness and insight, Milner (2006) contends that it is important to have teacher candidates recognize and think about the complexities of the political and social realities of race, socioeconomic status, and culture. Course readings, case studies and videos presenting diverse experiences and ways of thinking were specifically chosen to help teacher candidates develop awareness and insight of the impact that race and culture have on learning and schooling. Additionally Milner insists that deliberate interactions with culture and race are vital to teacher candidates learning and understanding of these complexities. During the methods course, teacher candidates spent one full day in an intermediate grade classroom were they able to interact with students from diverse races and cultures. Many assignments in the course required students to reflect upon their observations of and experiences with students from diverse races and cultures from their own.

Relatedly, Gay (2009) posits that a major part of preparing teacher candidates to be culturally responsive math educators requires spending time deconstructing the assumptions that mathematics is neutral, devoid of and divorced from the lived realities

of different racial, cultural, social and ethnic group. Teacher candidates need to recognize the explicit connection between culture and learning, and view students' cultural capital as an asset and not as a deficiency (Gay, 2008; Howard, 2010; Ladson-Billings, 2008). Considerable time was spent deconstructing such assumptions through discussion and selected readings that presented cultural and race as integral components to mathematical understanding, learning and teaching.

In the second interaction, Milner (2006) maintains that teacher candidates need to engage in critical reflection where they think deeply about themselves as racial, gendered, and cultural beings. Issues pertaining to equity, access, and social justice are typically ascribed to critical reflection. Many other scholars concur that critical reflection is imperative to improving the educational opportunities for marginalized students (Banks & McGee Banks, 2009; Dewey, 1933; Gay & Kirkland, 2003; Freire, 1970; Leonard, 2008; Schön, 1983, 1987).

In this methods course, teacher candidates' engaged in critical reflection as they read the content presented in the texts and viewed video episodes of mathematics teaching and the mathematical thinking of children by way of written reflections and class discussions. Dewey (1933) was one of the early theorists who talked about the value of reflection in education. He viewed reflection as a special form of problem solving steeped in scaffolding of experiences and events that should be viewed as an active and deliberate cognitive process. For Dewey, the purpose of critical reflection is to make meaning of one's experience that brings change into one's understanding of the self and the world (Howard, 2003). Much of Dewey's philosophical framework still guides the

thinking on reflection in education (e.g., Gay, 2012; Gore, 1987; Howard, 2003; Ladson-Billings, 1994; Schon, 1987).

Ladson-Billings (1994) argues in order for teachers to become culturally relevant, they need to engage in honest, critical reflection that challenges them to see how their positionality influences their students in either positive or negative ways. She further adds that critical reflection should include an examination of how race, culture, and social class shape students' thinking, learning, and various understandings of the world. In other words, critical reflection brings about a self-awareness by calling into question one's taken-for-granted ways of seeing, that is, one's experiences, ways of thinking, beliefs, assumptions, privileges, struggles and positions (Banks & McGee Banks, 2009). In the same way, teacher candidates need to engage in what Milner (2006) refers to as relational reflection; that is, they need to focus on themselves in relation to others (e.g., their students, their students' parents, their students' communities, and their students' ways of knowing). Therefore, much of the initial critical reflection included deconstructing conceptions about what it means to know and do mathematics and what does it mean to teach and learn mathematics. Critical reflection was essential in helping teacher candidates develop a critical mindset for teaching elementary mathematics. As, Howard (2003) contends, critical reflection is vital for preparing teachers to use cultural relevant teaching strategies.

Interaction three, bridging theory and practice consists of exposing teacher candidates to theoretical notions that help them think through their practice (Milner, 2006). The focus is for teacher candidates to develop their own theory of experience

(hooks, 1994). Milner drew from hooks (1994) theory of experience that acknowledges teacher experience as a legitimate theoretical notion and perspective that needs to be examined.

One example that illuminates hooks' (1994) theory of experience occurred in a class discussion. One female teacher candidate, in the group, shared her experience from the day before of working with a student who struggled with mathematics. The teacher candidate explained that the classroom teacher was explaining how to use bar models to solve addition and subtraction word problems. She continued explaining to the class that the use of bar models could be helpful for students to conceptualize addition and subtraction as we read in our text but the way this teacher explained this became a rote activity for the students and marginalized their thinking. Further expanding upon how even the language the classroom teacher used reduced the conceptual drawing of bar models to "first you do this", "then do this next", "and then you will always get the right answer". When the teacher candidate went to work with the struggling student, she said that she noticed the student was hung up on what to "do first" just guessing at numbers and when asked the student could not even tell her what the word problem was about. She connected this experience back to several of the course readings as she shared her observations and ended by explaining how impactful this interaction was and made what she was learning in the course more meaningful.

In this episode, the theory and research presented in the course readings was important but so was the teacher candidates' experience, which served a legitimate theoretical perspective that needed to be examined. The teacher candidates were able to

draw from the theory and bridge it with that of their practice. Each class session became a space to help teacher candidates connect conceptual learning and knowledge to practice. The sharing of experiences, stories and theories make the theory reading and practice more meaningful and relevant. Most of the bridging occurred in regards to mathematics teaching practices as described in the high-quality mathematics instruction gear of the conceptual framework. Also, examining issues from the other two gears (i.e., critical mindset and responsiveness to students' identities) in the use of or absence of the mathematics teaching practices.

Milner's developmental typography of interactions became the vehicle in which I utilized to engage teacher candidates in the conceptual framework for the methods course. It also was critical to the overall goal of this study, which was cultivating equity-mindedness with teacher candidates.

The elementary education program. The elementary mathematics methods course is part of an elementary education program at a Midwestern state liberal arts university with a student population of approximately 15,000. The elementary education program graduates approximately 50 teacher candidates per semester. The university has a strong tradition of teacher preparation, as it began as a teacher training school in the 1800s. The elementary education program consists of general education courses, core support courses, three semesters of methods courses and one semester of student teaching. Students are admitted to the program by an application process for each semester during the methods courses and student teaching. The students are organized into cohorts beginning their first semester of methods courses. Students attend a four-

week clinical field experience for each of the three semesters of methods courses followed by a full sixteen weeks of student teaching.

Participant selection. Like other types of phenomenology, the unit of analysis for post-intentional phenomenology is the phenomenon being studied, cultivating equity mindedness, and not the individual subjects in the study. The phenomenon is considered social and comprised of multiple individuals who are living and experiencing the phenomenon. So, it is essential to this study to have participants who had first-hand experience with the phenomenon so that rich description of the experience with the phenomenon can be gained. Therefore, it was necessary for the participants to be students enrolled in an elementary mathematics methods course that had an explicit focus on equity. Being an instructor of such a course, I choose to use my students as participants. Note, the students enrolled in the course are referred to as teacher candidates by the program, therefore I will continue to use this term when talking about this studies' participants.

For this study, the participants are 29 teacher candidates who are enrolled in the three-credit elementary mathematics methods course and their instructor. Initially, all 31 teacher candidates enrolled in this course were invited to participate in person on the first day of class by a professor they had in the previous semester. This was a requirement of the IRB to limit participants feeling coerced since I hold the role of course instructor and researcher. In the end, 29 of the 31 teacher candidates consented to participate. All of the teacher candidates are in their second semester of their methods courses with ages spanning between 22-25 years. The backgrounds of the teacher candidates are very much

reflective of the majority of teachers in the United States, whom are White European American middle-class monolingual women (Gay & Howard, 2000). Of the 29 teacher candidates, 24 of them were white females, 2 were black females and 3 white males. The teacher candidates self identified their genders and race in their written autobiographies. For example, one teacher candidate stated, "because I was a black girl my teachers automatically put me in the low group."

Interview selection. Twelve of the 29 teacher candidates, were selected to be interviewed individually based on maximum variation, purposive sampling. In general, the overall goal of purposive sampling is to select cases that would yield information rich data that would best serve to reveal how the phenomenon was experienced. However, the aim of maximum variation sampling is to maximize diversity in a small sample. This strategy is used to capture and describe the common themes that emerge across a range of variation and document the unique and diverse variations that have emerged (Patton, 2002, pp. 234-5). I developed a set of questions to guide my selection of the sample to be interviewed. These questions focused my attention on the phenomenon of cultivating equity-mindedness (see Appendix C for the list of questions utilized) that appeared in some key course assignments. I specifically chose to screen the teacher candidates written autobiography of their mathematics learning and written reflections because these assignments best illuminated the thought processes and experiences of the teacher candidates (data sources will further be explained in the next section). The 12 teacher candidates that were chosen displayed a wide range of equity-mindedness in their written work. For example, students that I considered as beginning in their understanding of

equity would write about students (i.e., meaning students in elementary classrooms) from a deficit lens and ignore their privilege. To illustrate, teacher candidates would write about things such as how students coming from single parent homes struggle with mathematics. I included a couple of students who wrote about mathematics teaching from a teacher-centered perspective. Also for beginning understanding, I made sure to interview a few students who indicated that they did not know what equity meant. One student in particular who I interview stated that though equity was related to money as in home equity. What I considered intermediate understanding, were teacher candidates who thought equity meant equality. These candidates often wrote about how all students should receive the same instruction. Additionally, they would speak about equity but in superficial ways such as, "It is important to provide all students access to math", however these teacher candidates never expanded upon what that entails. On the other side of the spectrum, what I would consider advanced in their understandings of equity were teacher candidates who readily attacked their assumptions and recognized their deficit lens towards students. These teacher candidates often looked at students as individuals and realized that teaching should be student-centered. Also, they used detail examples that showed they understood what was involved in equitable mathematics teaching.

Moreover, I included in the sample teacher candidates that varied in gender and race to maximize variation. It should be noted that this variation is limited to only one male and one black female student, as the population of students in the course is heavily comprised of white female. The other two teacher candidates who are not white females declined to be interviewed.

After transcribing the interview data, I used the same questions, as shown in Appendix C, to further narrow the sample size to four teacher candidates that displayed maximum variation in levels of equity-mindedness. The reason for this smaller sample size was to enable an in-depth look across all of the sources of data and to look at the phenomenon after the teacher candidates completed a four-week field experience of teaching mathematics in an intermediate classroom.

My roles: Instructor and researcher. In addition to serving as primary and sole investigator for this study, I was also the primary and sole instructor of the elementary mathematics methods course in which this research was situated. I hold the positions of assistant professor, chair of the elementary education department and doctoral candidate at another institution. Moreover, I, too, am reflective of the majority of teachers being a White European American middle-class monolingual woman.

In my role of course instructor, I was responsible for all the pedagogical and instructional designs and decisions. This is my eighth semester teaching this course and for six of the eight semesters I've committed to infusing matters of equity into the course. Additionally, I was responsible for evaluating progress of the teacher candidates and grade all course assignments. In my role as researcher, I had methodological, philosophical and ethical responsibilities.

As course instructor, I mainly positioned myself as a facilitator who guides students in their process of inquiry rather than engaging students in what Freire (1970) calls the 'banking conception' of education. From this perspective, the teacher acts as depositor and views students as depositories that need to be filled with information.

A typical class session would include teacher candidates engaging in discussion, critical reflection, and inquiry with the information they read prior to that session. As course instructor, I did not present information to the teacher candidates rather I would summarize information that the teacher candidates generated or discussed. When I shared with the teacher candidates, it was typically in the form of a narrative account of a teaching experience or interaction with students while learning mathematics.

Holding the dual role of course instructor and researcher became challenging at times. It was during the third week of the course I realized that I would need to try to separate the two roles, while I know such separation is not fully possible. Instead, I made the decision to focus my attention on being course instructor during the ten sessions. I needed to fully immerse myself in assisting teacher candidates in their understanding and growth of the course content and assignments. On average, I found myself spending 20 plus hours each week giving feedback on course assignments. It became evident that I could not analyze the data sources for the phenomenon equity-mindedness in addition to leaving extensive feedback on assignments, assessing understanding from those assignments, reflecting on the previous class session, and planning for the upcoming session. However, I would note statements teacher candidates made in their assignments that indicated equity-mindedness with plans to return to when engaging in analysis. It was not until the last week of instruction that I looked at the teacher candidates written work more analytic so that I could determine the sample of teacher candidates to be interviewed in-depth regarding their lived experience with the phenomenon of cultivating equity-mindedness.

There was one particular time where I experienced tension between my role as course instructor and researcher. It was after assessing the teacher candidates' assignments from session six that I realized I needed to make a change to my course calendar. It was evident that the teacher candidates were confused about how to construct a problem-solving lesson, which is paramount to the goals and purposes of this course. I was greatly torn between making sure I had followed the exact data sources (course assignments) I laid out in my proposal and being responsive to the needs of the teacher candidates. I realized that I needed to be a model of what the teacher candidates were learning in the course in regards to equity. It would have been hypocritical of me to ignore their needs and not respond. In the end, I chose to present my assessment of the problem-solving lesson plans to the class and ask them to voice their needs and desires. We spent time in small groups reflecting on this and together we created an outline of those last three sessions.

Component Two: Devise a clear, yet flexible process for gathering data appropriate for the phenomenon under investigation.

The second component of the research process is to develop a clear, deliberate, yet flexible plan for determining data sources and collection methods that are appropriate for the phenomenon under investigation (Vagle, 2014). In post-intentional phenomenology, the focus of the study is the phenomenon and the overall goal is communicating how it takes shape. Hence, it is the participants' intentional relationship with the phenomenon that is examined. It is not the individual participants or the objects of their experience that are under investigation. For this study, the goal is to explore how

cultivating equity-mindedness for teaching elementary mathematics takes shape. Therefore, the data sources gathered need to be spaces where the intentional relationship manifests (i.e., the relationship with equity-mindedness).

Traditionally, interviews have been used exclusively as the sole method of data collection in phenomenological methodological approaches, particularly with descriptive phenomenological methods (Giorgi, 1997; Moustakas, 1994; Sokolowski, 2000). Interviews are regarded as the most appropriate source of data because they allow researchers direct access to explore an individual's lived experience in-depth.

However, some scholars argue that the researcher needs to remain open to data gathering placing priority on meaning and determining methods that are most helpful and insightful for studying and understanding of the phenomenon (Dahlberg et al., 2008; Vagle, 2014; van Manen, 1990). Dahlberg and colleagues (2008) contend, "data gathering is an activity in which researchers seek descriptions, utterances, characterizations, narrations, depictions, and other possible expressions of the studied phenomenon" (p.172). Likewise, Vagle (2014) insists that multiple sources of data can be gathered that help to open up the phenomenon and contribute to understanding it.

Data sources. The sources of data utilized in this study are indicated in Table 4.2. Each data source aligns with the secondary research questions. Secondary research questions were constructed to help to focus the data gathering towards the primary phenomenological research question (Vagle, 2014). Most of the course assignments (i.e., data sources) required an integration of the areas in the conceptual framework. That is why I chose gears to represent the areas of focus in conceptual framework for the course

as they move together in teaching elementary mathematics (see figure 3.2 for my working conceptual framework). It is important to note that while conducting data analysis, I focused my attention on the primary research question (stated at the beginning of this chapter) to identify the tentative manifestations of the phenomenon (this process will be described in detail in component four). In the next several paragraphs, I will describe the sources of data gathered and explain how they are appropriate for understanding the phenomenon of cultivating equity-mindedness.

Table 4.2

Alignment of Secondary Research Questions and Data Sources

Secondary Research Questions	Data Sources
1. In what ways, if any, do teacher candidates demonstrate understanding of and commitments to utilizing high-leverage mathematical practices?	• Participants mathematics learning autobiography • Participants written reflections • Participants diagnostic interview written assignment • Participants problem-solving lesson with analysis written assignment • Transcripts from audio-recorded individual interviews conducted with participants in person • Instructor's reflection journal • Instructor's feedback comments on assignments
2. In what ways, if any, do teacher candidates demonstrate understanding of utilizing knowledge of students' identities for the teaching and learning of elementary mathematics?	• Participants mathematics learning autobiography • Participants written reflections • Participants diagnostic interview written assignment • Participants analysis of teaching assignment • Participants problem-solving lesson with analysis written assignment • Transcripts from audio-recorded individual interviews conducted with participants in person • Instructor's reflection journal • Instructor's feedback comments on assignments
3. In what ways, if any, do teacher candidates demonstrate critical understanding of the teaching and learning elementary mathematics?	• Participants mathematics learning autobiography • Participants written reflections • Participants diagnostic interview written assignment • Participants analysis of teaching assignment • Participants problem-solving lesson with analysis written assignment • Transcripts from audio-recorded individual interviews conducted with participants in person • Instructor's reflection journal • Instructor's feedback comments on assignments

Teacher candidates' data sources. The mathematics learning autobiography was used as a data source to capture the participants' pre-understandings of cultivating equity-

mindedness. For this assignment, teacher candidates reflected upon the issues and factors that influenced their mathematics learning. In their autobiographies, they described specific experiences that affected their mathematics learning. The autobiographies revealed the teacher candidates' backgrounds, experiences, assumptions, and perceptions about teaching and learning of mathematics. This information was helpful to identify some initial understandings of their thinking on high-quality mathematics instruction, being responsive to students' identities, and critical understandings since the teacher candidates wrote this before they started the course content.

Teacher candidate wrote reflections for seven of the ten sessions. Each reflection asked the teacher candidates to critically reflection on a specific area. For example, one-week teacher candidates were asked to compare their understandings and experiences with equity to various authors' conceptions from their readings. This reflection would mostly address the third secondary research question, critical mindset. Additionally, the reflection might contain some of question two, responsiveness to students' identities depending on how the teacher candidates responded. Appendix B lists the areas of focus for the reflections. Through these written reflections, teacher candidates reflected upon their experiences with the phenomenon and their understandings of it as well. Their recorded understandings, grappling's or sense making especially illuminate the 'cultivating' part of the phenomenon in cultivating equity-mindedness. For example, one female teacher candidate wrote about how she always thought of talking about someone's "race as taboo" and that if she believes in teaching the whole child that must include race.

Her writing shows a grappling to understand the impact of race on the teaching and learning of mathematics.

These written reflections captured aspects of the lived experience of cultivating equity-mindedness in a written narrative form. Interpretative phenomenologist, Max van Manen (1990), introduced the written lived experience descriptions, which he refers to them as 'protocol writing', as a source of data. According to van Manen, "writing mediates reflection and action…it is to measure our thoughtfulness…writing exercised the ability to see…to write is to show something" (pp.124-132).

The diagnostic interview was an assignment in which integrated all three areas that the secondary research questions address. For this assignment, teacher candidates were asked to create a worthwhile mathematical task (high-quality mathematics instruction) and have with a child, from their weekly field experience classroom, solve the task. The goal of this assignment was for the teacher candidates to examine in-depth the child's thinking. Then they wrote up a report in which they described their child's thinking, determine the child's conceptual understanding, and describe how you would respond to this child (e.g., next steps). This assignment revealed the teacher candidates understanding mainly of secondary research question one (high-quality mathematics instruction). However, the other two secondary research questions may appear depending upon what the teacher candidates write. To illustrate, several of the teacher candidates wrote about their child from a deficit viewpoint, which is secondary research question number three, critical mindset. Therefore, a return to the primary phenomenological research question would be used for analysis.

The problem-solving lesson was the cumulating assignment for the course where the teacher candidates needed to demonstrate competency in planning a problem-solving lesson. In addition, the teacher candidates were required to justify their plans and specifically describe how the five equity-based practices were addressed in their lesson. Thus, the problem solving reveals the teacher candidates' abilities and conceptions of all three secondary research questions.

The analysis of teaching assignment addressed secondary research question two, responsiveness to students' identities, and question three, critical mindset. For this assignment, teacher candidates analyzed a video of a teacher teaching a lesson in mathematics for examples of power, status, privilege, marginalization, agency, voice, and utilizing the children's backgrounds. This data source reveals what the teacher candidates recognize and fail to recognize regarding the two secondary research questions.

Teacher candidates' interviews. Phenomenologists often utilize unstructured, in-depth interviews to capture the lived experience of the participants experiencing the phenomenon (Dahlberg, et al., 2008). The unstructured interview is more dialogic and conversational (Patton, 2000). For phenomenologists, the goal of the interview is to uncover as much as you can about the phenomenon from each participant. Therefore, I utilized the unstructured interview for the 12 participants from my purposive sampling with the goal of facilitating articulation of the lived-quality of the phenomenon from each participant.

As stated in the context section of this chapter, the 12 teacher candidates were chosen using maximum variation purposive sampling. The 12 teacher candidates

displayed a wide range of equity-mindedness in their written work (as explained in the interview selection section). A breakdown of the teacher candidates' race and gender are as follows: 10 white females, 1 black female, and 1 white male (self-identified race and gender in their autobiographies).

The 12 interviews were conducted at the conclusion of the ten-week methods course over the span of one week. They were conducted after the course so that teacher candidates could reflect upon their lived experience with the phenomenon. The interviews took place in my office and lasted anywhere from 20 minutes to 90 minutes depending on the teacher candidates. Additionally, they were audiotaped and subsequently transcribed.

I carefully crafted interview questions (see Appendix C) to guide the teacher candidates through the interviews. van Manen (1990) warns researchers about having clarity of the phenomenon before interviewing. Therefore, the process of creating these questions helped give clarity of the phenomenon. It is important to note that I did not follow my interview guide with rigidity rather I used it more like a question bank. I focused on being responsive to each participant and asked s/he questions that seemed appropriate during each interview to open up and get a clear understanding of the phenomenon. As Vagle (2014) claims, it is not important to conduct each interview the same rather they should be treated as potential opportunities to learn something important about the phenomenon.

All of the teacher candidates appeared to be at ease and openly shared during the interview. As their instructor, I had formed a relationship with them over the last 10 week

so I infer that they must have felt confortable with me. Only two of the teacher candidates' responses were concise with little expansion, even when asked follow-up questions. An interesting event occurred in some of the interviews. Some of the interviewees asked to use our course texts that I happened to have laying out on my desk. The common response was that we did so much in the course that the content tended to blur. I happily obliged and even offered others to view the course texts if they would like to. During each interview I jotted down words and short phrases so that I could be responsive to the teacher candidates and listen for opportunities to uncover and understand the phenomenon. Also, I noted places were the phenomenon was becoming evident to make sure to follow up with when analyzing the transcription.

After the conclusion of teacher candidates' four-week field experience of teaching mathematics at the intermediate level in an elementary school, I conducted four post-field interviews. I initial chose to do five post interviews based on my conversation with Mark, my co-advisor. Due to the large amount of data I gathered, Mark suggested focusing on a smaller number. Initially, I asked more than five but only four white females responded to the invitation for the post interview. While I did not get racial and cultural diversity within the four, I was able to get maximum variation using the interrogation questions described in the context section of this chapter. These interviews lasted between the same 20-90 minutes and I jotted notes like I explained with the 12 teacher candidates' interviews. I carefully created a new set of questions (see Appendix D), which again helped me clarify the phenomenon. Each of the four teacher candidates was at ease and talked openly. Interestingly, there was one teacher candidate who opened her spiral

notebook to a blank page when we started. She used this notebook to jot down words before answering her questions and one time she even drew in example of a mathematics problem. During he response to the last question, "What was your biggest challenge?" She asked if she could have a moment to gather her thoughts. Then she proceeded to make a list of words. After about a minute she shared her very insightful thinking. A summary of the research participants' activities is provided in Table 4.3.

Table 4.3
Summary of Participants' Activities

Participants	Activity
28 teacher candidates	Participated in the course
12 teacher candidates	Purposively selected from the 28 for unstructured interviews
4 teacher candidates	Purposively selected from the 12 for post-field experience unstructured interviews

Instructor data sources. Thus far all the data sources described have been that of the participants (i.e., the teacher candidates). In this study the instructor, which is myself, is also a participant. There were two data sources that I used to help open up the phenomenon of cultivating equity-mindedness. First, I kept a reflection journal in which I spent time after each class session reflecting on my observations and thoughts. Furthermore, I wrote reflections over my thoughts, frustrations, excitements, etc. after grading some of the course assignments. Similarly to the teacher candidates' reflections, these reflections revealed my engagement with the phenomenon. The second data source I used was the instructor feedback comments written on the course assignments used as data sources in this study. My feedback comments were specific for helping the teacher

candidates' grow in their understanding of equity-mindedness. Therefore, they reveal my 'cultivating' of equity-mindedness with each teacher candidates.

Component Three: Make a Post-Reflexion Plan

According to Husserl (1998) the phenomenological method works entirely in the acts of reflection. When using a post-intentional approach it is important for researchers to understand themselves and be aware of their pre-understandings. Vagle (2014) contends that as human beings, we are always tied to our past and cannot escape that fact. However, it is important for researchers to make sense of what frames their perspectives (Lather, 1993). Post-reflexion is a form of researcher reflexivity in that the researcher examines her/his thoughts and perceptions. It is a way for researchers to be accountable throughout the research process. Linda Finlay (2008) claims that reflexivity can be powerful and makes the researcher sensitive to their assumptions and pre-understandings.

Vagle (2014) suggests four strategies for helping the researcher in practicing reflexivity. These strategies help the researcher document and interrogate her/his preconceptions and help develop new understandings of the phenomenon. The four strategies include recording:

1. Moments when we instinctively connect with what we observe and moments in which we instinctively disconnect.
2. Our assumptions of normality.
3. Our bottom lines-our beliefs, perceptions, perspectives, opinions that we refuse to shed.
4. Moments in which we are shocked by what we observe.

I utilized some Vagle's (2014) recommended practices (i.e., keeping a post-reflexion journal and creating an initial post-reflexivity statement) for engaging in post-reflexion through engaging in post-reflexive journaling and constructing an initial post-reflexion statement. I engaged in post-reflexive journaling in which I drew on Vagle's four strategies in two stages: (1) while I was teaching the course, and (2) while I was analyzing and crafting my text that captures the tentative manifestations.

Post-reflexive journaling. During the first stage, while I was actively engaged in work as an instructor, that is, planning for class sessions, teaching the course and giving feedback on course assignments. I made it a point to be reflexive during this time and capture it in journal after each class session for duration of the course. Appendix E shows an example of post-reflexive journal entry after a class session. In this particular reflection, I noted my personal reactions and things that surprised me during that class session. This post-reflexion journal during my focus on instructing helped frame my thinking when I moved into the data analysis process. For example, in journal entry located in Appendix E, I expressed my surprise about an assumption a teacher candidate made about a student's parents not valuing education. This act of stating my feelings helped me to see that I cannot make assumptions as well and the teacher candidates are just in the process of becoming equity-minded. Furthermore, by identifying this through post-reflexion, I looked for "making assumptions" as I analyzed the data to help identify equity-mindedness.

The second stage of post-reflexion occurred during data analysis and text construction. During this time, I continued to read through the data and write about it is a

responsive manner. I kept a post-reflective journal in the form of a word document and consistently post-reflexed after each data analysis session. Figure 4.2 displays an example of a standard entry from my post-reflexion journal.

2-18-16

I just finished a close read of Camryn's post-field experience interview and I cannot help be impressed with her level of understanding and thinking about equity issues. I don't know what caused Camryn's to latch onto the idea that mathematics wasn't personal and students needed to see themselves in the math. She sees it much deeper than merely created a relevant context for a story problem or putting students' names in story problems. In the interview, while she did create a familiar/interesting context for a graphing activity, her purposes for the students to learn something new about themselves and their environment. In her pre-field interview, she referred to this as a conviction, which I believe, led to deeper levels of implementation. When she planned lessons she claims that thought was always there-how are they going to learn something new about themselves or about their world in this lesson. She also states that she just hangs on this idea that math is a way to understand the world around you and that is always in her brain.

What sets Camryn's thinking apart from the others is that others see equity as knowing students and then acting by modifying instruction to meet the students' needs or creating a task that interest students or letting them solve a problem in multiple ways. However, Camryn's thinking is about providing opportunities for the students to "see themselves in the math". You can tell by her choice of words when discussing the importance of taking up social justice in math class, "I was convicted by the social justice articles …to build them (students) as people is just amazing to me." Who says, "Convicted"? Wow, just even that choice of word conveys so much passion and implies deep thinking. I'm really fascinated by Camryn's thinking, I want to dive into it deeper but at the same time I know that this is not a case study and I cannot privilege her voice over the others as her experience only reflects part of the manifestations.

I'm beginning to see a difference in the "levels" of equity-mindedness within the teacher candidates. Is that moving away from Post-Intentional? I think if I level teacher candidates' equity-mindedness then I think I maybe "stabilizing" knowledge and this would be working against post-structural commitments. These commitments are central to the methodology so I guess I just answered my question.

I'm starting to see an initial tentative manifestation take shape that has to do with the various forms of engagement of teacher candidates and greater depth of equity-mindedness. Ah…maybe that is what I call it "various forms of engagement" instead of "leveling" their displays of equity-mindedness. Maybe I just show the multiplicity or the different forms it can take because it is not my intent to position levels of equity-mindedness as if to create a hierarchy or form levels of ability. Meaning, I do not want to create a divide and cause others to form a deficit view about certain levels. That is not the purpose of my work nor would that be beneficial because as a profession "we" are trying to help promote other to think deeply about equity issues and if one feels they are on the "low" end of the spectrum of thinking about equity then that just might created the very structures that this research is trying to deconstruct.

Figure 4.2. Post-Reflexion Journal Entry.

A closer look at this journal entry will show how I used this process to ensure that the interpretations made during data analysis were in keeping with integrity of post-intentional phenomenological methodology. Through the post-reflexion process, I interrogated my feelings about what I was initially seeing in the data. In the entry, shown

in figure 4.2, I reflect upon my reading of a teacher candidate's interview by sharing my awe-struck feelings about her level of understanding and thinking about equity matters. Initially, I was viewing equity-mindedness almost in terms of "ability-levels" and it was through the act of post-reflexive writing that I was able to see what was framing my thinking, which was the instinct to put people on a continuum. As Vagle (2014) states, "The post-reflexive text also presses us to question our understandings" (p.132). Through this process, I questioned my thinking about "levels" and as a result it forced me to think about the idea of "levels" through the philosophical ideas that underpin post-intentional phenomenology. Thus, I came to realize that I was beginning to stabilize knowledge, which works against a post-structural commitment of "seeing knowledge as partial, situated, endlessly deferred, and circulating through relations" (Vagle, 2014, p.111). Ultimately, I came to realize that I might be creating inequities with this move to "level" equity-mindedness.

In efforts to destabilize my thinking about "levels" and think about it more post-structurally, I settled on the idea of thinking about it as "various forms of engagement". This was an initial attempt at identifying a tentative manifestation as it eventually was produced in the form of "metacognitive awareness". Thus, the process of post-reflexion writing helped to reveal and illuminate the intentional meanings associated with the teacher candidates' experiences of cultivating equity-mindedness as this phenomenon was tentatively manifested in shifting and changing ways.

Initial post-reflexion statement. Heeding Vagle's (2014) advice, at the beginning of this study I crafted an initial post-reflexion statement that describes my role in the

research, my initial assumptions, beliefs, and perspectives about the phenomenon. Moreover, I included my experiences with the phenomenon, as they are one of the reasons I began this inquiry. This initial post-reflexion statement provided me a way to keep my own assumptions and biases in check by acknowledging them and the impact they have on my study. While this initial statement occurred at the beginning of this study it was simply the first step of the continuing process of post-reflexing that occurs throughout the research study. Furthermore, I think important for readers of this study to know what frames the researcher's thinking as an effort towards being transparent with those who read this dissertation.

My initial statement. I found that my own experiences of being a teacher of minority students and professor of teacher candidates had a profound impact on me as a researcher. I have developed this brief statement to provide background for my perspective as a research, to examine potential limitations for this study, and address my own biases and assumptions as they relate to my research.

I am, as Gay & Howard report, like the majority of teachers in America, White female of European ethnicity. I am married with three young adult children. I grew up in a predominantly White middle-class community in the Chicago area. Being from the privileged culture, I have never experienced racism. It was not until I taught elementary school children from diverse races and cultures, in a small rural town in Oklahoma, that I even considered the influences of race, culture, and social class had on teaching and learning. The diverse context of my classroom forced me to examine my assumptions about teaching, learning and schooling. I was very fortunate to have relevant, high-

quality professional development at the school and district level that provided the knowledge and support needed for working with Native American, Latino, and poverty-class children and their families. I spent nine years working in schools with high-poverty and high-populations of minorities.

Immediately upon entry into teaching, I was face with the challenge of raising achievement of students struggling with learning mathematics. Being a fifth grade teacher, for six of the nine years, I was continually under scrutiny to raise mathematics test scores. During my first year of teaching it became evident that the traditional or dominant methods for teaching mathematics (i.e., the teacher models the steps a procedure and students copy) were unsuccessful in increasing achievement and developing mathematical understanding. The following summer after my first year of teaching, I attended a two week training from TERC for *Investigations in Number, Data, and Space*® (a NSF funded reform-based elementary mathematics curriculum) and learned about how to teach mathematics for conceptual understanding using a problem solving approach. This training revolutionized my teaching of mathematics and student learning. Resulting in a life-long pursue to improve the teaching and learning of elementary mathematics.

Presently, I am teaching preservice elementary education students mathematics methods course in teacher preparation program at state university in south-central Minnesota. Ninety percent of my students are White females and fall into the description that Gay & Howard (2002) provide. I supervise these same students in a four-week field experience. Therefore, I was able to observe my students implement the pedagogy

learned in their mathematics method course with elementary students in a classroom setting. I feel it is my responsibility to help prepare teacher candidates to teach diverse students. Over the last three years, I have witnessed the countless struggles of my teacher candidates to provide equitable instruction in mathematics to students of different races, cultures and social classes. Interestingly, in classroom discussions and written reflections my students appear to have an awareness of equity issues but the beliefs and dispositions conveyed in the classroom fail to carried over into teacher practice within the classroom.

This failure to provide equitable instruction within the teaching of elementary mathematics by my teacher candidates has prompted me to investigate ways to help teacher candidates' bridge their learning and awareness of equity issues and actual practice of teaching and learning mathematics. In order to create such a bridge requires an understanding of the experiences of teacher candidates 'as they are learning to become teachers of elementary mathematics. Therefore, pursuing rich descriptions of the teacher candidates' lived-experiences will allow me to trouble what we think we know about cultivating an equity mindset for the teaching and learning of elementary mathematics.

Based on my experiences, it is important for my readers to know that I privilege a problem-solving or inquiry-based approach to teaching mathematics where conceptual understanding is at the foundation. I believe that children are capable of thinking mathematically without adults telling them how to do so. Hence, mathematics instruction should be centered on digging-in to students' thinking. Examining and listening to student thinking should be a top priority for teachers. This comes with knowing how to ask productive questions to assist children in thinking mathematically. However, this

requires teachers to have a strong understanding of the mathematics content they will teach in order to recognize what students are doing and attempting to do mathematically and know how to build mathematics instruction from there. I also privilege discussion in some form or fashion. Children must have opportunities to talk about their mathematical learning and understandings. Therefore, teachers need to be able to facilitate rich mathematical discussions that have a strong focus on understanding mathematical concepts and ideas.

Component Four: Read and Write Your Way through Your Data in a Systematic, Responsive Manner

Consideration of the data as a whole and as individual parts was an ongoing process for post-intentional phenomenological data analysis. As Vagle (2014) states, all phenomenological research approaches embrace the whole-part-whole analysis method in some form. When interpreting, or making meaning of something, it is necessary to think about individual meanings in relation to the broader context (i.e., the whole). This provides a holistic meaning of the text. Individual moments cannot be interpreted without consideration of the broader context in which they are situated. However, once parts are deconstructed into units of meanings and put then together with other parts, a new analytic whole begins to take shape. These new wholes have particular meanings in relations to the phenomenon (Vagle, 2014). It is important to remember that the end task of data analysis is to craft a text that describes, interprets, and represents the ways in which the phenomenon manifested during the investigation. “As phenomenologists, we are actively engaged in crafting something, and as we engage in craftwork, we need to

resist the urge to follow a recipe and, instead embrace the open searching, tinkering, and reshaping that this important work requires" (p.104).

Vagle (2014) has developed a six-step process for data analysis, which reflects the explanation of the whole-part-whole process presented in the proceeding paragraph.

1. Holistic reading of the entire text.
2. First line-by-line reading with careful note taking and markings of initial units of meanings.
3. Follow-up questions for participants.
4. Second line-by line reading to articulate meanings.
5. Third line-by-line reading to articulate analytic thoughts about each part.
6. Subsequent readings that read across individual participant data looking for tentative manifestations (i.e., themes or patterns of patterns of meanings).

This whole-part-whole process, as Vagle describes, became more of an iterative cycle as I moved back and forth from whole to parts to whole, not rigidly adhering to each and every step, rather embracing the whole-part-whole process in the broader sense.

This process was used throughout this study as a means to produce tentative manifestations. Next, I will describe my whole-part-whole process used in this study. First, I would read through the piece of data to get the gist or the broad idea. My goal was to get a holistic sense equity-mindedness that was occurring within each teacher candidate. I jotted main ideas down and then summarized to get a sense of the way the manifestations might be taking shape. At this point, I recognized some broader ideas start to take shape. For example, when looking across multiple data sets, such as, a social

justice perspective, the idea of differentiation to stand for equity, and the idea of meeting the needs of all students. I made note of these potential tentative manifestations in my post-reflexion journal (see figure 4.3).

> After reading 5 interviews: Camryn, Julia, Olivia, Jenna and Piper. I'm noticing 3 initial units of meaning being produced. (1) Negotiation of Power (or Balance of Power or Power tensions) among the classroom teacher and teacher candidate, the textbook, tradition, and status of mathematics in society and schools; (2) Fear or concern of not knowing students well enough to design math instruction for field placements; and (3) Applications (or misapplications) of the term equity.

Figure 4.3. Early Entry in Post-Flexion Journal.

Next, I went back into each individual's data set and read it again this time highlighting (in different colors to identify the patterns I was seeing) and making notes of specific words and phrases that addressed the early broader topics and secondary research questions (see figure 4.1) that were constructed based on the literature. I focused my attention on how the term equity was used by teacher candidates and what they said or wrote about mathematical practices, knowing students' identities, and issues of power privilege and agency (i.e., a critical mindset). At this point, I recognized new analytic wholes beginning to take shape within those areas. For example, I started noticing when teacher candidates talked about effective mathematical practices they talked about them in ways that embraced multiplicity (i.e., multiple entry points to a problem, multiple solution strategies, and allowing for voices to be heard during discussions).

Then, I read across the individual data sets to determine if these early or initial tentative manifestations were appearing within other individual pieces of data. This process led me to construct some initial tentative manifestations (new wholes). Table 4.4 reflects this process. On the left side of the table were actual phrases lifted from the data and on the right side of the table are the initial tentative manifestations.

Table 4.4
Connection Between Quotations and Initial Tentative Manifestations for Discourses of Equity

Representative Quotes	Initial Tentative Manifestations
○ Equity can be added into any lesson ○ Also remember pieces of equity and put it in my teaching ○ I find it really disappointing that even students as young as ones in elementary school feel as if they are not given equity ○ Have equity in the room ○ To meet that equity	Equity is being used as a possession
○ Equity is able to reach the students with mathematical problems ○ Equity is more than teaching students at the level they are at but personalizing it ○ Equity is what makes a classroom run smoothly	Equity is like a person who acts
○ I wanted to teach a lesson that could be equitable ○ Equipped to teach an equitable classroom	Equity as an adjective
○ Equity should be implemented in the math classroom ○ Do equity ○ I want to use equity and bring in each students' culture into the classroom	Equity as doing something

I returned back to the data, this time with the purpose of checking to see if the initial tentative manifestations started to connect in any way. Some of those initial tentative manifestations began to connect together to form as broader or more significant tentative manifestations that encompassed a few of the initial tentative manifestations. For example, look at the tentative manifestations of significance, *discourses of equity*,

located on the right-hand side of the table. Compare this tentative manifestation of significance, *discourses of equity,* to table 4.4. Notice how the initial tentative manifestations came together in a more significant or broader way (as indicated by the right-hand side of table 4.5). This became an iterative process of collapsing initial tentative manifestations (former wholes now became parts) together to into tentative manifestations that have deeper significance (new wholes) as I continued to read and reread my way through multiple data sources.

Table 4.5

Connections Between the Initial and Significant Tentative Manifestations

Initial Tentative Manifestations	Tentative Manifestations of Significance
▪ Vulnerability ▪ Awareness of self ▪ Awareness of others ▪ Challenging notions ▪ Proceduralizing equity practices ▪ Distancing oneself	**Metacognitive Awareness** *Equity-mindedness exhibited a metacognitive awareness that enabled critical self-reflection and knowledge*
▪ Struggles with the textbook ▪ Struggles with structure ▪ Struggles with positionality ▪ Struggles with language use ▪ Struggles with student concerns	**Inherent Tensions: Struggles with Power** *There are power tensions between discourses of the learned in the methods course and the discourses operating in the institutional environment*
▪ Concerns over limited knowledge of students ▪ Understanding students' identities ▪ Seeing the particularities of students	**Knowledge of Students** *Equity requires a deep understanding of students and the communities they reside in that moves beyond demographical information and commonalities*
▪ Multiple entry points tasks ▪ Multiple solution strategies ▪ Multiple representations ▪ Multiple voices	**Multiplicity in Practice** *Equity requires embracing practices that gives students' agency over their mathematics learning by allowing for a multiplicity of voices*
▪ Equity is something you do ▪ Equity is a possession ▪ Equity is an agent ▪ Equity is a metaphor	**Discourses of Equity** *The language used to describe equity contributed to the production of equity-mindedness*

During the whole-part-whole iterative cycle, I would continue to post-reflex about the data analysis process. Post-reflexion truly become what Vagle (2014) emphasizes in his text, as writing your way through the data in an analytical and responsive manner by chasing the lines of flight. When an initial tentative manifestation would start to form, I

would engage in post-reflexive writing. It was through the post-reflexion process that the tentative manifestations of significance were produced. Figure 4.4 shows an example of a post-reflexion entry that lead to a tentative manifestation of significance. In this entry, I make connections between how teacher candidates viewed two mathematical practices through the lens of equity. They noticed that practices of using "worthwhile" mathematical tasks and having whole class discussions allowed for multiplicity in students' ways of thinking and seeing mathematics and connected those practices to equity.

My teacher candidates really latched onto two high-leverage practices in P2A: the worthwhile mathematical task and discussions. They repeatedly make comments throughout their reflections and lesson plans where this type of mathematical task allows for access the math by valuing individual thinking and that students will approach a task in multiple ways based on their prior knowledge, experiences and background. They continue to repeat the phrases "multiple entry points," "multiple pathways," and "multiple ways of knowing". Teacher candidates are seeing that tasks that allow for "multiplicities" are a way to work towards equity in math class.

For discussions, again the teacher candidates see this practices as providing students' voice and shared power of the mathematical ideas that are taken up in the classroom...So throughout their work they make statements on how this practice facilitates equity by allowing for "multiple voices" and the sharing of "multiple ways of knowing" I have lots of data statements to support this. This is really interesting to me as I'm not teaching students from a post-structural lens that privileges multiplicity but as I weave together their comments it's as if they are seeing that mathematical knowledge is not stable, you know that one answer or the teachers strategy.

Figure 4.4. Post-Reflexion Journal Entry.

As described in this section, the whole-part-whole process used to capture the tentative manifestations of cultivating equity-mindedness. Through this analytic approach to data analysis five tentative manifestations of significance were produced as indicated in Table 4.3. The next section explains the process of crafting a text that captured the five tentative manifestations of cultivating equity-mindedness.

Component Five: Craft a Text that Captures Tentative Manifestations of the Phenomenon in its Multiple, Partial, and Varied Contexts

The fifth component of the research process is to "transform lived experience into a textual expression" (van Manen, 2001, p.36) that captures the tentative manifestations of cultivating equity-mindedness. This section explains the processes used to transform teacher candidates lived experiences to a textual expression that reflects the image of the identified tentative manifestations. Chapter five of this dissertation contains the crafted textual expression.

Keeping in line with this concept of a textual expression, I strategically chose quotes and excerpts from the data sources that showcased how the phenomenon manifested for teacher candidates throughout the course and I chose "voices" of the teacher candidates that illuminated and represented the tentative manifestations. In beginning the process of crafting a text that captures cultivating equity-mindedness, I started the writing process by taking excerpts from the data that reflected the initial tentative manifestation that I was writing about. Then, I identified specific words and phrases that best reflected the image of the initial tentative manifestation. Next, I methodically took each one of those words/phrases, stopping and slowing down the process by opening up the meanings contained in that one word or phrase.

Beginning this process of crafting a phenomenological text for each tentative manifestation, I never knew exactly where the process would take me. This is what Vagle (2014) refers to as "writing your way through analysis" (p.134) and "chasing lines of flight" (p.135). The aim of post-intentional phenomenology is to see what the

phenomenon might become. This process is done, by following, where meaning, "takes "off" and in ways that we may not be able to anticipate" (Vagle, 2014, p.119). So my process was to identify words/phrases where meaning was about to "take of" and follow the "lines of flight" as to where the phenomenon might travel.

Once I slowed down the text and took it apart through the identification of words/phrases, I engaged in the process of theorizing in order to open up meaning. I engaged in what Jackson and Mazzei (2012) call "thinking with theory" (p.1). They borrow the phrase "plugging in" from Deleuze and Guattari's *A Thousand Plateaus* to describe their process of "thinking with theory". For Jackson and Mazzei, the process for "plugging in" theory involves drawing on specific theoretical concepts and using them to open up, expand, stretch, and even distort meanings. They adhere to post-structural notions that view meanings as temporary and can be transformed at any given moment. They, like Vagle, posit that meanings can be made and unmade, which involves resisting fixed notions of meanings/knowledge. Rather "thinking with theory" involves a "plugging in" of the vocabulary and concepts to push data in order to produce knowledge and meaning differently.

As previously stated, goal of post-intentional phenomenology is to follow the "lines of flight" that manifest and use theory to help them "take off". As Vagle (2014) states when crafting a text "you should feel free to play with form, bringing all that you have from the data, your post-reflexion journal, other readings, other theories, and other philosophies to bear" (p.137). This can be interpreted as a call to engage with "thinking with theory". Figure 4.5 is an example of this process taken from chapter five. In this

example, the bolded words in the excerpt are the words that "took off" to signal that they could be significant for understanding intentional meaning of phenomenon. Thinking about those bolded words and the context leading up to this excerpt, I saw that this could potential be a place to theorizing the intended meaning. The underline phrase indicates the theoretical notion that was used think with and "follow" the path of the tentative manifestation.

Another source of tension is revealed in Olivia's statement regarding the textbook's ability to relate to students.

> *You know the textbook just has **generic** problems. I mean sometimes they try to be like real world problems but they **obviously are so general** that students **might not see the value**.*

Her use of the phrases *"generic," "obviously are so general,"* and *"might not see the value,"* expresses a judgment towards the knowledge contained in the text. Theoretically speaking, Olivia might be experiencing *nepantla* as multiple realities regarding the mathematics text arise. On one hand the textbook holds much power as it is positioned as the source from which mathematical knowledge flows. Yet at the same time, the text can be read as powerless in its ability to have knowledge about the students to consider it of value by the very students it seeks to educate. Ironically, the text appears to both have the authority of mathematical knowledge for students and proves to be relatively inept at "knowing" students.

Figure 4.5. Example of Thinking with Theory.

For this study, multiple sources were utilized to craft a text that captures the tentative manifestations of the phenomenon. When crafting the text, I drew on the data sources, my post-reflexion journals, mathematics educational research, phenomenological philosophies and other theories. Two theories were significant to this study: (1) the notion of Anzaldúa's notion of *nepantla* and (2) Foucault's theory of power/knowledge (both described in chapter three). Early on in the process nepantla informed my work as I predicted that teacher candidates would struggle with multiple realities of focusing on

matters of equity for teaching mathematics. During the crafting of the phenomenological text, which by now I was deep into the study, I saw power at work and decided to bring in Foucault's theory on power/knowledge to assist in opening up meaning. Admittedly, Foucault is new for me, as I have not widely read his work. I realize that this is a limited view of Foucault and these are my early understandings of his theories.

It became apparent that through working with the data, that the tentative manifestation, discourses of equity, called for a different form of text than previously described. Found poetry was used as a way to capture and better express the tentative manifestation as it is considered to be an effective technique to express the everyday reality of people (Butler-Kisber, 2002). Meticulous attention was given to select phrases from the data that accurately reflected the tentative manifestation. The phrases were then grouped together based on attributes that described initial tentative manifestations. No words were altered or misrepresented in the process but ‘‘poetic license’’ (Butler-Kisber, 2010, p. 87) was used, as words were re-arranged in a different order than in the original text to provide fluidity and let the reader see and hear the voices of teacher candidates. The organization of the poem shows how the discourses around equity "took off" as the spacing and indentations were purposefully chosen as an attempt to visually show the movement of the discourses–back and forth and spread across the page.

Crafting a text that captures the tentative manifestations of the phenomenon in its multiple, partial, and varied contexts was the goal of this study. In order to do so, I followed "lines of flight" and engaged with relevant theoretical notions to illuminate meanings when appropriate. Throughout the writing process I repeatedly asked, "What's

being produced here?" as a way to help focus my seeing so that I could identify the meaning link between teacher candidates' lived experiences and the phenomenon cultivating equity-mindedness. Thereby, answering my research question: How might cultivating equity-mindedness with teacher candidates take shape?

Summary. The methodological approach that I have outlined in this chapter is based on a post-intentional phenomenological research design and is framed by a review for the research, phenomenological philosophies, theories and practices related to cultivating equity mindedness within elementary mathematics teacher preparation. The goal in post-intentional phenomenological methodological research is to illuminate the identified tentative manifestations to individuals whose practice would be enhanced by understanding how the participants of this study (i.e., the teacher candidates and course instructor) live through and make sense of a particular experience (i.e., cultivating equity-mindedness in an elementary mathematics methods course). Chapter five presents the crafted text that was described in component five. Five tentative manifestations of significance are described in detail using excerpts from lived experiences and theoretical notions and scholarly research to reflect an image of the phenomenon.

CHAPTER FIVE

TENATIVE MANIFESTATIONS

The title, tentative manifestations, is the appropriate for this chapter because it recognizes that meanings are fluid, passing, and subject to change (Vagle, 2014). In more traditional qualitative research methods, the term "findings" or "results" is most often used and these words have the potential to portray meanings as stable, singular and final. This is in contrast to the philosophical underpinnings that are foundational to post-intentional methodology, which embraces a post-structural view of meanings, as they are seen as partial, situated, unstable, fleeting and always changing.

This chapter presents the tentative manifestations of phenomenon cultivating equity-mindedness. Iterative cycles of phenomenological data analysis using qualitative methods revealed tentative manifestations (Vagle, 2014). A post-intentional phenomenological text was crafted to illuminate the multiple, partial and varied contexts of the phenomenon.

Efforts were made to transform the experiences of teacher candidates into a textual expression that reflects the image of the tentative manifestations. Detailed explanations and interpretations were constructed through the process of putting different theoretical concepts to work (Jackson & Mazzei, 2011) in order to open-up, interrogate and explain the multiple and varied ways the tentative manifestations of the phenomenon cultivating equity-mindedness appeared. It seems most appropriate to present the teacher candidates' experiences by using excerpts from the data as a way to contextualize their voices.

Chapter six of this dissertation directly addresses the meaningfulness of the tentative manifestations by offering conclusions and implications for practice.

Overview of the Research Study

This qualitative study utilized a post-intentional phenomenological research design (Vagle, 2014) to investigate teacher candidates' lived experiences of cultivating a mindset focused on equity matters while enrolled in a sixteen-week, undergraduate, face-to-face elementary mathematics methods course. Upon conclusion of the course, qualitative methods were used to collect data from the teacher candidates' personal accounts shared through individual unstructured interviews and written artifacts created as part of the learning activities while the course was in progress.

The primary phenomenological research question used to guide this study is: How might cultivating equity-mindedness with teacher candidates take shape in an elementary mathematics methods course? Iterative cycles of phenomenological data analysis using a whole-part-whole approach captured tentative manifestations (Vagle, 2104) of the phenomenon of cultivating equity-mindedness as it was experienced during the methods course. Through phenomenological data analysis five tentative manifestations of significance where produced: (1) Equity-mindedness may cause a metacognitive awareness; (2) Struggles with power relations might arise when implementing equity-based practices; (3) Equity-mindedness might involve a deep understanding of students and the communities in which they reside; (4) Equity-mindedness may attend to mathematics practices that facilitate multiplicity; and (5) Discourses regarding equity might produce conceptualizations of what it means to teach mathematics. These five

tentative manifestations are representations of how equity-mindedness took shape with teacher candidates.

Three secondary research questions were developed and used with the purpose to help focus data collection toward the primary phenomenological research question (Vagle, 2014) and help with identifying the ways in which the phenomenon, equity-mindedness manifested. Those secondary questions are: (1) In what ways, if any, do teacher candidates demonstrate understanding of and commitments to utilizing high-leverage mathematical practices? (2) In what ways, if any, do teacher candidates demonstrate understanding of knowledge of students' identities for the teaching of elementary mathematics? (3) In what ways, if any, do teacher candidates demonstrate a critical understanding for the teaching and learning of elementary mathematics. While the five tentative manifestations are represented within the three secondary research questions, the goal of this study was to answer the primary phenomenological research question as these five manifestations are presented as a tentative answer to the primary research question.

In post-intentional phenomenology, the author is free to play with form in order to reflect the image of the tentative manifestation by "bringing all that you have from the data, your post-reflexion journal, other readings, other theories, and other philosophies to bear" (Vagle, 2014, p. 137). Foucault's theory on power/knowledge and Anzaldúa's notions of *Nepantla* as well as research findings in mathematics education, were "plugged" (Jackson & Mazzei, 2011) into the data to help extend, open-up, interrogate and explain the multiple and varied ways the tentative manifestations of the phenomenon

cultivating equity-mindedness appeared. Tentative language (e.g., might, can, maybe) is used to better depict the fleeting, partial, shifting, and fluid nature of the phenomenon. Detailed explanations and interpretations were constructed for four of the tentative manifestations.

For one of the tentative manifestations (i.e., *discourses of equity*), I played with form and used found poetry (Butler-Kisber, 2002) as a way to better portray this tentative manifestation. The teacher candidates talked about the term equity in multiple and varied ways throughout the course assignments and interviews. Therefore, for this tentative manifestation the format changes from the way the other four tentative manifestations have been presented.

The teacher candidates' accounts of their lived experiences are shared through excerpts and direct quotes from the data. Additionally, some explanations were includes to clarify meaning as brackets were used to denote such clarifications. At times, length of the excerpt was preserved in order to preserve the richness of the account and the experience in context. Other times, shorter statements and partial phrases were sufficient in order to depict the phenomenon. The teacher candidates will be referenced respectfully by a pseudonym rather than their own names to protect confidentiality.

For clarity, the directly quoted narrative accounts given by the teacher candidates are differentiated from the rest of the chapter by using italics. Throughout Chapter four, my text, including my descriptions and explanations, are distinguished by the same font style, size, and formatting that is used throughout all other chapters of this dissertation. In

contrast, direct quotes from the teacher candidates' narrative accounts are distinguished by using italics, and block quotations are single-spaced.

Tentative Manifestation #1: Metacognitive Awareness

Cultivating equity-mindedness tentatively manifested as metacognitive awareness in teacher candidates. Being metacognitively aware means that teacher candidates were mindful of their own thought processes and actions. Flavell (1979) described two aspects of metacognition: metacognitive knowledge and metacognitive regulation. Metacognitive knowledge requires understanding you own thinking and developing strategies for planning, analyzing and gaining more knowledge. Metacognitive regulation requires the ability to define learning goals and monitoring ones' progress in achieving them (NRC, 2000). Research shows that metacognitive reflection is an important component of adaptive expertise (NRC, 2000). People with high levels of metacognitive awareness have developed habits of mind that prompt them to continually self-assess their performances and modify their assumptions and actions as needed. People who are less metacognitive rely on external feedback from others to tell them what to do and how to change.

Metacognitive awareness permeated through the teacher candidates' thoughts as they planned lessons, engaged in course readings, completed course assignments, and taught lessons in field experience classrooms. The methods course required teacher candidates to engage in critical reflection on a weekly basis in which they were asked to think deeply about themselves as racial, gendered, and cultural beings. This involves attention to their taken-for-granted frames of reference that is, their experiences and ways of thinking,

beliefs, assumptions, privileges, struggles and positions. It also involves the ability to recognize consciously or subconsciously deficit-based notions or negative perceptions about students and their families.

For teacher candidates, metacognitive awareness was produced in multiple ways, which includes: expressing vulnerability, awareness of self, awareness of others, challenging previously held notions, proceduralizing equity practices in attempts to try to apply them in practice, and distancing oneself in order to reflect upon ones thoughts and actions. In the following section each of the five examples of metacognitive awareness is discussed and supported with excerpts from data collected.

Initial tentative manifestation: Vulnerability. Cultivating equity-mindedness may leave teacher candidates feeling vulnerable as it may cause them to be exposed or to risk being seen as incompetent, not knowing everything (i.e. as this contradicts popular discourse surrounding teachers as holders of knowledge). However, in order for teacher candidates to become equity-minded they may see that equity-mindedness might require them allow themselves to be seen and exposed. Taylor is an example of a teacher candidate who understands that in order to be equitable she may need to be vulnerable.

> *So coming into this I just kind of had a narrow mind, because I thought this is what was happening, this was what I was going to learn, but then I even needed to open my mind to this whole idea of equity like open to new ideas. Like taking things into consideration when it's something that I'm not familiar or comfortable or that's regarding students and math in general.*

Taylor fully acknowledges her mindset prior to the methods course as being *"narrow"* minded. However, throughout the course she had to come to realize that she *"needed to open her [my] mind to the whole idea of equity like open to new ideas."* Her

statement, *"taking things into consideration when it's something that I'm not familiar or comfortable"* can be read as her needing to allow herself to be uncomfortable and reside in the unfamiliar as she learns to become a teacher of elementary mathematics.

Initial tentative manifestation: Awareness of self. Cultivating equity-mindedness manifested as an awareness of how personal biases, assumptions, learning preferences, habits, emotions and personal tendencies can impede student learning of mathematics. Several of the teacher candidates showed an awareness of how their personal preferences might be an obstacle to students learning mathematics. Camryn shares her recognition of her personal preference of explaining.

> *Even though I don't agree with the worksheets, I'm comfortable in–not comfortable in the way where I think it's okay to do it. I'm comfortable like it feels comfortable to just explain it. Like I'm good at explaining…but oh, I guess one this is productive struggle or letting go for students…I just want to be there and help them out I want to be like oh this is how you do it! But that's not really helping. That was a big, a BIG ah-ha moment for me.*

Her admittance of her comfortability with explaining is important in her path toward become equity-minded. As Camryn acknowledges her strength, *"I'm good at explaining"* but realizes that this strength is "*not really helping"* students. Her use of the phrase *"oh, I guess one this is productive struggle or letting go for students"* can be read as her understanding of certain practices, which facilitate conceptual understanding of mathematics. Her feelings support the literature on effective mathematics practices, which contend that engaging students in productive struggle provides them with greater opportunities to deeply understand and make sense of mathematical concepts and ideas (NCTM, 2014). Hiebert and Grouws (2007) also argue that struggle is a necessary component of teaching mathematics that supports students' learning of mathematics.

Additionally, Makenna recognizes that her personal learning preferences maybe a hindrance for student learning of mathematics. As she explains:

> *Sometimes I think we get so set on the way our teachers taught us or how I learned mathematics-this is how you do it, this is the way it's going to go, where everyone's going to learn it the same way. And it worked for me. I understood somehow it all clicked and that was fine. But I think like the idea of having multiple entry points and having like students that are going to learn very differently from the others was just something that didn't occur to me because I learned very straight forward, the way I was taught. It's just interesting to read how obviously we need to teach to each student differently, which is something I don't feel like ever happened in my classroom. I'm sure it did but because I learn very straight forward I just never noticed it.*

One way to interpret this excerpt is through a power/knowledge reading, as Makenna acknowledges the power that her former teachers may have had on her knowing through her statement, *"I think we get so set on the way our teachers taught us"*. Her use of the word *"set"* can be interpreted as her recognition of the impact that such methods have had on her. It is as if their methods have become stationary for Makenna. Her use of the phrase, "*And it worked for me"* can be seen as an awareness of the way she was taught *"worked"* for her in that she *"learned very straight forward"* which she describes as *"I was taught okay here's your formula, plug in the numbers"*.

Makenna's statement, *"because I learn very straight forward I just never noticed it"* is very telling as it can be interpreted as an acknowledgement that her preferred way of learning might hinder her ability to recognize other ways of learning and knowing mathematics.

She continues to explain:

> *I guess there is some things where I am still like you should just know how to do this. There's a formula you should know how to do it, you shouldn't have to tell why, but you should. I mean that's something that I work on. I still need to be able*

> *to tell why, but I am still like I don't even know that, I just showed you how to do that… I'm always thinking about how not everyone learns the way I do. That's something I really have to think about, because I mean...I'm just like yeah tell me how to do it and I don't really need to know why just tell me how. So something I'm thinking about is making sure I know why I'm doing it and why my students are doing it. So that's something interesting for me.*

Makenna's use of the phrase, "*you should just know how to do this"* can be seen as an honest response to the tensions that exist between a teacher candidate's personal ways of knowing and other ways of knowing. She acknowledges that she needs to work on accepting other ways of knowing, however, Makenna sees that she may not know "other" ways, which is evident through her statements, *"I don't even know that"* and *"I'm just like yeah tell me how to do it and I don't really need to know why just tell me how"*. Her proposed solution for her limited way of understanding is to make *"sure I know why I'm doing it and why my students are doing it"* which can be seen as her commitment to paying attention to the mathematics and the different ways in which students might be understanding it.

Likewise, Camryn acknowledges that her emotions maybe a hindrance to student learning. She explains her struggle to overcome her emotions:

> *I still have a little ways to go with that just because I still have that guilty feeling when I let kids do it on their own. I'm like oh I'm not helping them or they don't think I care about them or something. It's because I care about them that I do–do this… I think just my personality that I want to help them through.*

Her admittance of a *"guilty feeling"* and *"my personality that I want to help them"* can be interpreted as her recognition that her emotions and personal tendencies might prevent her from embracing letting students engaging in productive struggle and problem solving

as identified in the mathematics research as effective practices (NCTM, 2014; van de Walle, 2106).

Furthermore, Camryn realizes that she is her biggest obstacle is herself. She explains:

> *I think I am one of my biggest obstacles because I am comparing myself to my peers and I always find myself worrying about what my classroom teacher is going to think of what I'm doing or like…my supervisor–do they think I'm ready for teaching? I think I'm still in that mode that I need to have the right answer all the time. So sometimes I think…I think it ended up pushing me because I wanted to like be the best that I could be and I wanted to make sure I was using what we were reading about and I wanted to reach all students but I think in the process of being so focused on okay I need to do this, I need to do this, I need to do this, how many times did I just say "I". I was more focused on me doing the right thing, rather than like really getting to know, like I got to know a lot about students but really getting…well…and just being a human, you know just being a person with them. So that was probably one of my biggest obstacles is trying to find, is like doing the right things and focusing too much on that and not as much on really getting to know my students.*

Foucault's notion of power/knowledge may provide insight into this situation as Camryn expresses *"I think I'm still in that mode that I need to have the right answer all the time"*. This statement of hers can be seen as an effect of the power previous discourses have had upon Camryn's thinking and actions as she is used to mathematics being about having correct answers. Her statements of wanting to make sure she was doing what others expected of her might be read as her desire to please people, whether it be her mentor teacher, university supervisor, method's course instructor, or the texts she was reading. Additionally, Camryn expresses a desire to do the *"right"* thing, which is made evident through her statement *"I wanted to make sure I was using what we were reading"*. Her desires to please others and her personal desires can be read as her metacognitive awareness that she is under surveillance. She feels the pressures of the

"normalized gaze" from her mentor teacher, university supervisor, method's course instructor and her own beliefs about what mathematics teaching should look like–all measuring her up against their own discourses for teacher behaviors.

However, it is interesting to note that Camryn is very aware that her focus has been upon herself, which is made evident by her statement, "*I was more focused on me doing the right thing*". Her use of the phrase, "*I got to know a lot about students but really getting…well…and just being a human, you now just being a person with them"* can be read as her recognition that her current understanding of students is more surface level, such as knowledge about the students' common experiences. However, she realizes that learning mathematic requires connecting to students on a personal level. Camryn's feelings are in keeping with the findings of Villegas and Lucas (2002), suggesting that most teachers have no windows into the lives of their students as they cannot evoke shared frames of reference to make meaningful connections between classroom learning and the backgrounds and prior experiences of students who are culturally, racially, socially, and linguistically different from them.

Another way to interpret Camryn's metacognitive experience is through the lens of *nepantla*. Camryn is faced with competing discourses of what it means to teach mathematics and she works to pattern her teaching behaviors after them. However, in her efforts to *"do the right thing"* she finds this almost at odds with another discourse, that is, her desire to *"being human"* with them. Her somewhat contradictory statements might be seen as a source of tension and her feeling that she cannot do both. In *nepantla*, multiple realities come into focus as Camryn comes to see teaching mathematics as herself *"doing*

the right thing" and at the same time metacognitively aware her attention should be on *"being human"* with students.

Initial tentative manifestation: Awareness of others. Cultivating equity-mindedness manifested as an awareness of others. Makenna explains her awareness that certain contexts might not afford students opportunities to make connections to mathematics. She explains:

> *Just thinking about like you want it to be relatable to your students–I would have never really thought about oh I probably shouldn't football because some of these students probably don't know what football is. That wasn't something I would have thought of before because I wasn't thinking about equitable instruction…I was just thinking about oh, I need to teach… learning about equity has made me more aware of teaching to each student and thinking more broadly about like if I'm writing a problem what am I about and how can the students relate through trying to teach to all of them.*

Awareness manifests that contexts should be based upon students' backgrounds and experiences and that those contexts may differ from your own. Makenna indicates that as a result of her learning in the methods course she now needs to consider the context that she uses for creating mathematics problems. She confesses that this *"wasn't something I would have thought of before"* this can be considered as an honest admission that she would have just been focused on *"oh, I need to teach"* and that her newly acquired discourse for teaching mathematics has triggered a reflection upon her pedagogical actions including an attention to each student.

Likewise, Rachel reflects upon a similar experience to that of Makenna in that she needs to readjust her thoughts so that they reflect the thinking of students. She explains how her own ideas about mathematics learning needs to reflect the ways in which students think:

> *When students come up to you with questions–it's not that their questions could be wrong–but when you think about it the way that you learned, you have to think of it as this is the way they are learning and I have to transition my thoughts and my thought processes and think the way that the student is thinking.*

Being equity-minded might cause teacher candidates to privilege the thinking of students over their own. This was the case of Rachel and is evident in her statement, "*I have to transition my thoughts and my thought processes and think the way that the student is thinking".* This statement can be seen as her recognition that attention to student thinking should be at the forefront. Rachel's views about student thinking is in keeping with the mathematics education literature, which calls for teachers to attend to student' thinking in order to better support their conceptual understanding and to design and adapt mathematics instruction (Ball et al., 2003; Carpenter et al., 1998; Heibert et al., 1997; NCTM, 2014; Stein et al., 1996; van de Walle, 2016)

Initial tentative manifestation: Challenging notions. Cultivating equity-mindedness manifested as a willingness to interrogate previous held understandings, assumptions and biases as new ideas and experiences are encountered. For Chelsey, interrogating, or self-reflecting upon, her understanding of the concept of equity in the teaching and learning of mathematics was something that presented a challenge for her as she engaged with the ideas from the readings in the methods course. She explains:

> *I feel like the whole class [was challenging], I know this sounds cliché, but all of it was, like when I got my definition of equity, and then we would read things about it I would kind of still challenge it, like this is right, like this is my own definition but is it really going to help all my students?*

Chelsey's challenging of her own definition of equity can be interpreted as an honest evaluation of her own thoughts and ideas. Her use of the phrase *"is it really going to help*

all my students" can be seen as an interrogation process in which she challenges her previous held notions–questioning if they are actually helpful to students. After this response, Chelsey was asked if she could give an example of challenging her definition. She explains:

> *I think it was the reading with Mr. C, my definition [of equity] was using different tools to help them, but I realized that's a great definition but I'm totally missing the students' identities. And how like I need to also incorporate students' identities-that's also equity. Like incorporating their identities and lived experiences into the math classroom. So I thought it was really impacting how he [Mr. C] took that statement of "he's suspended because he's Mexican" and then he created a math problem of it and a lot of the students in the class kind of felt like yeah I get expelled or this because I am a certain race and he put it into a math problem students felt like yeah I get expelled because I'm a certain race and he made it into a math problem the students felt they could like not fix the problem but they're understanding it now.*

Chelsey's statement *"I'm totally missing the students' identities"* can be seen as her recognition that her definition of equity was lacking and it needed to move beyond "*using different tools to help"* to incorporating students' identities and lived experiences. She continues explaining:

> *And then it challenged my thinking in okay I want to do all these different things in equity to get what students need to succeed, but also for them to succeed I need to relate it back to their lived experiences so they can connect it and understand math in a context.*

Her use of the phrase *"so they can connect it and understand math in a context"* can be read as her new understanding of the role of identities and lived experiences bring to mathematics learning. When knowledge of students' identities and lived experiences are incorporated into mathematics instruction, it gives students the opportunity to make connections the can deepen understanding of mathematics. Chelsey's thoughts are supported by the literature on culturally responsive teaching, suggesting that students

need frames of reference to make meaningful connections between classroom instruction, cultures, and lived experiences (Gay, 2009; Ladson-Billings, 1994; Leonard, 2008; Villegas & Lucas, 2002).

Camryn is another example of challenging previously held notions that can provide insight into cultivating equity-mindedness. She shares a revelation she had as she progresses through the methods course.

> *Then progressing throughout the course, that's where I started to come up with bringing themselves and their identities, mathematics identities into the math, I never thought of that before or like you had said about status in the classroom…Going back to worthwhile tasks and having the task reflect what's going on in their lives, they can bring their culture and their experiences into it. And that also made me reflect towards the end of the course, on how it's not just something I create in the classroom, it's not just me putting that into the classroom, but it's like a whole classroom thing like it's about the students too and students bring that equity piece in, it's like that whole classroom environment, it's not just math and it's not just how the teacher creates it, it's how all the pieces come together.*

Her use of the phrase, "*bringing themselves and their identities, mathematics identities into the math"* can be seen as her reflection on what it needed for students to participate in mathematics. Camryn's feelings follow suit with the mathematics education literature in that students need to "see themselves as legitimate and powerful doers of mathematics" (Aguirre, et a., 2013, p.14) because "how students experience mathematics in their classrooms shapes their views of mathematics and themselves as mathematics learners and doers" (Aguirre, et a., 2013, p. 19). Rather, student need to see themselves reflected in the mathematics curriculum that they experience (Gay, 2009; Ladson-Billings, 1994; Leonard, 2008).

Camryn's statement, *"it's not just something I create in the classroom, it's not just me putting that into the classroom"* can be seen as another important revelation in her path toward becoming equity-minded. She realizes that creating a mathematics environment that has a mindset on equity is not solely depended upon her. For Camryn, equity is relational and requires collaborative efforts between herself and students.

Initial tentative manifestation: Proceduralizing equity practices. Equity-mindedness manifested for some teacher candidates manifested in breaking down the process of creating a "worthwhile" mathematical task into steps as well as creating a mental checklist to check to make sure the tasks were equitable. Chelsey explains her process of creating a thinking mathematical task that involves higher-level thinking.

> *When we had to do the meaningful [mathematical task], take a low-level task and make a high level, to me it was hard to because in my mind I know we had to make it meaningful and have multiple entry points, and I knew all the reasons why, but trying to put it in a problem it just was hard for me because it seems abstract, they seem separate to me, like they had to merge them and that was the difficulty I was having. I think a lot of math problems I have seen in the classroom are low-level and so I didn't experience, I mean I didn't see a lot of high-level so when I think of math I just think of that low-level and not meaningful math questions.*

Tensions might arise for teacher candidates, as they intellectually understand the criteria for creating "worthwhile" mathematical tasks, but struggle with application. For Erica, when she states that she *"knew all the reasons"* this can be read as her cognitively understanding the criteria involved for creating a "worthwhile" mathematical task. However, actually creating such a task was difficult for her, which is evident by her use of the phrases *"was hard," "seems abstract"* and *"seem separate."* Chelsey's words *"I didn't see a lot of high-level"* tasks, might give reason as to why creating a "worthwhile"

task is difficult. Her feelings emulate the teacher education research suggesting that teachers are influenced by the number of years spent observing teaching practices in their K-12 schooling (Lortie, 1975). Lortie refers to this, as the *apprenticeship of observation*, in which he argues, is largely responsible for many of the preconceptions that teacher candidates hold about teaching. Even though it appears as if Chelsey is embracing a new discourse for mathematical tasks, previous experiences with low-level mathematics tasks seem to present difficulties for her in regards to creating high-level tasks to use with students in the classroom.

The power of discourses established during teacher candidates' *apprenticeship of observation* might pose as a potential barrier to their ability to design "worthwhile" tasks that promote more equitable opportunities for students' mathematics learning. Chelsey continues, explaining her struggle with creating "worthwhile" mathematical tasks.

> *So it took me a while to get used to like-I am still struggling with it now–it's not automatic–I don't know if its ever going to be but at least I am aware of it now. But to create our lesson plan, a meaningful task, was kind of a struggle. So okay I had to come up with the word problem, then I had to step back, like I have my problem now, how am I going to make it meaningful, how am I going to make it with multiple entry points. So I still have to…take it step by step. Like, I will have my problem–my task, then I have to go back and think well okay this is how I'm going to add multiple entry points and then I don't want them just to do just the procedure, I want them to think about it and discuss about it and how am I going to incorporate that into my lesson or my task?*

Her use of the phrase "*it's not automatic*" might be interpreted as her assumption that this process should be natural however she honestly admits that that it may never be "*automatic*". While creating a "worthwhile" mathematical task may not be "*automatic*" she acknowledges that she has an awareness of it now. Chelsey's awareness can be read as an understanding that there are differences in the types of mathematical tasks that

teachers create and those tasks determine the kinds of thinking in which students engage. Such interpretation is consistent with the research of Stein and colleagues (2000) in that different mathematical tasks produce different levels and kinds of thinking by students.

Chelsey's self-described "*step by step*" process can be read as way to remedy or overcome the "*not automatic*" process of creating a task by breaking down the creation process through a series of checks identifying the criteria developed for "worthwhile" or high-level tasks. She continues by summarizing her thought process for creating mathematics tasks by stating, "*I'm still having to think about it and then add it in. It's always a checklist in my head."* One way to interpret Chelsey's process is that she starts with a low-level thinking task and then she *adds in* the established criteria for a "worthwhile" task (i.e., in the form of a cognitive checklist) to transform it. In other words, she draws on her prior conceptions of low-level tasks to remake it into one that is "worthwhile". Ironically, Chelsey proceduralizes the very thing (i.e., the "worthwhile" high-level task) that seeks to break free of prescribed ways thinking with students.

This is illustrative of the power that discourses can have on teacher candidates' thinking processes. As Chelsey's engages with previously established discourses for mathematics tasks, she extends that knowledge to creating "worthwhile" mathematical tasks. In the process, she may have inadvertently reduced it to rigid procedures that can potentially standardize the creation of high-level "worthwhile" mathematical tasks.

Initial tentative manifestation: Distancing oneself. Cultivating equity mindedness manifested in the form of a stepping back to create some distance (physically or mentally) for reflection on one's actions and thoughts. This distancing allows one to

create necessary space to observe one's thinking and actions. Also, it helps in determining if one's thought and actions are truly in accordance with desired outcomes. For Makenna, this distancing occurs in the form of putting away and coming back to evaluate her task using the discourse established in the methods course. She explains:

> *I wrote something but it didn't really allow for multiple entry points. Well, I read it again. So I wrote it one day then I put it away for a day then I came back to it and I was reading it and when I was thinking about it, connecting it and relating it to everything we've read and I was like okay how is this going to help my students and I was like this isn't–this is how I learned! It's not how everyone else would learn. This would be just for anyone that would learn how I did. So then I had to think about it in a way of how could all of my students learn through this task…I'm constantly thinking am I actually doing what I think I'm doing? Am I doing what I say I want to do?*

When Makenna uses the phrase *"I was like okay how is this going to help my students"* can be seen as her questioning of the mathematical task she created the previous day. When she states, *"This isn't–this is how I learned!"* can be interpreted, as her recognition that the task she created the previous day is reflective of her learning preferences. Makenna explains how she sought to remedy this situation "*I had to think about it in a way of how could all of my students learn through this task"* as this can be seen as Makenna's attempt to look at her mathematics task with the learning of her students at the forefront. Her statement, *"I'm constantly thinking am I actually doing what I think I'm doing? Am I doing what I say I want to do?"* might be seen as her commitment for making a conscious choice to step back and reflect upon her actions and planning to make sure they are aligned with her intent.

Reverting back to practices teachers have previously experienced or ones that are comfortable for them can be problematic for cultivating equity-mindedness. Creating

space to reflect in the moment might be seen as a way to alter interactions with others. Like Makenna, Camryn engages in distancing, however, it is more of a mental stepping back in the moment. Camryn recalls a time where she struggles to change her interactions when helping students with their mathematics.

> *Like we read about sometimes teachers will revert back to what they know. There was at least one time were I wanted to do that. I'm trying to remember that but I think it was when I was helping a student and I just wanted to say like okay so here is our word that tells us that we are subtracting like just look for the key words. You know that is what we learned. Instead, I had to really had to take a step back and think–I want the student to come to a situation in life and be able to figure out what they need to do and so in this situation let's think about what is going on in the question instead of just I found my word and it says fewer so I know I have to just subtract.*

Camryn honestly admits that she really wanted to tell the student to *"just look for the key words"*. However, she was able to resist reverting back to practices of comfort (i.e., which she described earlier as being comfortable with explaining) and stop in the moment to *"think"*. Her use of the phrase, "*I want the student to come to a situation in life and be able to figure out what they need to do,"* can be read as her ability to reflect on the "bigger picture" of learning or meaningful long-term purposes of education writ large. One way to interpret Camryn's actions is that she was able to recognize the potential negative consequences of her actions (i.e., explaining or telling). A power/knowledge (Foucault, 1982) reading might see this situation as her recognition of the power her action of telling could have on the ability to control students' thinking. Thus, for Camryn the purposes of education might be seen as facilitating learning so that students become competent problem solvers.

What is being produced here are conscious decisions to purposely "step back" creating a space to reflect upon equity discourses for teaching mathematics and attempt to change or alter a course of action. The distance creates space (whether it be physically or mentally) that allows one to check how personal preferences, actions, assumptions, might work against equity.

Summary of tentative manifestation #1: Metacognitive awareness. Cultivating equity-mindedness produced a metacognitive awareness in which teacher candidates' attended to their thoughts, actions, biases, and assumptions about teaching and learning mathematics. They expressed an awareness of how their personal learning preferences and privileged ways of knowing might hinder student learning. For teacher candidates metacognitive awareness manifested in multiple ways. Those ways included: expressing vulnerability, awareness of self, awareness of others, challenging previously held notions, proceduralizing equity practices in attempts to try to apply them in practice, and distancing oneself in order to reflect upon ones thoughts and actions.

Tentative Manifestation #2: Inherent Tensions in Power Relations

Cultivating equity-mindedness is not a linear path for teacher candidates nor does it reside solely within the university classroom. As teacher candidates enter their field experiences classrooms they carried with them their discourses of what it means to teach mathematics in an equitable manner into their field experiences. That is equity-mindedness requires mathematical knowledge for teaching, knowing students' identities, and critical knowledge. These newly acquired discourses created *regimes of truth*

(Foucault, 1984) for the teacher candidates regarding the teaching and learning of mathematics.

Teacher candidates lived experiences in elementary classrooms afford opportunities to observe and practice newly learned knowledge and beliefs about teaching. However, it is not long before their experiences in the classroom bring them face-to-face with competing discourses, as newly acquired discourses constructed in the methods course bring institutional practices sharply into focus (Britzman, 2003; Walshaw, 2004). It is in these spaces that teacher candidates' personal discourses often come into conflict with intuitional practices operating in their field experience classrooms thus creating tensions from what Foucault terms *dividing practices*. These inherent tensions often put teacher candidates into the state of *Nepantla,* where personal discourses regarding the teaching and learning mathematics (i.e., often directly shaped by the methods course) come into conflict with the normalized institutional practices operating in the elementary school environment (i.e., their field experience classrooms).

Anzaldúa (1987) refers to this place of inherent tensions as *Nepantla* (i.e., literally meaning "neither here nor there"). For Anzldúa, *Nepantla* is a space where one's perspective is confronted with the perspective of another (i.e., Anzaldúa uses the term *nos/otras* to describe this relationship between the self/other) thereby causing inherent tensions as one struggles with competing ideas, discourses and multiple realities. These inherent tensions became a place of *Nepantla* for the teacher candidates as they struggled to negotiate between their regimes of truth and the normalized practices operating in their field experience classroom.

The work of Michel Foucault can provide insight into the *nos/otras* (i.e., self/other) relationship that causes a person to experience *nepantla*. For Foucault, these relationships are practices of power as power is embedded within these relations. Power and knowledge are inextricably related, as knowledge is always an exercise of power and power always a function of knowledge, hence the use of the term power/knowledge. Foucault does not always regard power as negative as in a form of domination. Power can be productive and dynamic producing new truths that make relations of domination and inequity reversible through resistance. Foucault (1982) said that "Power is everywhere; not because it embraces everything, but because it comes from everything" (p.231) including us.

Discourse is a vehicle that power operates through, as it can simultaneously be a mechanism and an effect of power (Foucault, 1998). Discourse, according to Foucault, is not limited to just spoken language but is wide-ranging as it includes, written text, symbolic language, as well as people's thoughts and actions. It is through such discourses that words are created, categories are and ideas developed which in turn function as truths for individuals. Foucault is mainly interested in what discourse does to facilitate power and influences the social reality for people.

Foucault's language can be particularly helpful because it provides a theoretical expression of power relations. What is produced from these power/knowledge relations is new knowledge about oneself or a new truth and changes the way a subject participates in the world. It is through power relations and experiencing *nepantla* that teacher candidates are continuously being transformed. For many of the teacher candidates the new

knowledge gained resulted in a deeper awareness of inequities operating within mathematics education. In the following section examples of the teacher candidates' struggles within power relations is discussed and supported with excerpts from data collected.

Initial tentative manifestation: Power struggles. Teacher candidates are often confronted with the recognition that some classrooms lack equity-mindedness and the consequence affects students in the classroom. In efforts to respond to certain classroom situations, teacher candidates often run up against barriers to equity. There is a growing awareness that there are real implications for equitable teaching that teacher candidates have little to no agency over their environment due to their position as teachers in-training. As Dan Lortie (1975) notes, that the time teacher candidates spend observing is not passive rather it is charged by power relations operating in the classroom environment. For some teacher candidates these places of *nepantla* came from power relations manifested in struggles with the authority of textbooks, structures and methods operating in the classroom, positionality, use of language, and concerns for students in the classroom. In the following section each of the five different examples of power struggles is discussed and supported with excerpts from data collected.

Struggles with the textbook. Olivia was asked about what might be the most challenging for her in regards to teaching mathematics in an equitable manner, she responds:

> *Challenging or changing the way they do teach math…you might have to follow the book in the way it is written, and I think the hardest part is going to be challenging that, and teaching math the way that I think is going to benefit students instead of just the way that I am told to do it.*

For Olivia, the textbook is problematic because there is dissonance between her personally established discourses for teaching and learning mathematics and discourses operating in her field experience classroom. It is important to note that Olivia recognizes the power residing in mathematics textbooks. Her use of the phrase, *"I am going to have to challenge that"* can be read as an explicit engagement with the authority and tradition that is present in the textbook. She seems to be positioning herself in relation to this power and authority. In this sense, the texts Olivia is imagining being required to use as a future teacher embodies power and a loss of agency for the classroom teacher. Olivia's feelings in this regard are consistent with a body of mathematics teacher education research (e.g., Apple, 1992; Amit & Fried, 2005; Haggarty & Pepin, 2002; Herbel-Eisenmann, 2009; Smith, 1996; Wagner & Herbel-Eisenmann, 2014), suggesting that the textbook is the mathematical authority in the classroom as it is often positioned as the source of correct solution strategies and answers. This is evident in Olivia's statement in which she describes a real concern about needing to adhere to the textbook and learn its prescribed strategies despite struggling to understand how that reconciled with the mathematical and equity-based practices learned in the methods course.

> *I don't even know how to solve the problems [the way the textbooks shows]. How am I supposed to go around and help these students solve these problems? So I have to like read through their textbook and figure out what that textbook's definition of the answer is and help the students solve it in that correct way for the class.*

The power of the text can make teachers feel confined to the textbook's knowledge—and even lead teachers to lose trust in their own content and pedagogical knowledge as professionals. Olivia's statement, *"figure out what that textbook's definition of the*

answer is," can be considered as a surrendering of her mathematical knowledge for teaching to that of the text's knowledge. Her use of the phrase, *"that correct way,"* can be interpreted as a source of truth that nullifies a teacher's knowledge and controls the students' solutions.

Another source of tension is revealed in Olivia's statement regarding the textbook's ability to relate to students.

> *You know the textbook just has generic problems. I mean sometimes they try to be like real world problems but they obviously are so general that students might not see the value.*

Her use of the phrases *"generic," "obviously are so general,"* and *"might not see the value,"* expresses a judgment towards the knowledge contained in the text. Theoretically speaking, Olivia might be experiencing *nepantla* as multiple realities regarding the mathematics text arise. On one hand the textbook holds much power as it is positioned as the source from which mathematical knowledge flows. Yet at the same time, the text can be read as powerless in its ability to have knowledge about the students to consider it of value by the very students it seeks to educate. Ironically, the text appears to both have the authority of mathematical knowledge for students and proves to be relatively inept at "knowing" students.

Knowing students is considered integral for planning instruction for mathematics. Olivia realizes that mathematics curriculum should be responsive and relevant to students, which requires knowledge of students' lived experiences in order to do so. When speaking about using strategies from the methods course to help a student in her field experience classroom she states:

> *It is important to make things more relevant for him. I don't really know much of his interests yet maybe if I can learn more about his interests I can change the setting of a problem or help him use simpler numbers. So that's kind of my goal during my field experience helping him change his identity.*

Making mathematics curriculum relevant to the lived experiences of students is a key component in the work towards achieving equity (e.g., Aguirre et al., 2013; Gay, 2000; Ladson-Billings, 1994, Leonard, 2008). It requires knowledge of students lived experiences. Olivia expresses an understanding of the role of knowledge of students' plays in learning mathematics as noted in her phrase, *"maybe if I can learn more about his interests I can change the setting of a problem."* This same phrase can also be read as an expression of teacher agency as she is positioning herself as an agent of change capable of positively impacting the mathematics learning of this student. Olivia's realization of her ability to make change is consistent with the mathematics research on the positive impact of teachers' actions on student learning over the impact of the textbook (e.g., Remillard, 2000; Remillard & Bryans, 2004; Smith, 1996; Smith et al., 1996).

Tensions may arise when personal beliefs of knowing students and a desire for teacher agency are in opposition with discourse regarding the textbook operating as the authority of mathematical knowledge. For Olivia, the prescribed mode of instruction was inequitable for students by restricting the agency of a teacher.

> *My teacher said something to me the other day that I just thought was crazy. She said we had an old principal who told us that the math lessons are in this book, in a certain order, for a reason so that is why you have to teach them in that order because she [the mentor teacher] thought sometimes they were out of place but her old principal said they're in the textbook for a reason so don't question it do it that way. But I was thinking you're a teacher. You know how your students are learning-you can make a reasonable change, skip a lesson or do a lesson in a*

> *different order because you think that is their learning progression. But she doesn't feel like she can do that. She feels like she has to follow the prescribed order to the textbook because the creators of the textbook made it that way.*

Olivia's use of the word *"old* to describe the mentor teacher's principal is significant as it gives insight into the power relations operating. In this vignette, she explains now her mentor teacher's former principal required strict adherence to the mathematics textbook. The use of the term *"old"*, in this context, signifies that this principal is no longer at the school. Nevertheless, the echoes of the *"old"* principal's words, *"the math lessons are in this book, in a certain order, for a reason,"* are still heard by the mentor teacher and passed onto Olivia. Foucault (1995) leads readers to recognize that a power of normalization is created through the echoes of the old principals. Theoretically speaking, Foucault (1979) explains that power does not have to be exercised in order for it to be in operation. As he describes, "the perfection of power should tend to render its actual exercise unnecessary; that this architectural apparatus should be a machine for creating and sustaining a power relation independent of the person who exercises it" (p.201). Foucault's notion helps provide understanding to the ways in which the power of the textbook (an example of what Foucault means as *apparatus*) operates, as it no longer needs the enforcement, provided by the former principal, to remain in its position of authority rather it has become a normalized discourse for the teaching of mathematics in this classroom.

The whole idea behind teachers' lacking of agency to change instruction is *crazy* for Olivia. Her use of the phrase, *"she's a teacher…you can make a reasonable change, skip a lesson or do a lesson in a different order because you think that is their learning,"*

can be read as indignation. In the sense that Olivia cannot fathom how the classroom teacher, who has knowledge of her students' lived experiences, reflected in her use of the phrase, *"you know how your students are learning,"* is prohibited from drawing on such knowledge to make a *"reasonable"* adaptation to the mathematics curriculum. Of course, the textbook only has distant and perhaps impersonal knowledge of students, whereas the teacher, ostensibly, is better positioned to have personal knowledge of students. Hence, personal knowledge of students grants a teacher agency in making instructional decisions, something no textbook can "do" by itself. From an equity-based perspective, "teaching depends on the capacity to recognize and intentionally tap students' knowledge and experiences as resources for mathematics teaching and learning" (Aguirre et al., 2013, p.43).

Tensions might arise as competing discourses (i.e., power of the textbook, knowing students, making teaching relevant, teacher agency and lack of agency) collide with personal regimes of truth. Theoretically speaking, Anzaldúa (1978) describes *nepantla* as the site of transformation in which new knowledge is birthed and for Foucault (1984) new knowledge about oneself is the product of power relations. Returning back to the opening remarks made by Olivia, *"I think the hardest part is going to be challenging that, and teaching math the way that I think is going to benefit students instead of just the way that I am told to do it,"* provide evidence that she is maybe experiencing a transformational process in that achieving equity will likely require challenging normalized institutional practices.

Struggles with structure. Structures and normalized practices operating in field experience classrooms presented themselves as a source of tension for teacher candidates. Teacher candidates often found themselves in power struggles as they came into contact with the structures that differentiated from their newly constructed discourse acquired in the methods course. The structures and routines operating in institutional spaces might pose as potential barriers to equity for the teaching and learning of mathematics. Abby describes her struggle and frustration with the current structure for mathematics learning in her field experience classroom.

> *I want to be equitable, but our teacher does teach traditional math so here's the lesson and hands a worksheet to every single student...so it is very frustrating watching the students struggle and be given the same worksheet and then just be like ok it is due tomorrow there you go work on it for the rest of the class. It's always like 50 minutes, and it is the same routine everyday. It's pretty much 10-minute warm-up from the previous day's homework, like a 20-minute lesson, and 10-15 minutes left on homework. It is the same every single day, it's very routine, and I feel like just the schedule itself is not supporting every single learner in that classroom and so it's very frustrating I'm like ahh… don't do it like that! I find it boring and cannot sit and I pace in back of the room.*

Abby's use of the phrases, *"same worksheet*, *same routine*, and *same every single day"* indicates a noticing of practices designed for regulating student engagement in mathematics. It is interesting to note how the body "knows" spaces, places and learning as Abby expresses a bodily response to the structure, through her use of the words *"cannot sit"* and *"pace."* Theoretically speaking, the body plays a key role our understanding of the world as Foucault (1984) states, "the body is the inscribed surface of events…it is the body that bears and manifests the effects of regulating discourses in its gestures, its postures, but above all its habits (p.83). Thus, the purpose of regulating discourses is to produce "docile bodies" that have been made submissive by behavioral

control (Foucault, 1979, p.172). Abby's bodily response can be interpreted as a form of resistance to the operating structure by way of rejecting the normalized discourse of sitting during mathematics learning and doing the same routine day after day by pacing in the back of the room. What is produced from this situation is that Abby's body "knows" that the current structure marginalizes student participation thereby limiting understanding of mathematics. Abby's bodily way of knowing is also consistent with numerous studies have indicated, such instructional models (i.e., described by Abby) do not appear to be an efficient way of establishing mathematical understanding (Skovsmose, 2004).

Furthermore, Abby's perceptions are consistent with the equity literature. As Aguirre and colleagues (2013) explain, "equity does not mean that every student should receive identical instruction. Instead, equity demands that responsive accommodations be made as needed to promote equitable access, attainment, and advancement in mathematics education for each student" (p.43). In Abby's statement, *"the schedule itself is not supporting every single learner,"* shows her recognition that the structure is preventing students from being seen as individuals, thus not allowing responsive accommodations to be made. She has established a discourse for teaching and learning mathematics that involves students having *"opportunities to voice opinions and to discuss their thinking"* and seeing students *"as individuals* along with *embracing their different learning styles."* The current structure does not afford opportunities for students to be seen as individuals nor for their voice to be heard.

Teacher candidates often position themselves in relation to the discourses operating in the methods course (Walshaw, 2004). During field experiences other forms of discourse often come into play through normalized practices operating in the elementary school environment. In some ways these institutional discourses confirm teacher candidates personal discourses and at other times they contradict them. This is true for Abby as she explains how her learning in the methods course shaped her expectations as to what she should see in the field.

> *You set our standards so high on what we could see in the classroom and we get there and we are very much like this is not equitable-I do not like this. And it's like they [mentor teachers] could have been teaching for five years and we are coming in here as first years totally judgmental just in the sense that we are already so defensive and protective over our students that we don't even know and seeing the structures of the classroom that hasn't grown for the 21st century and hasn't grown with the idea of supporting your equitable opportunities for students.*

Abby's use of the phrase, *"you set our standards so high on what we could see in the classroom,"* can be seen as evidence as to the influence of the methods course upon her expectations for the teaching and learning of mathematics. These competing discourses might cause Abby to experience *nepantla* as tensions arise from this power relation. Abby, by way of her own use of the words *"totally judgmental"* makes judgments about structures of the classroom working against equity. Her use of the phrase *"structures of the classroom that hasn't grown"* can be read as her recognition of how the classroom structure limited students' opportunities for learning.

One way to open up Abby's experience is to look for what is being produced within these power relations. Foucault can provide insight into this, as he contends subjects come to understand themselves in relation to others and use knowledge

constructed within relations and practices of power to transform themselves. This is evident by Abby's use of the phrase, *"so defensive and protective over our students that we don't even know."* These words might be read as newly acquired knowledge of her role as a teacher, which would require her to be a protector of students. Abby further confirms this new knowledge from a statement made later during her interview as she was asked where does she see herself going with the ideas she learned in the methods course and she responded:

> *I see myself being the teacher that principals are either going to love or hate because I am going to be challenging them in every way possible, I want that 110%, I want that integrated equitable classroom.*

Her use of the phrase, *"challenging them in every way possible,"* can be considered as way of resisting or destabilizing the institutional practices that structure mathematics and marginalize students. This *"challenging"* can be seen as Abby's way of defending and protecting students from inequities. Theoretically speaking, Foucault (1984) insists that knowledge is not made for understanding; it is made for cutting (p.88). This "cutting" can be seen as an activity used to destabilize or resist what appears to be fixed truths established through normalized institutionalized practices (Jackson & Mazzei, 2012). For Abby, this "cutting" appeared in the form of her future commitment to challenging inequities. Her future action of *"challenging"* can be seen as a way of her exercising power as Foucault (1980) describes that power is not just exercised on individuals but they are vehicles of power as it is always moving and circulating within the practices of people.

Operating classroom structures might present themselves as a hindrance to implementing newly acquired discourses for teaching mathematics for some teacher candidates. These structures can be seen as what Foucault (1979) calls as a form of *disciplinary power* that works to regular behavior. Thus for teacher candidates, the power of the classroom structure might also regulate what practices they are able to implement. For Olivia, structure of her field experience classroom was a source of tension as it presented itself through the inability to implement the ideas and practices learned in the methods course. She describes a desire to apply what she has learned and expresses concern about her ability to retain her learning.

> *So I guess it is just hard to implement these ideas, I wish that I was able to use these ideas right now while I'm learning them - to make them stay stronger in my brain but by the time I'll have my own classroom and have the ability to do it I'm afraid that these will be kind of pushed back and you know maybe some day I will think about one or two but I won't think about maybe all of them like I am now.*

The lack of being able to apply learning in institutional spaces can produce concern for teacher candidates' future ability to teach mathematics in an equitable manner. Olivia's statement, *"I wish that I was able to use these ideas right now while I'm learning them,"* can be interpreted as a realization that she does not have power, in this situation, to practice her newly acquired discourses for teaching of mathematics. Additionally, Olivia's use of the phrase, *"I'm afraid that these will be kind of pushed back,"* can be read as a genuine concern that she may not be able to readily access and apply her newly acquired discourses when she becomes an inservice teacher. Additionally, her statement, *"to make them stay stronger in my brain,"* can be seen as her recognition that in order to internalize practices she needs to immediately apply them.

According to Foucault (1984), power produces knowledge and truths. For Olivia what is being produced is an honest concern for her being about her immediate need to apply learning and the very real impact of being restricted from doing that may have upon her inservice teaching.

Like Abby and Olivia, the structure of Camryn's field experience classroom was problematic and created tensions because it conflicted with her personal discourse regarding teaching mathematics. Camryn has constructed some personal discourses for teaching and learning of mathematics from the methods course such as, students need to *"see themselves in the math" and "should learn something about the world around them as math is totally something that helps explain the world around you."* Furthermore, she is *"really convicted"* by the idea of teaching mathematics for social justice in that *"you can build them [students] as people."* Camryn describes this struggle to change the current structure of the classroom within this power relationship.

> *It was hard sometimes given the resources that my teacher provided. She would give me kind of a lesson out of the book and, especially that first time, I didn't know does she want me to do the worksheets because that is basically what her lessons consisted of whereas let's go through the worksheets together and here's your homework so I kind of went out on a limb to make things more interactive and individual for students…like bring themselves into it [the math lesson].*

The institutionalized structures established in classrooms can make teacher candidates feel restricted in what they can practice and implement. These spaces can leave teacher candidates feeling forced to fall in line with those established structures thus surrendering their power. For others, these structures can cause teacher candidates to see the possibility of freedom by exercising power through resistance. In Camryn's use of the phrase, *"so I kind of went out on a limb,"* can be read as a form of "cutting" (i.e., a

resistance or destabilizing) of the normalized classroom practices that are operating in her field experience classroom. Theoretically speaking, Foucault's notions of *power/knowledge* can help provide insight into Camryn's power struggle. For Foucault (1979, 1984) power is not always negative and relations are not always of domination, rather power can be productive and produce forms of resistance to domination, which in turn produce new truths that can make inequity reversible. Power's productivity implies the possibility of freedom so teacher candidates can contest inequity encountered in institutional spaces. For Camryn, this "cutting" (i.e., her going *out on a limb*) works to produce a new sense of agency for her-one where she is a vehicle of power (i.e., having freedom) capable of redefining the current structure of going through worksheets and doing homework into one that is more socially just that affords opportunities for students to see themselves in the mathematics.

Struggles with positionality. Teacher candidates are in a unique position as they charged with the responsibility of planning lessons, enacting those plans and assessing student learning all the while lacking the full credentials to operate as legitimate members of professional teaching community. Their positionality can be a source of tension for teacher candidates as they negotiate their responsibilities under the supervision of a mentor teacher and the institutional norms established in the schools in which they are placed. This is true for Matt and Abby, as they both experienced struggle and frustrations in their lack of agency and power due to their position as teacher candidates.

Matt describes a lack of agency as he feels he is prohibited access to information that will help him teach mathematics in an equitable manner.

> *Something frustrating to me is coming into a school and not having access to the information I need to teach successfully. So you're coming in where like you're not the actual teacher, which is totally fine, but we talk about how you need to understand your student's culture and backgrounds and know where they're coming from. So if you don't know their home life or if you don't know where they are coming from it's really hard to try to bring a truly equitable lesson into play if you don't completely know your students and where they are coming from. There's a lot of information we aren't allowed to look at I think.*

His statement, *"you're not the actual teacher* and *there's a lot of information we aren't allowed to look at,"* can be read as his acknowledgement of his position as teacher candidate. The struggle for Matt is that he feels he needs access to information about the students he is responsible for teaching. This is evident by his statement; *"it's really hard to try to bring a truly equitable lesson into play if you don't completely know your students and where they are coming from."* Matt's feelings are consistent with the literature on culturally relevant mathematics teaching, which calls for drawing on students' lived experiences, social, racial, cultural and linguistic identities is critical for mathematics learning (Aguirre, et al., 2013; Delpit & Howard, 1997; Gay, 2009; Gutiérrez, 2001; Leonard, 2008).

Likewise, Abby is troubled by her position in her field experience classroom. She tells of the internal struggle she faced being the "new" person in the classroom and not being able to share her ideas about teaching mathematics in an equitable manner.

> *The first time I was in the classroom watching them work through just a regular multi-step multiplication problem and watching some of the students have misconceptions about what steps needed to come when and the teacher just went back to what the book said and said these are the steps you need to take. This didn't address their needs. So at the time being new you didn't have a voice of what could have been changed and even now watching students do the correct work and having the answer being correct but not in the black and white correctness that the teacher wants it so it's marked incorrect. But it's not*

> *incorrect it was correct it just wasn't taken to the step that it needed to be taken to – to they way teacher wanted it to be.*

Abby's statement, *"being new you didn't have a voice of what could have been changed,"* can be interpreted as her awareness of her positionality as teacher candidate. For Abby positionality was problematic because it restricted her agency to change instructional practices that she feels are marginalizing student learning of mathematics.

Theoretically speaking, Matt and Abby might be experiencing *nepantla* (i.e., literally meaning "neither here nor there") as multiple realities arise in regard to their positionality as teacher candidates. Ironically, Matt and Abby are expected to teach students and be evaluated on their teaching ability like fully credential teachers yet at the same time they are really not teachers as they face barriers to engaging as legitimate members of the teaching community. These relations (i.e., between the supervising mentor teacher and the teacher candidate) of power can be quite complex as the very thing mentor teachers seeks to empower and help develop knowledge and skill for teaching yet at the same time participate in act that seek to depower teacher candidates. For Matt, his was restricted access to what he believed was critical information to teaching students mathematics equitably. For Abby, she felt her voice was silenced by the institutional practices operating in her classroom. What is produced from these relations that these two teacher candidates are involved is the knowledge that their positionality can entail multiple realities of being a teacher yet at the same time not being a teacher.

***Struggle with language and actions*.** The language and teachers uses and actions teachers engage in can often present hindrances for student learning. Teaching practices can regulate and control behaviors thereby marginalizing some students. Teacher

candidates can be acutely aware of instructional practices employed by their mentor teachers (Britzman, 2003; Walshaw, 2004). Thus, is the case for Camryn and Chelsey, as these teacher candidates describe their observations of the relations between teachers' words and actions and student learning.

Camryn describes a situation where she observed her mentor teacher taking a conceptual lesson (i.e., using the representation of comparison bars to find difference for subtraction situations) and using specific language that controlled student thinking.

> *And the teacher would say what do you do first? And the students would say you add or you have to find this and the teacher would say no, no, no what did you have to do first before you do anything else. She was getting at that you have to draw the bars first in order to get the answer. She even made the comment you will get the right answer if you do this every time. So that makes students feel I need to do this to get the right answer.*

Camryn's retelling of the observed teaching episode can be read largely as a noticing of productions from discourse. Her account is consistent with what Foucault (1979) calls *disciplinary practices* (i.e., practices used to regulate behavior). The use of sequential language, (e.g., *"what do you do first"* and *"before you do anything else"*) in the teaching episode is used to regulate and control how the students approach the problem by telling them what to do and when to do it. Her use of the phrase, *"that makes students feel I need to do this to get the right answer,"* can be seen as her insight into the effect such regulating discourses have on student learning. Camryn continues by telling her experience helping a student directly after the whole-class teaching episode and the impact it had on this particular student.

> *He was so concerned about getting the numbers in the right spots and I asked what is the question asking you and he was like oh do I need to put the 12 here. He was looking for the word and ignoring the context the word was used in and*

> *so coming back to the idea of power in the classroom and the language that we [as teachers] use is so powerful. It seems like they stop thinking about the math anymore and they are only thinking about getting the right answer, using the comparison bars, which is only a tool to help students conceptualize the problem. You need to teach in a way where the students can explore, not controlling their thinking.*

Observations of teaching practices illustrate how teacher candidates' notions about teaching mathematics get produced. For Camryn new knowledge was produced from this experience about influence of teacher language as evidence by her words *"the language that we use is so powerful."* Thus, as a result she now sees that *"you need to teach in a way where the students can explore, not controlling their thinking."*

Chelsey describes a tension between what she observes the mentor teacher saying and what she sees her mentor teacher privileging. She reflects on a situation from her field experience where her mentor teacher tells students that they can solve their word problems using different methods but then she privileges the one *"standard"* way.

> *Right now we are doing word problems and she's like yeah you can do it this way and this way and even this way but we're going to go back to the standard way now. She talked about it [the other methods] for like 30 seconds. And so when I'm trying to help the students understand word problems and how to solve them and also write them. I say, "Hey why don't we use pictures?" Because I knew they were more visual. The students were like, "We can't do it that way it has to be this way!" And I said, "It's okay she said we could do it other ways." [Students replied] "No, she didn't."*

Chelsey's use of the phrase, *"it's okay she said we could do it other ways,"* can be interpreted as her understanding for the need for students to use multiple strategies to solve a problem. Her belief is consistent with the mathematics education research in that students need to be able to solve problems flexibly by drawing on multiple solution strategies (NCTM, 2002, 2014; NRC, 2001).

In this experience, Chelsey struggles to help students use another method based on her knowledge of them. However, her efforts are stopped short due to the students' perspective of what the teacher expects. She continues with her reflection of the teaching episode.

> *Then I was like, if I talk about the standard way and barely touch on all those other ones then the students will think that's the only way to do it–that's only correct way and those others are just swept under the rug. But if I take an equal amount of time to go through each one then the kids would see it's all right to choose whatever one they like and there's not one way that is the correct way.*

Chelsey's words can be interpreted largely as an awareness of the impact of privileging one method and marginalizing other methods. Her use of the phrase, *"if I take an equal amount of time to go through each one,"* can be seen as her way of trying to offset the marginalization of other methods thereby creating equity.

For Chelsey, what is now being produced through observation of this teaching episode is new knowledge of implications that teacher privileging can have on students as made evident through her words.

> *You don't fully understand the impact of your teaching on each student until you see it or you're in the classroom and you see a child struggling because they think the teacher's way is the only correct way. That was just really impactful for me.*

For both Camryn and Chelsey, power/knowledge is more of an indirect experience as they directly observed the ways in which power played out between teachers and students. However, being a close observer/participate of such relations afforded them openings to transform their knowledge of teaching mathematics. Theoretically speaking, Foucault (1984) contends that knowledge is produced in one's struggle to construct the meanings of one's actions, thoughts, and feelings. Both Camryn

and Chelsey now recognize the how teachers' language and actions can regulate and control student learning thereby producing inequities in the teaching and learning of mathematics.

Struggles with student concerns. During field experiences teacher candidates' personal discourses can come into conflict with intuitional practices operating in their classrooms. Tensions might arise as teacher candidates interpret observed practices as being inequitable for students. Some teacher candidates felt a call to action as a means of remedying the perceived inequitable situation. Matt, Makenna and Olivia express concerns about students in their field experience classrooms in which they perceive as inequitable for students based on their new discourses brought about from their learning during the methods course.

Matt shares a concern about the students' mathematics learning that he has observed during his time in his field experience classroom. He explains, *"I know my students need to be further along in multiplication and division."* Note that Matt feels responsible for catching students up as evidenced in his words *"I feel like the responsibility is on me. So…it's what am I going to do to catch these students up?"* He continues by retelling his observations of the classroom practices during mathematics.

> *What I've seen so far–and I'm not going to follow it–is that you give students a worksheet and so they…well are supposed to fill it out when they already know that you're going to put the answers up on the Smart Board so then they just copy problems and then they hand it in and look like geniuses so they all get 100% proficiency.*

Tensions might also manifest in the teacher candidate's observed method of instruction—and sometimes these instructional methods can be read as inequitable for students. Matt explains:

> *They aren't struggling they aren't thinking through what they're doing they aren't even doing the math. There's no learning really occurring–there is no way they can understand anything conceptually so it's like what are we going to do to get these students back to where they need to go.*

Matt's use of the phrase, *"they aren't struggling, they aren't thinking through what they are doing* and *there is no way they can understand anything conceptually,"* can be interpreted as his observation that students are not engaging in productive struggle which is an important component for developing a deep understanding of mathematics. His noticing is consistent with the research from the NCTM (2014), which states that effective mathematics instruction supports and engages students in productive struggle as they grapple with mathematics ideas and relationships. Matt's use of the words, *"I'm not going to follow,"* can be read as a form of resistance to the observed practices, as he is caught up in power relations between him and the perceived practices of his mentor teacher. One way to interpret Matt's actions is that these perceived inequitable practices could cause teacher candidates to see the possibility of freedom by exercising power through resistance. As Foucault (1981) theorizes, "there cannot be relations of power unless the subjects are free" (p.12). For Foucault, power can be productive and produce forms of resistance.

Matt's strong feelings of responsibility for the students creates tensions and causes him to ponder, *"if I take every single math lesson for the rest of the time I am here I think I maybe I can give my teacher different ways to present the material too."* His

words can be interpreted largely as an exercise of power through the "cutting" or destabilizing of the normalized classroom practices by his perceived ability to influence his mentor teacher's practices.

Makenna expresses her concerns about students being pulled out of the regular class during her field experience.

> *I think that in my field right now, its been interesting for me because our students, I think there might be a half hour where they are actually all in the room. Other than that they [other teachers] are constantly pulling out students which I think weird for me to see because then I'm wondering how we, as teachers are actually teaching them equitably.*

Her use of the phrase, *"I'm wondering how we, as teachers are actually teaching them equitably,"* can be interpreted as her expressing a genuine concern about the type of mathematics instructions some students are receiving. This situation is problematic for Makenna, as she explains that when she inquired about how the students were being taught mathematics the reply she received was that the students were receiving *"intensive instruction."* She brings her telling of this experience to a close with a final thought, *"so that's been interesting how I am trying to learn to teach each student and they are getting pulled out so I can't because I don't really know them."* Makenna's final remarks indicate that she might be experiencing *nepantla* as multiple realities of learning to plan instruction for students manifest and become a source of tension. She has established a discourse for equity in the methods course that involves meeting the *"needs of each student."* Therefore, she indicates that the absence of certain students does not allow for her to really get to know them, which is needed for her discourse of what it means to provide equitable mathematics instruction.

Makenna reflects on a troubling situation that occurred during her field experience during her post-interview. She tells of a student in her third grade class that *"no one takes the time to work with him"* and is often *"dismissed"* because he is very low. As she continues to describe the situation her voice begins to crack as she states, *"It's not okay! I would help him read the math quiz because if he can't read the math quiz of course he's not going to get the math right."* This statement can be interpreted as Makenna's understanding as to what truly needs to be assessed (i.e., mathematical understanding not reading skills). She continued explaining that her mentor teacher accused her of helping him solve the math problems because the student got all questions but one correct, however, she responds to her mentor teacher's accusations imploring, *"I swear to you all I did was help him read it!"* Makenna is caught up in a power relation between her and her mentor teacher that attempts to position her as unethical. Her lack of agency left her unable to make impact for students.

When asked how her understanding of equity has deepened since her four-week field experience, Makenna responds with the final words:

> *The one student who got brushed by–I was like that doesn't happen that often think. Really it does. I was naïve enough to think that oh yes it's an issue but not that bad! But it really is because the entire time I was there she was kept saying oh he's low and she wasn't even trying to teach equitably to him.*

Observations of teaching practices illustrate how teacher candidates' notions about addressing equity concerns in mathematics in institutional spaces get produced. For Makenna the realization that inequities are very real and they do occur often was produced as a result of this experience.

Olivia describes an inequitable situation from her field experience where she notices three to four low-level students continued lack of participation and perceives her mentor teacher as not being responsive to the issue. She shares her concern for this student and her struggle to engage him in mathematics.

> *This one student in particular that troubles me and every time I go to help him, he's like well I don't like math, so I don't want to do it, and he keeps circling back to that he isn't good at math, he doesn't like math.*

Tensions may arise as teacher candidate recognize their inability to remedy in equitable situations–and sometimes it may manifest as uncertainty in how to apply learning from their methods course. Olivia explains:

> *I know we talked about changing the identity and changing them to think that anyone can do math like through the problem solving lessons and the discussions but in a class that's how it is where they teach it the way they do. How do I get him to believe in himself?*

Later in the interview, Olivia's thoughts abruptly return to this student and she shares one idea for helping engage him in mathematics.

> *That's the one student that I was thinking about that maybe if I write his names in the problems I can help him. Just making things more relevant for him and learning more about his interests and change the setting of a problem.*

This can be seen as her drawing on her personal discourse of making mathematics relevant for students as a way to interest them in a problem–as Olivia's ideas are congruent with the literature on culturally responsive practices that call for making mathematics curriculum relevant to students' lived experiences as a way towards making mathematics instruction responsive to the identities of students (e.g., Aguirre et al., 2013; Gay, 2000; Ladson-Billings, 1994, Leonard, 2008).

For Matt, Makenna and Olivia equity concerns for students' mathematical learning manifested through power/knowledge relations and practices within institutional spaces. All of the teacher candidates try to remedy their inequitable situations in various ways. Resistance and the cutting of normalized practices were production for Matt. Makenna's concern may have had her experiencing *nepantla* as she negotiated the normalized practices in the classroom and relations of power produced knowledge of very real inequities operation. For Olivia tensions may have manifested as she struggled with ways to remedy an inequitable situation for a student.

Summary of tentative manifestation #2: Inherent tensions in power relations. Power relations between teacher candidates and their mentor teachers often caused them to experience *nepantla*–where tensions manifested as candidates negotiated multiple realities and competing discourses, normalizing practices operating in institutional spaces. These manifestations appeared through struggles with the authority of textbooks, structures and methods operating in the classroom, positionality, use of language, and concerns for students in the classroom. Teacher candidates were shaped by their experiences. For some candidates' knowledge manifested in the form of "cutting", resistance, disruption of normalized practices and discourses operating in field experience settings. Teacher candidates constructed new regimes of truth as to what it means to teach mathematics equitable. New truths about themselves and their subjectivities (i.e., how they see themselves in relation to the subject) were produced.

Tentative Manifestation #3: Knowing Students

Knowing students and utilizing such knowledge in the teaching and learning of mathematics is considered an essential component in the mathematics education literature on equity (e.g., Aguirre et al., 2013; Gay, 2000; Ladson-Billings, 1994, Leonard, 2008). Not only does this require knowing students' mathematical thinking to plan instruction, facilitate discussions and assess mathematical understanding but it also entails knowing students' background (i.e., culture, community, language, gender, social class, race) and prior experiences to make mathematics learning relevant so that students can make connections to their lived experiences. "Knowing" students is produced in different ways. For some teacher candidates, such "knowing" is produced as a mere retelling or misapplication of the discourses established in the methods courses. For other teacher candidates, "knowing" is produced and transformed in some way as it is brought into being through the teacher candidates' lens and experiences.

Teacher candidates often described this as knowing information about students, building relationships with students and building the identities of students. However tensions persist for teacher candidates around what knowing students means and what knowing students entails. Knowledge of students was produced in multiple ways, which include: concern around not knowing students enough to design mathematics tasks, othering students (i.e., position students as different from themselves), developing negative narrative, and seeing the peculiarities in students. In the following section examples of knowing students is discussed and supported with excerpts from data collected.

Initial tentative manifestation: Concerns over limited knowledge of students.

Armed with the discourses around knowing students established in the methods course, teacher candidates come face-to-face with the realization that their "knowing" of students is limited in many ways. This realization often produces feeling of apprehension and nervousness for teacher candidates.

Olivia describes her struggle of not knowing students enough to plan "worthwhile" tasks.

> *I don't feel like I know what fourth graders are supposed to know or their learning progressions for the whole year so I don't know where they are at or what the problem should include.*

Tensions might persist for teacher candidates over their limited knowledge of mathematics understanding for a particular grade level. Olivia's use of the phrase *"supposed to know*" can be read as her belief in a certain mathematical knowledge base that defines particular grade levels. Olivia continues on stating that she has *"very little context*" of her students in her field experience and tells of a student, in which she created a "worthwhile" task for and it ended up being too easy.

> *So that was my problem I didn't know the threshold of what the students could handle and what would be their using but confusing area and so I gave her a problem that was too easy.*

Lack of knowing students' mathematical knowledge can be a barrier to creating problems that afford students' opportunities to go deep with mathematics (i.e., by engaging students in high cognitive demand tasks that support and strengthen mathematical proficiency). Olivia's understandings about the type of mathematics tasks (i.e., that she refers to as "worthwhile") that students should be engaging in are in keeping with the

mathematics literature defining what constitutes effective mathematics tasks (NCTM, 2014; NRC, 2001; Stein et al., 2000) and the equity literature which calls for creating opportunities for students to go deep with mathematics (i.e., engaging students in worthwhile tasks) and drawing on students' knowledge and experiences (Aguirre et al., 2013). Nonetheless, one thing that is being produced through Olivia's experience are tensions of not knowing the mathematical understandings of students to create mathematical tasks that engage students in deep mathematical learning.

Likewise, Camryn expresses her concern about not knowing students and how that impacts her ability to create a "worthwhile" task and implement a class discussion. She explains:

> *I've seen good examples, like when I read the vignettes and I watch the videos, but when it comes to me having to create it that's where I get stuck still. I think like I can make a worthwhile task but it's probably because I don't know my students as well yet to be able to pull in their experiences and their lives into a math problem is still hard from me because I don't know them that well. I think this is the main thing, or even supporting a discussion, I think I can plan out how its going to go but I'm nervous on how to implement it into the classroom.*

Tensions may arise as teacher candidates compare their cognitive understanding of practices and their actual ability to put such practices into action with students. Camryn's words *"I've seen good examples"* can be interpreted as her cognitive understanding of creating a mathematics task, however, her belief of not knowing students well enough creates tension. She recognizes that students' lived experiences need to be brought into a task to be considered equitable, which is supported by her use of the phrase *"pull in their experiences and their lives into a math problem."* Camryn's view reflects the literature in that equity-based mathematics teaching necessitates that educators "intentionally tap

students" knowledge and experiences–mathematical, cultural, linguistic, peer, family, and community–as resources for mathematics teaching and learning" (Aguirre et al., 2013, p.43).

Camryn continues describing how she is *"pulling in"* knowledge of her students' experiences and tying those experiences into the mathematics lessons. Yet, she questions whether her use of the students' common experiences is enough to *"personally"* draw students into the mathematics. Camryn explains:

> *I know that they have been doing this walking to school this month, so pulling that in and things like oh how many ways could we march, like kind of in an array that way, so pulling in things that I know that they are doing. Or I know that they just went to the [museum] so I could pull in something about that in with math. My lesson for Monday is about symmetry and congruence so I could even bring in Native American cultural prints that maybe have symmetry in them or like tie those pieces together. That ties in things their doing in school together, but does that tie them personally? And that's where I'm stuck because I feel like I still don't know them as well. But I'm also trying to figure out ways to include multiple entry points and ways that students can have multiple representations, so maybe they're creating something that's symmetrical, a shape or pattern using the pattern blocks or something that they can bring themselves into.*

Camryn's use of the phrase *"but does that tie them personally"* can be seen as her critically reflecting upon the meaning of *"pulling in"* students into the mathematics. One way to interpret her thinking, is that bringing students into the mathematics needs to move beyond common experiences that is it needs to connect with students at a deeper level–one that gets more at their personal identity. This thinking is further made evident through Camryn's comment about figuring out how to include multiple ways for students to enter and represent a problem–as this can be seen as ways at getting to students connected with mathematics at a personal level. Affording students opportunities to draw

on their own ways of thinking (i.e., through the use of multiple entry points and representations) and valuing their multiple ways of thinking, can aid the development of a student's mathematical learning identity (Aguirre et al., 2013; Boaler, 2002; Martin, 2000, 2009). Camryn's use of the phrase "*they're creating something…. that they can bring themselves into"* can be read as her understanding that mathematics thinking needs to value personal construction by drawing on practices that would afford students such opportunities. This is supported by the equity literature in mathematics, which calls for affirming students' mathematical identities (Aguirre et al., 2013). Moreover, Gutiérrez (2012) insists that the mathematics classroom should not be a space where students need to check their identities at the door.

Another way to read this experience of Camryn's is that she maybe experiencing *nepantla*, as multiple realities of knowing and not knowing students occur and begin to contradict one another. There is a type of knowing that is made evident through Camryn's statements regarding knowing common experiences that her students have shared together, while at the same time, not really knowing if students will personally connect to those experiences. *Nepantla* encapsulates ideas of expected contradictions that twist and change the normal discourse. The discourses produced from the methods course call for teachers to affirm students' identities by drawing on multiple resources of knowledge. However, such discourses were complicated when Camryn wondered if these actions alone would allow her students to personally connect with the mathematics.

Theoretically speaking, Anzaldúa (2002) contends "nepantla is the zone between changes where you struggle to find equilibrium between the out expression of change and

your inner relationship to it" (pp.548-549). Camryn's questioning of whether she has done enough to "*tie"* the students personally to the mathematics is illustrative of her grappling to find balance between the normalize discourse and her relationship to it (i.e., meaning that a teacher might not be able to fully be able create contexts for tasks that personally connect to all students).

Initial tentative manifestation: Understanding students' identities. One significant goal in the literature on teaching mathematics in equitable ways involves understanding the role and impact that students' identity has on the teaching and learning of mathematics (Aguirre et al., 2013). This means knowing what cultural, linguistic, racial, gendered resources students might bring to the classroom and what dispositions they may hold toward doing mathematics to build positive student identities for learning mathematics.

During Piper's interview, she explains how she needs to have knowledge of students' culture to build relationships and plan instruction. She has adopted discourses from the methods courses that have caused her to *"change her opinion on teaching."* She states that *"identity is what they [students] create but also their relationships around them"* and continues by explaining that relationships shape identity formation through acceptance and valuing of other's ideas. However, Piper attempts to articulate that learning mathematics involves something *"bigger"* than building students' identities by accepting and valuing students' ideas. She explains:

> *I see math, even writing lessons or teaching math, in a different way from this course. I tweeted something from a reading in class where students saying, "We are mathematical." This is bigger than multiplication and division, it's just bigger, everything is bigger, like reading is bigger. It's implementing it into their*

> *lives. I guess it's like real things they can apply and care about and things they are interested in. I guess it's applying us…people are mathematical. It is applying themselves into mathematics.*

Her use of the phrase mathematics is *"bigger than multiplication and division" and "people are mathematical"* can be read as her recognition that students are capable of making sense of mathematics. Students have mathematical ideas, experiences, and individual ways of thinking about mathematics and this is bigger than just delivering mathematics content to students. In other words, Piper's words can be seen as her positioning students to be mathematically knowledgeable aligns with the literature on teaching mathematics that positions students as competent sense-makers capable of co-constructing their overall conceptual understanding, and coming up with multiple solution methods (Hiebert et al., 1997; NRC, 2001, NCTM, 2014, van de Walle, 2016).

> *I am like still in the process of learning about teaching and things that are uncomfortable, let's say like race, in our classroom. I just need to not be afraid of that and try to embrace it as a positive. Sometimes I think we get scared because that instead of I don't understand because…I don't know…because I'm not them and I don't know their background but I need to try to think of it as a positive challenge in my classroom and not just as there's so much diversity in my classroom what am I going to do? I think it's like an automatic mindset, it's just like oh I don't know anything about them or I don't know where they come from but its like I'll get to know them and then use it in a positive way not oh my gosh this is what I have to do its like what you get to do.*

Tensions can arise as teacher candidates reflect upon what it means to know students whom are economically, linguistically, culturally and racially positioned differently from themselves. This excerpt details an honest reflection about an uncomfortable topic (i.e., race) as Piper admits that she is still in the process of learning. Her use of the phrase *"not be afraid of that"* can be seen as an expression of fear with regards to encountering race in the classroom. Confronting such thoughts are important

for teacher candidates as Martin (2006) argues that the teaching and learning of mathematics is a racialized experience. One way to read Piper's words is that she knows that students are mathematical sense makers however she is afraid of teaching students who are racially different from herself. She is concerned about reverting back to her *"automatic mindset"* that views students racially different from herself from a deficit perspective, which is evident by her use of the phrases *"I don't know anything about them," "I don't know where they come from"* and *"I think we get scared."* Her use of the pronouns *"them," "they"* and *"we"* might be seen as the process of othering and portraying herself as the center of focus and "the other" at a distance. Her use of the word *"try"* can be seen as tentative attempt to reframe her *"automatic mindset,"* which views students racially different from her as problematic. Piper's use of the phrase *"I'll get to know them and then use it in a positive way"* can be read as a tactic, or a strategy, to act upon the discourses learned in the methods course, which calls for drawing on the backgrounds of students to help make mathematics relevant.

Foucault's theory on power/knowledge can offer a way to read this experience. For Foucault (1987) power is circulated in and through discourses. Piper views students positioned racially different from her as problematic. Positioning racial diversity as problematic can be considered what Foucault (1972) calls as a *dividing practice*, which is making judgments about people based on categories and differentiations that we have established. Thus, such dividing practices are tremendously influential in controlling how we identify and categorize people – ultimate influences the discourses we construct about others.

She admits that she needs to *"try"* to reframe her discourse (i.e., *"see it as a positive").* However, her othering language puts the focus on herself as the center of things. Piper's way of reframing her discourse is through her act of getting to know students and using that knowledge in mathematics instruction. She is attempting to gain some sort of agency over an uncomfortable situation (i.e., teaching students racially different from herself) by regulating the "knowing" of students as an activity she controls. Piper's thoughts help to explore how cultivating equity-mindedness manifests. These thoughts might be read, to some degree, as misguided attempts to remedy an uncomfortable situation by applying a culturally relevant practice (i.e., using knowledge of students in mathematics teaching) without interrogating or deconstructing how these deficit framings occurred.

Another way to read this experience is through the lens of *nepantla*, as multiple realities that contradict begin to manifest for Piper. In this case, she expresses an understanding that students are competent sense makers of mathematics yet at the same time she indicates that she is in control of the "knowing" of student. Her use of the phrase *"I'll get to know them and use it"* can be read as her positioning herself in control of extracting knowledge about students and getting to employ that knowledge. Whereas, her language *"people are mathematical"* and *"applying themselves into mathematics"* can be seen as her positioning the "knowing" within students and students in control of employing it. For Anzaldúa (1987) people must first begin to think differently about something before they can act to change a discourse. This might be a way to interpret what is happening to Piper while in *nepantla*. She is beginning to think differently about

one way of "knowing" students (i.e., mathematically) while still grappling with another way of knowing (i.e., racially). Theoretically speaking, Anzaldúa (2002) contends "nepantla is the zone between changes where you struggle to find equilibrium between the out expression of change and your inner relationship to it" (pp.548-549). For Piper might be beginning to see that there is a mathematical way of "knowing" students and a racialized way of "knowing" students (i.e., understanding how students' racialized experiences impact their ways of participating and knowing mathematics). Hence, teacher candidates may reside in *nepantla*, by embracing uncomfortable spaces and grappling with multiple realities as they are learning what it means to be equity-minded for the teaching and learning of mathematics.

Attempts to act upon newly acquired discourses from the methods course might lead teacher candidates to make assumptions and misunderstand situations. Such misinterpretations could have the potential to perpetuate myths about students' identities. Lexi recognizes the impact of students' identities within the learning of mathematics however she makes some assumptions that could perpetuate inequities. She explains:

> *When we talked about bringing the students' personal identities into like those correlate with their math identities, which I definitely noticed and that wasn't something I was aware of before, as the students would talk about… I guess one thing specifically they would come in one day and be like super on and then be like do everything you ask and then the next day if they were having a bad day and their was something going on at home, it definitely reflected in their math and then so seeing that and like learning about their home life I guess I pushed myself more to figure out what was going on in their home life just to establish that relationship and to understand why they are maybe not focused because it might not be because they can't do it but because its something going on at home and just some of them how I could definitely tell they learn differently based on one student came from a single parent household who he was the head of house he had three younger sisters so his learning was just very different then one of my students who had two parents home all the time who help her homework. She just*

> *gets it right away – it comes really easy for her. Whereas, the student in the single parent household kind of has to teach himself and like learn through it. So it is just really interesting to see how their home life came into the classroom and like how it affected their learning styles.*

Lexi describes how she *"pushed"* herself to figure out what was going on in her students' home life. This can be seen as an attempt to apply a discourse from the methods course regarding being responsive to students by understanding their backgrounds and experiences. However, when Lexi describes how one of her student from a single parent household learning *"was just very different than one of my students who had two parents home all the time"* and she expresses that this student *"has to teach himself and like learn through it."* Both of these statements can be interpreted as an over simplification of student mathematical ability and family structure. What is actually being produced from this situation is a negative narrative about single parent households based on her observations. Essentially, in Lexi's efforts to connect with students, she relied on a distilled version of students' home situations and accepted a static notion of what it means to be from a single parent household. Whereas, Martin (2000) explains, that even if students come from backgrounds characterized by poverty and limited resources, they often exhibit high levels of resilience and mathematical excellence in the face of these circumstances.

Foucault can provide further insight to open up power/knowledge relations operating through Lexi's narratives about the households of students. Foucault believed that knowledge is a form of power, however, he further theorizes that knowledge can be gained from power. Foucault (1977) states:

> Knowledge linked to power, not only assumes the authority of 'the truth' but has the power to make itself true. All knowledge, once applied in the real world, has effects, and in that sense at least, 'becomes true.' Knowledge, once used to regulate the conduct of others, entails constraint, regulation and the disciplining of practice. (p.27)

For Foucault (2006), power becomes more efficient through the use of observation or use of the *pedagogical gaze* and its neutrality and the possibility of its gaining access to the object. It is through such observation that Lexi has acquired knowledge (i.e., gained access to the student) regarding the impact family structures have upon students' mathematical ability and learning. This new narrative or discourse about family structures now has the power to operate as "the truth" for students' mathematical ability. Therefore, new "truths" are being produced that have the power to perpetuate inequities for the teaching and learning of mathematics.

Initial tentative manifestation: Seeing the particularities of students. In efforts to get to know students by understanding their backgrounds, experiences, culture, race, gender, social class–all the things that make up their identity–some teacher candidates inquired deeply about how students make sense of mathematics. They made attempts to try to understand them in ways that goes beyond generalized knowledge and normalized discourses about certain types of students. Rather, looking keenly at the peculiarities of each situation with each student, thus, producing a transformation in what it means to "know" students. Camryn provides an example of looking beyond the normalized discourses and seeing the peculiarities of students. During her interview, she describes of

an experience of looking deeply to uncover knowledge of students to assist with mathematical learning. She explains of an experience with bilingual learner in her field experience classroom.

> *This student is Hispanic and apparently the student's parents don't speak any English and so I don't know if he has any siblings or not, but what that means for him at home, or how important he is for their role in like fitting into society. But I'm wondering…I want to know did he do the math in his head in Spanish or in English? But I did notice, I did subtraction and he was counting out loud and he was counting in English, so he's very fluent. But it was interesting because it seemed like the student had a really good grasp of what the concept was but then when it came to asking why you do it or how does that work, especially the regrouping, he didn't understand. Like I asked him and he said, "You chop the 100 to make 10." and I said, "Oh how many tens do you get when you do that?" and he said, "One." So, like not really understanding, making the connection, because you put the 1 ten here to make it 13 instead of a 3. But not understanding that you're actually taking 10 tens. So that's something I never thought to dig into, like digging into how students are really thinking about the concept and not the rules.*

Camryn's use of the phrase *"apparently the student's parents don't speak any English and so I don't know if he has any siblings or not, but what that means for him at home, or how important he is for their role in like fitting into society"* can be read as an attempt to look deeply at this particular student and understand his position in his family. It is an attempt to look beyond the fact that he has limited English language abilities as an explanation for mathematical misunderstandings. Her use of the phrase *"But I'm wondering…I want to know did he do the math in his head in Spanish or in English?"* can be seen as an attempt to determine if the errors are due to mathematical or language misconceptions. This experience caused Camryn to internalized the value of examining the thinking of students, as evidenced by her words, *"So that's something I never thought to dig into, like digging into how students are really thinking about the concept."*

Camryn further reflects upon another experience with this same student during a lesson she taught on symmetry. She explains:

> *I'm still unsure if it is the language barrier or it's something else. But I think it was the last week, we got out the geo-boards again and I asked him if he remembered symmetry and if he could make a symmetrical shape and I don't-he looked at me as if he didn't understand the word and I remind him same on both sides and he came back with this patterns and he had a diamond with triangles overlapping and the colors were symmetrical and so even beyond language-you can still have that mathematical understanding even if you don't quite have that word for it, you know? Like that was really powerful to see because, especially, he had been working…which this isn't bad, but he had been working in a kindergarten book to get him up to the level we've been working with coins and money and adding and subtracting, building the foundation with him. And I don't know, something's you don't need the exact works for. I don't know what I'm trying to say but it was powerful to see.*

Her statement, *"I'm still unsure if it is the language barrier or it's something else"* can be considered as her openness to exploring other possibilities, not just limited to language, for figuring out mathematical conceptions. In Camryn's telling, she explains how she reminds this student the meaning of symmetry and how he was able to create symmetrical shape that was beyond her expectations. Her use of the phrase, *"so even beyond language– you can still have that mathematical understanding even if you don't quite have that word for it, you know?"* can be seen as her realization of mathematical competence can be present even if language is not and that you have to *"dig"* to uncover it. Camryn's views are consistent with the mathematics education literature that acknowledges the considerable strengths English language learners bring to mathematics learning and how those strengths may go unrecognized if the instructional focus is only on the use of English vocabulary and pronunciation rather than on additional ways in

which these students are communicating their ideas through gestures, representations, and their first languages (Aguirre et al., 2013).

Camryn describes this experience of recognizing the mathematical understandings of a bilingual learner as *"powerful to see."* Her statement *"he had been working in a kindergarten book to get him up to the level"* can be viewed as recognition that this student may have been placed at a much lower level in mathematics due to his limited use of the English language. Camryn continues on in the interview reflecting on this experience stating, *"I don't know how to explain it-but like he can do the same things,"* which provides further evidence to support her recognition of his mathematical ability and understandings.

A power/knowledge reading can help provide insight into this experience. The normalized discourse in the classroom positioned bilingual learners as lacking in mathematical ability, whereas, Camryn pushed to *"dig"* deeper, beyond the surface, can be considered as a form of resistance to the normalized discourse of the fixed notion of mathematical ability of English language learners which was operant in the ways in which the classroom teacher positioned the bilingual student in *"kindergarten books"* as a means to catch him up. Such digging into "knowing" students beyond fixed notions of ability led her to uncover mathematical understanding. Camryn explains the power of sitting down and getting to know students.

> *And so it's finding out like how that student can understand it. So even if you are teaching it one way and that student's scores aren't showing… like if you tried that other way of doing it like you might see something you've never would have seen. Like I don't know that I would have seen that symmetrical, that pattern had I not sat down and talked with him and explained it in a different way.*

This experience of Camryn's illustrates the power of focusing on the peculiarities of students. Shifting to looking at the peculiarities, may enhance teachers candidates' opportunities to recognize the multiple resources and responsibilities that bilingual learners bring to mathematics learning and participation.

Summary of tentative manifestation #3: Knowing students. "Knowing" students is produced in different ways. Teacher candidates often described this as "knowing" information about students, building relationships with students and building the identities of students. Cultivating equity-mindedness may cause tensions to surface as teacher candidates figure out what it means to "know" students. This section explained the multiple ways in which knowledge of students was produced, which included: concerns of not knowing students enough to plan tasks, othering students, developing negative narratives, and seeing the peculiarities in students.

Tentative Manifestation #4: Multiplicity in Practice

Mathematics teaching is complex, as it requires teachers to have a deep understanding of mathematics content they are expected to teach (Ball et al., 2008), understanding of how mathematical learning progresses (Clements & Sarama, 2004; van de Walle, 2016) and the ability to draw on practices that are effective in developing the mathematics learning for all students (NCTM, 2014). In the methods course, teacher candidates came to acquire a discourse for teaching mathematics that includes engaging students in solving and discussing tasks that promote reasoning, problem solving and conceptual understanding of mathematics content (NCTM, 2014). The course had a focus particular focus on the NCTM's (2014) eight Mathematics Teaching Practices (see

chapter 2 for a explanation of these practices) combined with a focus on equity. Teacher candidates came to view such teaching practices through the lens of access (i.e., affording students opportunities to access mathematical ideas and concepts), agency (i.e., empowering students to see themselves as capable of making sense of mathematics) and identity (i.e., affirming and building of students backgrounds and experiences). However, tensions persist for teacher candidates as they reflected upon and began to implement newly learned practices for learning mathematics. Struggling to make sense of this new discourse for teaching mathematics often resulted in teacher candidates making comparisons to their prior experiences and conceptions of teaching mathematics as well as comparisons to practices observed in elementary classrooms. Practices for teaching and learning mathematics was produced in multiple ways, which includes: creating tasks that have multiple entry points, valuing student thinking by embracing multiple solutions strategies, posing purposeful questions to facilitate mathematical understanding and sharing multiple mathematical ideas and strategies through discussion.

Initial tentative manifestation: Multiple entry points and multiple solution strategies. In cultivating equity-mindedness, many teacher candidates latched onto the idea that mathematical tasks themselves should offer multiple entry points so that students with varying knowledge and skills and levels of confidence to engage with the task can make valuable mathematical contributions. Such tasks have the potential to open up greater opportunities for participation because they allow students to use a variety of solution methods and they have the potential to provide greater access to mathematical concepts and ideas.

It is well documented in the mathematics education literature that mathematical tasks should to be problematic, require high-cognitive demand, and do not prescribe a specific solution method (Hiebert et al., 1997; Smith et al., 2009; van de Walle et al., 2016). van de Walle and colleagues (2016) refer to such tasks as "worthwhile". In other words, "worthwhile" mathematical tasks should have multiple ways to enter and exit a problem.

Understanding of mathematical tasks was produced in various ways: realization that there are multiple ways to solve problems, tasks may present contradictions, tasks provide insight into students' thinking, tasks can uncover conceptual understanding and tasks can be challenging to create.

Tensions in understanding multiple ways. Teaching mathematics requires teachers to create tasks that have multiple entry points and allows for multiple solution strategies (NCTM, 2014). While learning new discourses for teaching and learning mathematics, teacher candidates might reflect upon their prior schooling experiences, bias, assumptions, and personal beliefs. Tensions might surface as a result of engaging in such reflection. Chelsey explores a possible tension as she shares her thinking on students using multiple solution strategies.

> *Having multiple entry points into an equitable classroom helps a student realize, "Oh, I'm doing it a different way but its okay because I'm still understanding the process of how doing it." So that's what really stuck out to me in my math class is that multiple entry points are really important and it's okay. Because in my classrooms growing up, nope, there's only one entry point you only did this and sometimes I did do things differently and I did the process and I've understood but I could not do it on the test that way I had to do it the standard way and I wouldn't understand and I wouldn't get the right answer. So it's kind of frustrating, like I don't want my students to go through that. Like if another strategy works for them, I want them to do it and if they are really understanding*

> *the process of it…it's the same thing, like why do they have to do it the standard way?*

Chelsey's use of the phrase, *"I'm doing it a different way but its okay because I'm still understanding the process"* can be interpreted as her understanding that there is more than one way to understand a mathematical idea or concept. To make sense of her new discourse that entails *"multiple entry points are really important and it's okay,"* Chelsey expresses her frustration from her former schooling experiences that regulated certain solution strategies. When she explains, *"I had to do it the standard way"* can be read as an expectation to solve problems in a specific way. Her solution methods appeared to deviate from the normal discourses for solving problems as evidenced in her statement, *"sometimes I did do things differently."* Chelsey's statement, *"so it's kind of frustrating, like I don't want my students to go through that"* can be seen as her recognition of the potential harm regulating students' solution methods might produce. Her feelings are in keeping with the mathematics literature that mathematical tasks should provide students multiple entry points and should encourage them to use a variety of strategies to make sense and solve them (NCTM, 2014; Stein et al., 2009).

During the interview, Chelsey continues describing her feelings on the importance of using multiple solutions strategies. She explains:

> *But then reading about the multiple entry points and stuff, I've realized, "Oh, I can do it different ways and its alright that they're not all understanding it the standard way, but they're doing it a different way and still understand it." That was like a light bulb went off. I was like you can always do it different ways, but not on tests you have to do it the standard way, so that's where I was like, "Oh, even on tests you can have them do it whatever way they want if they are still understanding it."*

A power/knowledge reading may provide insight into Chelsey's internal conflict, as Foucault (1987) contends power circulates in and through discourses. Chelsey's use of the phrase, *"I was like you can always do it different ways, but not on tests you have to do it the standard way"* can be read as her coming to accept that students can solve problems in different ways, however, that did not apply to *"tests."* In this context, *"tests"* appear to hold some sort of authority and power in which they regulate certain solution methods (i.e., *"the standard way").* The discourse surrounding *"tests"* seems to be a barrier to Erica's acceptance of multiple solutions. Chelsey's statement, *"But then reading about the multiple entry points and stuff, I've realized"* can be seen as her method which enabled her to disrupt the previous discourse on *"tests"* which is made evident by her use of phrase *"even on tests you can have them do it whatever way they want."* As a result, Chelsey now thinks students should use their own methods for solving problems in all situations.

Chelsey explains that one day, while reading her texts from the methods course, a *"light bulb"* went off and she realized that mathematics wasn't always about plugging in formulas. Rather, learning mathematics entails grappling with mathematical ideas. She explains:

> *Oh, I didn't know it was okay to struggle a little bit and then learn from it. For me in math, if you struggled you didn't understand it. Nope, people who didn't struggle, they got it. They were the good ones, they were the smart ones–they were born with the math gene.*

Chelsey's use of the phrase, *"then learn from it"* can be read as realization that struggle can produce mathematical understanding. Her feelings reflect the mathematics education literature, which suggests that instruction should provide students opportunities to

struggle by exploring the mathematical structure of problems and relationships among mathematical ideas (NCTM, 2014). Erica's statement *"if you struggled you didn't understand it"* might be seen as her prior conceptions that understanding mathematics entailed quick retrieval of answers.

As Chelsey struggles to sort out what it means to teach and learn mathematics, she might be adopting an emancipatory set of teaching practices for mathematics. Her experiences and frustrations of having to solve problems in a standard way and her feelings of protecting her future students from experiences like hers might be the catalyst that leads to her to adopt the new discourse for what it means to be an effective teacher of mathematics. A discourse which includes understanding that learning mathematics require teachers to plan tasks that have multiple entry points, engage students in productive struggle, and allows students use multiple solution strategies.

Like Chelsey, Olivia and Gretchen commented on the value of using tasks that allow students to use a variety of solution methods. Olivia compares this to her prior schooling experiences in mathematics. She explains, *"I just really love the idea of showing the different paths to the solution because when I was in school it was just like you follow the steps and you have to show all the steps so your teacher knows that you did it the correct way."*

It appears that Gretchen also latches onto the idea of privileging multiple solution strategies. She explains:

> *I think there are multiple ways to teach a math concept. I think its important, there's a lot of teachers stuck in their ways, you know, this is the only way to teach it. I think it is important for teachers and students to explore together all of the different ways.*

Observing classroom practices can influence teacher candidates' conceptions of how mathematical tasks should be employed. Gretchen explains how her mentor teacher allows for multiple ways to solve problems.

> *He [my mentor teacher] explains all the ways to do a task but then when it is time to focus on one particular way, he makes sure the students focus on that way. When it comes to the test, so he'll have like some questions that are like do this problem this way and then at the end he will have some where its now okay pick your method to complete the task. So just making sure you're teaching math and there's not just one-way to complete it but there are multiple ways so just incorporating that into your classroom is a big part.*

However, for Gretchen there are some instances that require students *"to focus on one particular way"* such as *"when it comes to the test."* This is in contrast to Chelsey's insights that *"even on tests you can have them do it whatever way they want if they are still understanding it."*

Contradictory nature of implemented tasks. Tasks that promote reasoning and problem solving are considered "worthwhile" endeavors as they allow students access to the mathematics through multiple entry points (NCTM, 2014). Implementing such tasks with students can be challenging for teacher candidates. As Camryn explains:

> *There was a student and she was quieter so she didn't always ask for help but I would just notice she was really struggling to even start because she would sit there and just like of like stare at it or she was doing it incorrectly and guess at what she was doing. Umm…she was a challenge for me to get through to her, like different ways of explaining, and it still felt like she was just guessing the answer and didn't feel confident and I didn't know if she would be able to like do it the next day or in a different context. Then one day I got out just some of those little counters with red on one side and yellow on the other. We would just set up the problem using those counters. At first she didn't get what I was saying that these are just counters but when we established that these are the CDs and these are the DVDs like now let's do to this problem and then she was setting up the problem herself with the manipulatives. Even just finding different entry points*

> *and the readings [from the course] talked a lot about accessibility for students so finding that point where the student can enter into the problem and they can have that access.*

Tensions may arise when the discourse you have come to learn as to what constitutes effective teaching begins to contradict itself. One way to interpret this experience is through the lens of *nepantla* (Anzaldúa, 1987, 2002) as it might be a way to understand the complexities involved in implementing "worthwhile" mathematical tasks. In this experience, Camryn is challenged by a situation involving a student who does not know how to draw upon her prior knowledge for solving a problem, as noted by her statement, *"she was really struggling to even start."* In this instance, the "worthwhile" task fails to live up to her expectations as another reality begins to manifest, which is, what do you do when students do not have a way into a task that is supposed to be accessible by all students. This other reality is what Anzaldúa (2002) refers to as "seeing double" as another perspective (i.e., the *otras* in *nos/otras*) collides with the discourse of a "worthwhile" task (i.e., the *nos* in *nos/otras*). This means that Camryn has to actively contest the discourse she was expected to consume, know, and reproduce in the classroom when she encountered a student "*struggling to even start*".

Her first instinct was to use a physical manipulative (counters) to model the problem, which is in keeping with the mathematics education literature in that students benefit from using physical objects and acting out the process during problem solving (NCTM, 2014). Her statement *"At first she didn't get what I was saying that these are just counters"* can be read as the student's misunderstanding as to how the counters could be used to solve the problem. It was not until Camryn used a context (i.e., CDs and

DVDs) that allowed this student a way into the problem, this is made evident by her statement, *"when we established that these are the CDs and these are the DVDs like now let's do to this problem and then she was setting up the problem herself with the manipulatives."* This action is also reflects the research on effective mathematics practice, which states that using contextual situations can assist students in problem solving because the context is often based on students' experiences which helps them to conceptualize (van de Walle, et al., 2016).

Nepantla might occur because the task provides access and does not provide access at the same time. This experience produces a shift in Camryn's thinking around what it means to have and implement a "worthwhile" mathematical task. In her use of the phrase, *"finding that point where the student can enter into the problem"* can be read as her awareness that she may have to facilitate or assist students in entering into a task. Additionally, for Camryn being in *nepantla* changed her thinking about students' mathematical abilities. She explains:

> *I guess I just like that word access to the problem because a lot of the times like previously I would think they don't get it but they just don't have access like they don't have that key to unlock the problem for themselves.*

Her use of the phrase *"previously I would think they don't get it"* can be seen as a deconstruction of a former assumption about students' mathematical abilities, which viewed students who struggled with solving problems from a deficit perspective. Now, she has a new way of seeing, one that views it as a matter of *"access"* or a *"key to unlock the problem for themselves."*

Tasks provide insight into students' thinking. For Abby, a mathematical task can be a window into students' thinking. She reflects upon her previous understandings of mathematical tasks and compares that to her newly acquired discourse of what constitutes a mathematical task.

> *You aren't just saying, "Hey I need you to do these 10 worksheet problems." It's here's one worksheet problem and it's going to be like so in-depth and intense that you're going to have think about it way deeper. Then, I, as a teacher, would rather give a strong mathematical task than a worksheet with 20 problems because that's where I can see, that's my insight.*

Abby's use of the phrase *"in-depth and intense that you're going to have think about it way deeper"* can be seen as her understanding that mathematical tasks place higher-level cognitive demands on students whereas prior understandings of mathematics tasks entailed many problems (i.e., *"10 worksheet problems"* and *"20 problems"*). Her understanding emulates the criteria for effective mathematical tasks established from the research in mathematics education which states that effective tasks for teaching and learning mathematics focus students' attention on mathematical reasoning and problem solving to build new mathematical knowledge (NCTM, 2014; Smith & Stein, 1998; van de Walle, 2016). For Abby, *"the task is the most important because this, to me, is where all of that learning is going to happen."* Similarly, Crespo (2003) contends that the tasks that teachers plans to implement in the classroom are one of the most important pedagogical decisions that them will make. Tasks "determine not only what substance [students] learn but also how they come to think about, develop, use, and make sense of mathematics" (Stein, Grover, & Henningsen, 1996, p. 459). Abby's use of the phrase, *"that's where I can see, that's my insight"* can be considered he recognition that

mathematical sense making and reasoning might be present when students engage in high-cognitive demand tasks thus allowing for greater insight into the students' thought process and depth of conceptual understanding. This is consistent with the mathematics education literature, which contends that high-cognitive demand tasks are vehicles for building students' capacity for mathematical thinking and reasoning (Stein, Grover, & Henningsen, 1996).

Tasks help uncover conceptual understanding. Tasks provide different opportunities for learning and require different levels of thinking for students (Smith & Stein, 2011). Jenna reflects upon a diagnostic interview she conducted with a student in her field experience classroom. She provided this student with a mathematical task in which the student was to solve a division problem two different ways and justify her solution. In additional to the task, Jenna asked purposeful questions to assess the student's conceptual understanding however the student expressed feelings of frustration in solving the division problem in a second way since she already knows how to divide. She explains her interaction with this student.

> *She seemed to get kind of like frustrated when she couldn't come up with it because she is like well "I know how to do these like why?" So I guess like just how her emotions were going throughout that whole thing. But I also thought it was interesting just listening to how she was talking through it and how she was this goes into number. Like it doesn't go into 7 well no that's 700. It's like how many groups of 5 go into 700, not how many times does 5 go into 7. She did it all and when she was really confused about it I was just kind of like you know give her some questions like so what if help you, I'm going to give you a quick trick, not trick but just like, "What if I say what if 5 doesn't go into 7 it's actually going into 700." And she just froze because she was like, "What are you talking about it is going to 700?" I was like, "What place value is 7 in?" And she goes "hundreds place" and [I ask] "What is that number actually representing?" And she was like "7". I was like "7…" And she was like (slow pause) "100?" And she was so confused.*

Jenna's purposeful question, *"What if I say what if 5 doesn't go into 7 it's actually going into 700"* can be seen as an attempt to uncover the student's conceptual understanding of the division algorithm. Her description of the student's response, *"she just froze because she was like, 'What are you talking about it is going to 700?'"* can be seen as Jenna's recognition of the student's lack of conceptual understanding for division. She reflects upon the knowledge gained from this experience.

> *So I think that was very eye-opening and I think why those purposeful questions and giving those multiple entry points used in that diagnostic interview actually like just like opened my eyes so much to that these students do not understand conceptual understanding if you just put it on the board. It was so interesting.*

Jenna's use of the phrase *"those purposeful questions"* and *"giving those multiple entry points"* can be interpreted as her acknowledgment that these two mathematical practices (i.e., posing purposeful questions and using worthwhile tasks) provided insight into students' thinking so that she could determine mathematical understanding. Jenna's feelings about mathematical tasks emulate that of the research produced by Smith and Stein (2011), which contends that well designed tasks permit students' opportunities to demonstrate their mathematical understanding and ideas.

Constructing tasks are challenging. Creating mathematics tasks that are worthwhile can be difficult for some teacher candidates. Furthermore, it is often the methods course that provides teacher candidates with their first exposure to such tasks. Taylor reflects upon her struggles in creating a mathematical task.

> *Because I wanted to come up with a task that could be equitable that students could relate to their own lives with and that might help them or they might have background knowledge on. But I didn't know how to do that and I just kind of, kind of just thought I had to create it on my own in my mind.*

Taylor's use of the phrase *"a task that could be equitable"* can be interpreted as her understanding that there are other things to consider besides just the mathematics concept when creating a "worthwhile" task. Her use of the phrases "*relate to their own lives*" and "*background knowledge on*" can be seen as her interpretation of what it means to make a task equitable, which entails making tasks relevant for students lives and drawing on background knowledge. Her feelings reflect that of the mathematics education literature, which argues that "effective teachers understand how contexts, culture, conditions and langue can be used to create mathematical tasks that draw on students' prior knowledge and experiences" (NCTM, 2014, p.17). Taylor's use of the phrase *"that might help them"* can be read as her recognition that drawing on students' prior knowledge and experiences might help to affirm students sense of identity, which supports Aguirre and colleagues (2013) assertion that a positive and productive learner identity can contribute to mathematics learning.

Taylor continues describing her struggle to figure out how to create an equitable task however, she is expresses a lack of knowledge for making a task problem solving. She explains:

> *I kind of was just thinking like measurement, like measure the desk. I didn't know how to make it equitable. I didn't know how to make it a task that you were like solving a problem. Although we were learning all the ways how to, it's just to take such a broad topic and break it down into you know measurement is measuring it to the next 1/2 unit but that's still so not specific at all. So for me, my one way of thinking, was well I have to measure something. But I just didn't know what and I didn't know how to make that work if that makes sense.*

When she states, *"I didn't know how to make it a task that you were like solving a problem,"* this can be interpreted as her lack of understanding for how to create a

problem solving lesson involving measuring to the nearest unit. Her use of the phrase, *"my one way of thinking, was well I have to measure something"* can be read as her realization of the limitations of her thinking and how it can get fixed on a certain idea. Taylor explains how course text I (the methods course instructor) suggested she consult *"really helped"* her create an equitable mathematical task. She explains:

> *So when you told me to look and van de Walle for a resource that really helped me, as there were multiple ones on measurement. So, when I read through those, I picked one that met my goal. I picked a task that I could change a little bit to change meet goal and objective, but umm so that's kind of how I did it. And thinking of my class, I changed the task for that. I know some of them walk to school and we were measuring paths. So I know that they walked to school on paths so when there's a curvy path or a straight path which one is actually shorter? The curvy path looks shorter but you got to take all the curves. So that is what I was going for, I just wanted to relate to…I mean 95% of the kids walk to school so I thought that why when I read that task I thought that's kind of cool. They could definitely relate paths to their own lives but we're measuring the paths now and if they are going to be late for school… we have that issue in our class right now, kids being late. Yeah, I just thought that would fit in and I could just use those examples and the kids would be oh yeah let's solve this problem.*

Taylor's statement, *"And thinking of my class, I changed the task for that"* can be seen as her awareness of the need to draw upon her students' prior knowledge and experience to make a task equitable. She continues to explain how she chose a context that her students could relate to (i.e., walking to school on paths) and adapted the task found in the course text. When Taylor explains, *"the kids would be oh yeah let's solve this problem"* this can be interpreted as her recognition of the role relevant context might play in creating engagement and interest to draw students into the mathematics. Her feelings are patterned after Aguirre and colleagues (2013) argument that equity-based teaching depends on the capacity to recognize and draw on knowledge of students as resources for teaching

mathematics, which includes helping students bridge everyday experiences to learn mathematics.

Initial tentative manifestation: Sharing mathematical ideas through talk. Equity-mindedness recognizes that students need agency over their learning and have opportunities to think deeply about mathematical ideas. The mathematical practice of facilitating class discussions can provide students opportunities to explain their own ideas and respond to the ideas of others in an authentic way. Discussions were described as giving power to students, exploration through talk and a vehicle for building shared understanding together.

Teacher candidates descriptions of their lived experiences suggest that classroom discussions have the potential to increase participation, provide access to mathematical concepts and to build shared mathematical understanding for students. Two key conceptualizations of discussions were produced from the teacher candidates' reflections on their experiences. These productions include, thinking about discussions as a place for students to justify their answers and providing students power through the sharing of solution strategies to deepen understanding of mathematics concepts.

Justifying answers. Having students justify their answers might be a way to help promote equity within the mathematics classroom as it positions students' as authors of mathematical ideas. Camryn describes a specific example of engaging students in justifying their answers during her field experience. She explains:

> *Especially with like justifying their answers-I had a graph that went up by 100s and there was a bar that reached like midway between 700 and 800 so I asked like how much is that? Because it doesn't line up with any of my numbers on the side one student said 705 and I said okay anyone else? Another said 750 and we*

> *got a couple of answers and then I brought it out to the class does anyone want to justify one of those answers? So then we talked about 750 and why we thought it was there. Umm, and then students are like revising their thinking through their peers explanations and especially in those moments and when you ask like those kinds of questions the children's faces–like they're so focused on okay well what is it and trying to make sense of it. So that was a specific example, but in general, you can't just give an answer it's not like right or wrong, yes or no…it's like why? What other answers could we have? Or maybe we have an incorrect answer like why might this person say that? So why did that person say705 instead of 750? So that is exploration through talk.*

When Camryn states, *"we got a couple of answers and then I brought it out to the class does anyone want to justify one of those answers"* this can be read as a pedagogical move to position students as mathematical thinkers who are capable of constructing arguments, determining solutions and making sense of mathematics. Her use of the pronoun *"we"* might signify her understanding of the collaborative nature involved for constructing answers. Notice, that Camryn gathers answers from students then asks the class (i.e., *"I brought it out to the class"*) to determine if the answers make sense. The entire time she does not reveal the answer rather she orients the students' responses to one another, which is made evident by her statement, *"students are like revising their thinking through their peers explanations."*

When Camryn describes the children's faces as, *"so focused on okay well what is it and trying to make sense of it,"* this statement can be seen as her recognition that through the process of justifying answers and critiquing the reasoning of others, students are actively engaged in trying to understand and respond to each other's thinking in order to make sense of the problem under exploration. Her thinking supports the mathematics education literature (NCTM, 2014; Smith & Stein, 2011), which contends that when students have opportunities to discuss and represent their mathematical thinking with

others, it helps them process ideas more deeply. Additionally, when they have opportunities to hear and see the mathematical reasoning of other students, it also deepens their understanding.

Giving power to students to understand concepts. Sharing of mathematical solutions and strategies might be seen as way for teacher candidates to give students agency and power over their learning. Jenna sees discussions as a way for students to voice their mathematical ideas and to better understand mathematical concepts.

> *I just think that because every student has their voice being heard and I think that is really powerful in a classroom having power of your voice. If you feel you have some power in what you're saying or you have just a voice so I know within lessons that I've done, the lessons that the students are very active and engaged and like talking and discussing instead of just sitting there doing by themselves. It seems like they understand the concepts better. Like today, as an example with mean, median, and mode–they were finally able to see the leveling out of mean instead of just add and divide because they had the graphs in front of them and the were able to move stuff. I just thought that with the discussions I saw pairs having, they were able to really grow in that. I just see the power of having students understand the conceptual part of it, not just these are the steps now go and do this. One [student] will say something like "Oh, how did you get?" and they gain a deeper understanding by talking to each other than just them doing it by themselves. They're like, "Oh I didn't think of it but that makes more sense than the what I was doing." The discourse among students builds a shared understanding of the content.*

Jenna's experience teaching in her field experience classroom have lead her to value power of student voice which is made evident by her statement, *"that is really powerful in a classroom having power of your voice."* Her feelings are consistent with the mathematics equity education literature, which suggests giving students voice can help to affirm identities as their mathematical contributions appear to have value when they are positioned as mathematical thinkers and sense makers (Aguirre et al., 2013).

When Jenna explains that students *"gain a deeper understanding by talking to each other than just them doing it by themselves,"* can be interpreted as an awareness of how the process of sharing of mathematical ideas by talking can help students understand the mathematical concept under exploration. Her observations in this regard are consistent with a large body of mathematics teacher education research (NCTM, 2014; Smith & Stein, 2011), suggesting that discourse advances the mathematical learning of the whole class. This building *"a shared understanding of the content"* through discourse is important part of equity as it positions students as constructors and co-constructors of mathematical ideas as well as offering them opportunities to gain multiple perspectives for solving problems (Aguirre et al., 2013).

Summary of tentative manifestation #4: Multiplicity in practice. Equity-mindedness recognizes that mathematical practices need to be examined using the lens of access, agency and identity. For teacher candidates, employing mathematical practices means embracing multiplicity. This might occur through tasks that provide students multiple entry points and exit points that allow for multiple ways of knowing and multiple solutions strategies and discussions that allow for multiple mathematical contributions to be shared. In the same way, Gutiérrez (2013) argues, "being open to the multiple meanings that students place on mathematical practice and offering an educational setting where those meanings can be valued and built upon is a step in the right direction" (p.55).

Tentative Manifestation #5: Discourses of Equity

As equity-mindedness was brought into the gaze of teacher candidates, they began to construct truths or knowledge about equity through their course readings, assignments, discussions, and classroom observations–producing a "new" discourse for teaching mathematics in an equitable manner. Thus, cultivating equity-mindedness produced a particular discourse by teacher candidates for the ways in which they would talk about and describe equity in the teaching and learning of mathematics. The language used to describe equity has the potential to greatly contribute to their understandings and interpretation of the concept of equity.

The phrase "magical property" was borrowed from Bic Ngo (2012) as a way to describe the power produced by teacher candidates' discourses to describe the term equity. Ngo suggests that discourses have a "magical property" of creating identity and reality for people. Ngo's term "magical properties" can be put into dialogue with Foucault's theory of power/knowledge. For Foucault power is inseparable from knowledge, hence his creation of the term power/knowledge. Discourse is the vehicle though which knowledge and truths are created. Therefore, discourses can be both an instrument and effect of power but also a hindrance, stumbling point of resistance and a starting point for an opposing strategy. Discourses can diffuse and produce power, reinforce it, as well as undermine it and expose it by making it unstable and possible to obstruct (Foucault, 1978). The use of the term "magical property" is useful for describing discourse, as it paints a vivid picture into the workings of Foucault's notion of discourse. As discourses have the ability to make visible what is often less visible or invisible.

For teacher candidates, their discourses around equity came together to produce understanding, meaning and truth. As Foucault (1977, 1980) argues, an individual is a product of discourses. The question remains as to how do such discourses shape teacher candidates understandings and actions in institutional environments and contribute to inequities in it. A poem was crafted to illustrate the contradictory, perceptive, complex and shifting nature of teacher candidates' conceptions of equity. In the following section examples of discourses of equity is discussed and supported with excerpts from data collected.

Crafting a text that captures the multiple discourses of equity. In post-intentional phenomenology, the author is free to play with form in order to reflect the image of the tentative manifestation (Vagle, 2014). This tentative manifestation, discourses of equity, called for the use of a form that could portray the multiple and varied discourses of equity provided by teacher candidates. Found poetry was used as a way to feature the tentative manifestation by structuring the voices of teacher candidates.

Found poetry is considered to be an effective technique to express the everyday reality of people (Butler-Kisber, 2002). Meticulous attention was given to select phrases from the data that accurately reflected the tentative manifestation. The phrases were then grouped together based on attributes that described initial tentative manifestations (i.e., equity as something you do, equity as a possession, equity as an agent and equity is metaphor). No words were altered or misrepresented but ‘‘poetic license’’ (Butler-Kisber, 2010, p. 87) was used, as words were re-arranged in a different order than in the original text to provide fluidity and let the reader see and hear the voices of teacher candidates.

The organization of the poem shows how the discourses around equity "took off" (as in reference to Vagle's call for *chasing lines of flight*) as the spacing and indentations were purposefully chosen as an attempt to visually show the movement of the discourses–back and forth and spread across the page.

For Olivia, *"Equity is not an easily definable quality that if we name it we can put into our classrooms. It is a struggle of finding the balance between all of these key concepts."* This poem attempts to capture the multiple and varied ways teacher candidates struggle to define, what Olivia describes as *not easily definable*.

Equity

is something you do…
To be practiced in lessons
By choosing appropriate strategies and techniques
And adapting

Catering to all students
Ensuring ALL their needs are met

Getting them out of Tier 2 or 3
Or making sure they don't stay there for long

A lot of helping
And leveling
And something you do for others
Such as strugglers and diverse learners

What a teacher needs to do for EACH child…

Equity

is a possession…
Something you "have"
That's brought into the classroom
Comes in pieces to be put together
And can be added into any lesson

It can be "given"
As tools and resources students need to succeed
OR it can be withheld
Causing barriers and hindrances

Can be lens used to evaluate actions
To see students' assets
To see them as equal in your eyes

Is for ALL students…

Equity

is an agent that…
Allows for opportunities to learn
Guides teaching
Goes hand-in-hand with math
And closes the achievement gap

Forces teachers to get to know their students' identities
Brings culture in
And makes classrooms run SMOOTHLY…

Equity

is metaphor for…
Fairness
Equality
Differentiation
&
Social JUSTICE…

Equity

For teacher candidates, discourses for equity can be seen as producing four initial tentative manifestations: (1) equity is something you do, (2) equity is a possession, (3) equity is an agent, and (4) equity is metaphor. Next, a further unpacking and "digging in" to each of the initial tentative manifestations with particular attention to what is produced through the discourses around equity is presented. This digging offers an opportunity to

better see the shifting, fleeting and fluid nature (Vagle, 2014) of cultivating equity mindedness as well as the "magical properties" discourses of equity may produce.

Equity is something you do. In this initial manifestation, equity appears to have taken on the "magical property" as something you do. Teacher candidates most often described equity in terms of a teacher's with students. Many of the teacher candidates use the pronoun "I" or the word "teacher" when explaining the actions of equity. For example, when Ellie discusses her mathematics lesson planning and choosing the appropriate strategies from the course's text, she states, *"I want to do all these different things to get what students need to succeed."* This can be read as her acknowledgement that her choices for planning mathematics are critical to matters of equity. Whereas with Lexi she wants *"to use equity and bring each students' culture in to the classroom."* This can be seen as her understanding that it is the teacher's responsibility to use equity through her bringing her students' cultures into the classroom as if that is solely depended upon her abilities. Although the teacher might be seen as an integral part toward achieving equity in the mathematics classroom, a power/knowledge reading may present another important aspect that is absent in the discourses of teacher candidates. The majority of the discourse around equity as, *something you do* positioned teachers as the agent who "does" equity. Only Camryn realized that equity was not solely in her power rather equity is constructed in conjunction with students. She explains that equity is *"not just something I create in the classroom, it's not just me putting that into the classroom, but it's like a whole classroom thing, like it's about the students too, and students bring*

that equity piece in, it's like that whole classroom environment, it's not just math and it's not just how the teacher creates it, it's how all the pieces come together."

Another production of "equity is something you do" is the teacher candidates' discourse around requiring teachers to meet the needs of *"each," "every"* and *"all"* students. While such discourse is patterned after the culturally responsive literature, which calls for teachers not accept generalized notions about students, but rather look at them as individuals (Gay, 2009; Ladson-Billings, 1994; Leonard, 2008). However, in attempts to make "all" student visible, teacher candidates may overlook the realities of planning and enacting mathematics instruction for a classroom of diverse learners. Such catch phrases as *"each," "every"* and *"all"* may be reflective of idealistic notions and can be seen as initial attempts to move away from generalizing and seeing students as a whole. The use of the phrase *"ensure all their needs are met"* can further support the idealistic notions teacher candidates adopt when cultivating equity-mindedness, as it is difficult for teachers to make sure guarantees about the needs of their students. Where as Lexi was the only teacher candidate to openly ask the question, *"How do you teach to every student…the teacher will be teaching and she can't possible teach each individual student or teach 24 different ways?"* This can be seen as her trying to make sense of the call to see students individually and the realities of teaching mathematics to full classroom of students.

In efforts to meet the needs of *"each"* and *"every"* student, teacher candidates developed discourses of *"helping," "leveling," "returning to Tier 1"* (e.g., whole group or whole class) and equity is something that is done for *"struggling students," "ELL,"*

"SPED" and *"diverse learners"*. This can be seen as teacher candidates' interpretation that equity is only for students who lack from the norm in some way. Foucault's notion of dividing practices might be able to help explain the discourse. For Foucault (1995) dividing practices form of language that serves both to include and exclude through claiming to measure what is good and bad, normal and nonnormal, right and wrong. Labeling (e.g., through dividing practices) may give identity to certain students, which may assist teachers in meeting their needs. However, in the process, it may cause teachers to view students, whose behaviors deviate from what is considered normalized, from a deficit lens thus perpetuating inequities by not seeing the assets of the labeled students.

Equity is a possession. In this initial manifestation, equity appears to have taken on the "magical property" as an object or commodity that is owned. Teacher candidates often spoke of equity as something you own or possess, like an object to be "held" onto or an object to be "given" out. The teacher candidates' discourses can be interpreted as a positioning of the teacher as "owner" of equity and students as the "recipients" of equity. For example, the following teacher candidates tell how they need to bring the object "equity" into their classroom or teaching. Two teacher candidates explain, *"I need to make sure I have equity in the classroom"* and *"I need to remember the pieces of equity and put them together in all of my teaching not just math."* While, yet another explains that one can, *"add equity into any lesson"* by giving equity to students in the form of *"tools" and "necessary resources."* All of these examples can be read as the teacher in possession of object equity. Additionally, another teacher candidate expresses, *"I find it really disappointing that even students as young as ones in elementary school feel as if*

they are not given equity." This can be read as an example of the students being on the receiving end of equity.

A power/knowledge (Foucault, 1980) reading might provide insight into how such discourses powerfully organize thinking and experience. For Foucault the subject (teacher candidate) is produced and regulated in discourses. Thereby, positioning equity as a possession to have in the classroom or bestow out to students, may potentially cause teacher candidates to view themselves as the "owners" of the commodity equity. Being in the position of an owner affords one power to use it and exert control over it. As Foucault posits, "power is neither given, nor exchanged, nor recovered, but rather exercised, and that it only exists in action" (1989/1996, p. 89). This new or "magical" way of seeing equity from an "owner" lens might cause teacher candidates to privilege their actions and overlook the students' part in the achieving equity. Equally important, teachers might "bestow" equity to who they deem is in need of it rather than making it available to all.

Equity is an agent. In this initial manifestation, equity appears to have taken on the "magical property" of becoming an entity or agent that possesses power to obtain specific results and employ particular actions. Many of the teacher candidates' position equity as the subject by ascribing human attributes to a thing not human in their discourses, such as, *"equity allows for opportunities to learn", "equity guides teaching", "equity brings culture into the classroom"* and *"equity makes classrooms run smoothly."* This positioning of equity as an agent might have the potential to cause teacher candidates to withhold personal responsibility as the agent "equity" can do the work. Thus releasing the teacher from any sort of responsibilities or actions. Moreover,

positioning equity as an agent can simultaneously distance teacher candidates from knowing students, as it can be see as the job of equity.

It is interesting to note, the power that teacher candidates gives to equity through their discourses. The statements, *"equity closes the achievement gap"* and *"equity forces teachers to get to know their students' identities"* can be seen as an attempt to over generalize what attention to equity matters in the classroom can accomplish. These generic and general statements can be read as a possible disregarding of the complexities involved in creating an equitable environment. Meaning, if teachers let equity operate then they will automatically get to know students and be able to close the achievement gap. Rather, such simplistic notions of equity ignore the contextual and specificity nature of classrooms as well as institutional structures and systems. As Gay (2013) contends:

> Culturally responsive teaching, in idea and action, emphasizes localism and contextual specificity. That is, it exemplifies the notion that instructional practices should be shaped by the sociocultural characteristics of the settings in which they occur, and the populations for whom they are designed. (p. 63)

The use of such statements might be seen as simplified attempts to accredit equity with accomplishing unrealistic goals without recognition of the contextual and particulars of individual classrooms and institutional structures and systems.

Equity is metaphor for fairness, equality, differentiation and social justice. In efforts to make sense of equity in elementary mathematics, teacher candidates have come to equate equity with certain terms or concepts. Through teacher candidates' discourses, metaphors were created to represent their understandings about equitable mathematics

teaching and learning. Lakeoff and Johnson (1980) writing on metaphors may provide insight into understanding the teacher candidates' discourses of equity. They argue that metaphors are ways of understanding concepts and the essence of a metaphor is understanding and experiencing one kind of thing in terms of another (Lakeoff & Johnson, 1980, p.5). Metaphors structure the way people perceive, think and the actions they perform. For Lakeoff and Johnson, language reveals the conceptual system, which define everyday realities. Similarly, Foucault (1984, 1988) claims that discourses help to create "conceptual schemes" that one draws on to organize reality as they provide knowledge about what is possible to speak and do at any given moment.

Many teacher candidates, unconsciously created metaphors for the concept of equity by structuring such notions of, fairness, equality, differentiation, and social justice to represent equity. The teacher candidates start with the concept of equity and then relate that to the conceptual metaphor (i.e., fairness, equality, differentiation, and social justice). These metaphors are reflected in the discourses of teacher candidates used to describe equity.

Fairness. For some teacher candidates, equity was interpreted as fairness. This is made clear through the following discourses:

> ***Equity is Fairness***
> *"We need to recognize how we can be fully equitable to all students fairly."*
> *"Equity is all about being fair and fair is being able to try and meet the needs to all students."*
> *"Equity is defined as the right to all students to have fair opportunities for growth and achievement."*

In each of these three examples, the teacher candidates' used the idea of being fair to define equity. From these examples, the idea of fairness applies to the treatment of

students by meeting their needs and providing fair opportunities for learning. Such discourse can be seen as attempts to make sense of the mathematics education literature on equity, which calls for teachers to provide students opportunities and support to learn mathematics as well as providing responsive accommodations based on the needs of students (Aguirre et al., 2013; Gutiérrez, 2013; NCTM, 2014).

Equality. Several teacher candidates created a metaphor, which defined equity in terms of equality. This is made evident through the following discourses:

> ***Equity is Equality***
> *"Equity is achieved by equal outcomes not equal treatment rather providing for individual differences."*
> *"You need to make sure you see all your students as equal in your eyes."*
> *"Equity is treating them equally in the sense of giving the students the attention they need for learning."*
> *"Maintaining equal status as much as possible in the classroom and treating everyone equally will affect how your classroom will run."*

In each of these examples, the teacher candidates' used the idea of being equality to define equity. Equality is expressed as equal outcomes, seeing all students equal, providing equal treatment, maintain equal status and giving equal amounts of attention. This discourse can be seen as attempts to make sense of the mathematics education literature on equity, which calls for seeing that all students, regardless of background characteristics, have the same likelihood of achieving meaningful outcomes (Gutiérrez, 2013). While not all of these discourses present an accurate portrayal of what the literature suggests, they can be considered attempts to apply ideas of equity to the actions of teachers.

Differentiation. For some teacher candidates the metaphor of differentiation was used to define equity. This is evidenced through the following discourses:

Equity is Differentiation
"Equity simply means being able to differentiate and adapt ways of teaching to fit the needs of all students regardless of their background and learning styles."
"Some students might need to have more hands on examples and manipulatives in their learning and others might enjoy the worksheets or flashcards."
"You have to look at all their learning levels and teach so each student has the ability to learn and explore at their level."

In each of these three examples, the teacher candidates' used the idea of differentiating mathematics instruction to make sense of equity. From these examples, differentiation can be seen as adapting teaching to students' backgrounds and learning preferences and levels of understanding. This discourse can be seen as attempts to define equity based on the mathematics education literature on equity, which argues, "Equity is attained when students receive the differentiated supports (e.g., time, instruction, curricular materials, programs) necessary to ensure that all students are mathematically successful" (NCTM, 2014, p.63).

Social Justice. A few teacher candidates created a metaphor, which defined equity as a matter of social justice. This is evidenced through the following discourses:

Equity is Social Justice
"Math is totally something that helps explains the world around you."
"You can bring social justice issues into your math lessons for students to learn about their world or examine inequities in their world."
"Taking up issues of social justice builds students as people."
"Students need to see something new about themselves or about the world around them through mathematics."

In each of these examples, teacher candidates' used the idea of social justice to express equity. From these examples, the idea of taking up issues of social justice can be seen as using mathematics to examine and explain injustices in the students' world, a way to build students people, and a way to open up issues so that students develop new

insights into themselves and their world. This discourse can be considered a reflection and internal processing of the literature regarding teaching mathematics for social justice that suggests students be afforded opportunities to utilize mathematics to critic inequitable situations in their community, which in turn lets them to see the role mathematics plays in their world and the power mathematics has in shaping their world (Gutstein, 2006; Martin, 2003).

In efforts to make sense of equity, teacher candidates', unknowingly, created metaphors as ways to conceptualize equity in the teaching and learning of mathematics. It is important to note that these metaphors are partial representations of equity as they are not complete within themselves. They are likely the result of the connections teacher candidates' made throughout the assigned readings, assignments and class discussions in the methods course. Thus, these metaphors individually privilege some aspects of equity while disregarding other important aspects, thereby simplifying the complexities involved in conceptualizing equity. While not all of these metaphors present an accurate portrayal of what the literature suggests, they can be considered attempts to apply ideas of equity to the actions of teachers.

Summary of tentative manifestation #5: Discourses of equity. Cultivating equity-mindedness produced a variety of discourses by teacher candidates as they engaged in making sense of the term equity for the teaching and learning of elementary mathematics. These discourses might be seen as having "magical properties" in that they have the ability to make the invisible visible and produce understanding, meaning and truth. Four initial tentative manifestations were produced through the teacher candidates'

discourses of equity: (1) equity is something teachers do, (2) equity is a possession that can be given and received, (3) equity is an agent who can obtain specific results and employ particular actions, and (4) equity is a metaphor for fairness, equality, differentiation, and social justice. These productions can be seen as attempts to define the multiple and varied aspects of equity for the teaching and learning of mathematics.

Summary of chapter four: Tentative manifestations. In this chapter, post-intentional phenomenology was used to craft a text that captured the tentative manifestations of the phenomenon of cultivating equity-mindedness in its multiple, partial and varied contexts (Vagle, 2014). Detailed explanations and interpretations were constructed that drew upon Foucault's theory of power/knowledge and Anzaldúa's notion of *nepantla* as well as research findings in mathematics education to open-up, interrogate and explain the multiple and varied ways the tentative manifestations of the phenomenon cultivating equity-mindedness appeared.

Next, in Chapter six, conclusions and implications for the tentative manifestations are presented by highlighting the pedagogical insights that hold particular relevance for addressing the challenges and opportunities associated with cultivating equity-mindedness for the teaching and learning of mathematics. The insights gained from this study are used to propose future directions for teacher educators.

CHAPTER SIX

OVERVIEW, DISCUSSION AND IMPLICATIONS

One of the major concerns outlined in the educational literature is that issues of cultural and linguistic diversity and racial equity are often taught in a single multicultural education course that is often disconnected from the rest of the pedagogical courses (Gay, 2000; Leonard, 2008). Little consideration is given to the specific demands of the different academic disciplines may require for addressing issues equity (Banks, 1993; Ladson-Billings, 1994). This study is an attempt to begin to tackle this problem outlined by the literature as it purposefully embedded issues of equity alongside the typical content contained in a mathematics methods course. Examining how cultivating equity-mindedness manifested through the experiences of teacher candidates within an elementary mathematics methods course provided a way to begin as Mckenna explains, *"That wasn't something I would have thought of before because I wasn't thinking about equitable instruction…I was just thinking about oh I need to teach [math]."*

This chapter begins by describing the charge as called for by the literature as the motivation behind this study. A brief overview of this post-intentional phenomenological study is presented. Followed by, a summary of five tentative manifestations that were produced as they relate to the primarily phenomenological research question that guided this study. A discussion of the broader implications drawn from the tentative manifestations, which include insights gained from the teacher candidates' experiences that helped inform practical suggestions for addressing the challenges and opportunities associated with learning to teach mathematics in an equitable manner. This chapter

concludes by suggesting possibilities for future research studies that resulted from this study.

One of the major concerns outlined in the educational literature is that issues of cultural and linguistic diversity and racial equity are often taught in a single multicultural education course that is often disconnected from the rest of the pedagogical courses (Gay, 2000; Leonard, 2008). Little consideration is given to the specific demands of the different academic disciplines may require for addressing issues equity (Banks, 1993; Ladson-Billings, 1994). This study is an attempt to begin to tackle this problem outlined by the literature as it purposefully embedded issues of equity alongside the typical content contained in a mathematics methods course. Examining how cultivating equity-mindedness manifested through the experiences of teacher candidates within an elementary mathematics methods course provided a way to begin as Mckenna explains, *"That wasn't something I would have thought of before because I wasn't thinking about equitable instruction…I was just thinking about oh I need to teach [math]."*

Overview of Study

This post-intentional phenomenological study explored the experiences of teacher candidates as they begin to develop ideas about what it means to teach elementary mathematics in an equitable manner. The objective was to better understand the nature cultivating equity-mindedness and the ongoing, dynamic tensions that might exist. Tentative manifestations of the phenomenon cultivating equity-mindedness were pursued in order to reveal the partial, shifting, and fleeting nature of this phenomenon as well as the intentional relationships or the meaningful connections between cultivating equity-

mindedness and teacher candidates. Personal accounts, shared through individual unstructured interviews and written artifacts created in the methods course, were collected and analyzed to provide insight into the experiences of teachers candidates as they engaged with the phenomenon.

This study began with identifying the phenomenon, equity-mindedness, in its multiple, partial and varied contexts. As post-intentional phenomenological methodological approach (Vagle, 2014) was used to investigate teacher candidates lived experiences with the phenomenon while enrolled in a sixteen-week, undergraduate, face-to-face elementary mathematics methods course. This systematic but flexible methodological approach was used to collect and analyze data with a particular focus of seeing meanings or intentionalities from a post-structural lens (i.e., partial, sees both/and, and circulates though relations) and a focus on opening up the phenomenon by following "lines of flight" (Deleuze & Guattari, 1987).

The aim of the inquiry was to capture tentative manifestations of the phenomenon of cultivating equity-mindedness and associated intentional relationships as they were revealed in different ways through the teacher candidates' experiences. Iterative cycles of phenomenological data analysis using a whole-part-whole approach captured tentative manifestations (Vagle, 2104) of this phenomenon. Followed by crafting text to portray the image of the tentative manifestations of cultivating equity-mindedness in its multiple, partial and varied contexts (Vagle, 2014).

The purpose of this study is to help teacher educators and teacher preparation programs better understand how teacher candidates learn to teach mathematics with an

explicit focus on equity by specifically addressing the following research question: How might cultivating equity-mindedness with teacher candidates take shape in an elementary mathematics methods course?

Overview of the Tentative Manifestations

The tentative manifestations were presented through the voices of teacher candidates' as they describe their experiences with cultivating equity-mindedness. In this study, cultivating equity-mindedness took shape by tentatively manifesting as: (1) metacognitive awareness; (2) struggles with power; (3) knowledge of students; (4) multiplicity in practice; and (5) discourse of equity. These five tentative manifestations are representations of the phenomenon and collectively they address the primary research question that guided this study.

Metacognitive awareness. Cultivating equity-mindedness produced a metacognitive awareness in which teacher candidates' attended to their thoughts, actions, biases, and assumptions about teaching and learning mathematics. They particularly expressed an awareness of their personal preferences for learning mathematics and privileged ways of knowing mathematics might pose as a hindrance for student learning. Teacher candidates' metacognitive awareness initially manifested in multiple ways which included: (1) expressing a need to be vulnerable; (2) awareness of self; (3) awareness of others; (4) challenging previously held notions; (5) proceduralizing equity practices in attempts to try to apply them in actual teaching; and (6) distancing oneself in order to more clearly reflect upon ones own thoughts and actions.

Struggles with power. Power relations between teacher candidates and their mentor teachers often caused them to experience *nepantla*–where tensions manifested as candidates negotiated multiple realities and competing discourses, normalizing practices operating in institutional spaces. These initial manifestations appeared through struggles with the authority of textbooks, structures and methods operating in the classroom, positionality, use of language, and concerns for students in the classroom. Teacher candidates were shaped by their experiences. For some candidates' knowledge manifested in the form of "cutting", resistance, disruption of normalized practices and discourses operating in field experience settings. Teacher candidates constructed new regimes of truth as to what it means to teach mathematics in equitable ways. These new truths about themselves and their subjectivities (i.e., how they see themselves in relation to the subject) were produced.

Knowledge of students. Cultivating equity-mindedness may cause tensions to surface as teacher candidates' work to figure out what exactly it means to "know" students in mathematics. Teacher candidates often described this as "knowing" information about students, building relationships with students and building the identities of students. This "knowing" of students was produced in multiple ways which included: (1) concerns of not "knowing' students enough to plan tasks for mathematics instruction; (2) struggles with "knowing" the identities of students that are economically, linguistically, culturally and racially positioned differently from yourself; and (3) misapplying discourses and inadvertently developing negative narratives about students;

and (4) looking beyond the surface and purposefully digging in to see the peculiarities in students.

Multiplicity in practice. Equity-mindedness recognizes that practices for teaching and learning mathematics need to be examined through an equity lens. Teacher candidates came to view such teaching practices through the lens of access (i.e., affording students opportunities to access mathematical ideas and concepts), agency (i.e., empowering students to see themselves as capable of making sense of mathematics) and identity (i.e., affirming and building of students backgrounds and experiences). For teacher candidates, employing mathematical practices meant embracing multiplicity. This idea of multiplicity in practices of mathematics was produced in primarily two ways: (1) mathematics tasks need to be designed so that they provide students multiple entry points and exit points as to allow for multiple ways of knowing and multiple solutions strategies; and (2) the practice of conducting a mathematical discussion is important because it allows for multiple mathematical contributions to be shared by students.

Discourse of equity. Cultivating equity-mindedness produced a variety of discourses by teacher candidates as they engaged in making sense of the term equity for the teaching and learning of elementary mathematics. These discourses (i.e., the language they used to talk about equity) might be seen as having "magical properties" in that they have the ability to make the invisible visible and produce understanding, meaning and truth. Four initial tentative manifestations were produced through the teacher candidates' discourses of equity: (1) equity is something teachers do, (2) equity is a possession that can be given and received, (3) equity is an agent who can obtain specific results and

employ particular actions, and (4) equity is a metaphor for fairness, equality, differentiation, and social justice. These productions can be considered attempts to define the multiple and varied aspects of equity for the teaching and learning of mathematics.

This section provided an overview of the five tentative manifestations, of the phenomenon, cultivating equity-mindedness, that were produced through the experiences of teacher candidates in the mathematics methods course. The next section will present a discussion and implications of some important takeaways gathered from working across the five tentative manifestations.

Discussion/Implications

The tentative manifestations can be used to suggest principles and practices for addressing ways to help teacher candidates cultivate an equity-oriented mindset for teaching mathematics. In order to prepare teacher candidates for teaching elementary mathematics in an equitable manner, teacher educators should consider how teacher candidates come to understand equity and what it means in the context of teaching mathematics. They should acknowledge the different levels of understanding teacher candidates will have for the concept of equity, particularly as it applies to mathematics teaching and learning. In this study, teacher candidates entered the methods course with a wide variety of conceptions for equity. Some teacher candidates opening admitted to have never thought about equity in teaching. For two teacher candidates, equity was thought to be something pertaining to an amount a person owns in her/is home (home-equity). The majority conceived equity to be fairness through treating everyone equally. Only a few teacher candidates thought of equity as meeting the needs of all students. So

this leads to the question of how can teacher educators meet teacher candidates where they are at in the journey with equity? As teacher educators embed equity matters into their mathematics methods courses they need to be prepared for a wide variety of conceptions of equity and think about ways in which to create learning activities that will accommodate the variety as well as ways to building on and expand current conceptions.

As teacher candidates discourse are discussed throughout this section, it should be acknowledged that for many of the teacher candidates, these are their first attempts to even consider of equity in education let alone for the teaching and learning of mathematics. For this reason caution should be used when reading the discourses of teacher candidates as to not position them from a deficit perspective rather the purpose of sharing their discourses is to help teacher educators think about ways in which they can create instructional opportunities and plan activities that assist candidates in their journey to becoming equity-minded mathematics teachers.

While working across the five tentative manifestations, four important takeaways emerged that might be considered important implication for teacher educators committed to embedding equity concerns into mathematics methods. The four important takeaways are: (1) teacher candidates should see equity as outcome and process; (2) developing a nepantla pedagogy; (3) humanizing mathematics teacher education; and (4) being prepared to fight for equity.

Seeing double: equity as outcome and process. Prominent mathematics education equity scholars, conceive equity as a process, which recognizes its evolving nature that must respond to the needs of an ever-changing society (Aguirre, 2009;

Gutiérrez, 2002; Martin, 2003). It is recommended that teacher educators be attentive to ensure that teacher candidates also conceive equity as an evolving process. In this study, teacher candidates' discourses of equity often positioned it as a stable outcome. There are inherent dangers in viewing equity as an outcome that were brought to light through the discourses of teacher candidates. Many of the candidates sloganized equity by using such phrases as *"ensuring all needs are met," "meeting the needs of each and every student," "reaching every student"* and *"equity is simply differentiating."* In the same way, teacher candidates spoke of equity as a possession or commodity that the teacher hands out or employs or as something a teacher does for or to students.

It is likely that teacher candidates acquired such discourse from different ways in which scholars defined and wrote about equity in the course's texts. To demonstrate, the NCTM (2014) states, "Equity attained when receive differentiated supports" or " ensuring that students have access to high-quality, curriculum, instruction, and supports they need" (p. 63). Similarly, Aguirre and colleagues (2013) suggest, "Equity does not mean that every student should receive identical instruction. Instead, equity demands that responsive accommodations be made as needed to promote equitable access, attainment, and advancement in mathematics education for each student" (p.9). Based on these few examples, it is likely that teacher candidates began to develop a discourse for equity as supports a teacher gives, providing access to things, and actions teacher employ to meet the needs of each student. Equally important, is the context of the course itself as it is positioned as a course in which teacher candidates acquire methods to enact with students. Combined, these things direct the attention to the actions and behaviors of

teacher candidates. They came to see equity as employing certain practices, like using tools to "fix" inequities. Take a look at the slogan "equity is reaching every student", from the teacher candidate's perspective this might mean to provide manipulatives for hands on learners, allowing students to draw, or including more math games for students who need to move. In other words a teacher candidate come to see this as "if I do these different things then I will help get students to the same outcome." It is not surprising that teacher candidates develop such a myopic viewpoint that seeks to stabilize equity.

Another dominant discourse of teacher candidates was see equity as allowing for *"individual paths"* to arrive at the same answer or outcome. This was most often used in the context of allowing students to use their own strategy or invented method to come up with the same answer to a mathematics problem or to meet the same mathematics standard. A big "ah-ha" moment in the course for many teacher candidates was the idea that children have inherent ideas about mathematics and can reason mathematically to create methods for problem solving. The majority of teacher candidates latched onto this idea and saw this through an equity lens as being responsive to students by allowing them to use their own methods and not standardize their method, which they came to see this as inequitable. However, the end result remained stable. Whether it is meeting the same standard or arriving at the same answer the outcome is already determined, stable and fixed. In the same way, these discourses can be seen as an attempt to frame equity as a fixed notion.

It is not surprising that in the era of accountability and standards-based education that teacher candidates focus in on outcomes. They may not even be cognizant of it

because this discourse is so ingrained in the fabric of education for the past two decades and has been in the spotlight on a national level for about the same time. Most recently, the attention is on common core state standards as it almost makes a daily appearance in the media and is often part of candidates' political platform. It is interesting to note that not one of the teacher candidates in this study ever called into question the appropriateness of the standards or questioned outcomes. The authority of the standards was widely accepted, as an appropriate goal for all students and it was their job to uphold them.

Such discourse positions equity as an outcome or goal to be achieved and seeks to stabilize equity. For this reason, it is important to be aware that the ways in which teacher candidates talk about equity can reinforce conceptions that actually contribute to furthering inequities. According to Martin (2003), there is a real danger that can result from conceiving equity as an outcome, that is, if marginalized students do not reach the desired outcome then deficit notions about them can perpetuate because the problem is see as inherent in the students and their circumstances are seen as all encompassing rendering them powerless to act or resist. This can be particularly true if equity is conceived as "fixing" students, as "fixing" implies that there is something inherently wrong with students who need to be given the "tools" of equity so that they can meet the desired outcome.

Yet, teacher candidates do need to acquire practices to work toward eliminating inequities in the mathematics classroom and some practices afford more opportunities for that than others. Subsequently, conceiving equity as an outcome, meeting the needs of

each and every student, and providing students access to the mathematics can contribute toward the work of equity. For this reason, it is recommended that teacher educators help candidates to develop mentality that can hold multiple truths. Moving away from singular meanings and truths for equity such as *"equity is differentiation"* is essential. Equity requires certain actions by teachers and will produce certain outcomes and it is a process that continues to evolve, change and cause transformation. Positioning *equity as an outcome* is dominant throughout the literature and the texts that most teacher candidates will encounter. Therefore, it will be important for teacher educators to keep the idea of *equity as a process* prominent throughout the mathematics methods course. Equally important, is for teacher candidates to continue to interrogate their conceptions so that they do not remain stable and fixed. They must "have the means to challenge these discourses and re-inscribe them with other meanings" (Gutiérrez, 2013, p.43). If individuals are the product of discourses and the meaning people make for themselves occurs as they negotiate such discourses (Foucault, 1977, 1980) then teacher educators need to carefully attend to the discourses they take up for taking about equity within mathematics teaching and learning.

Developing a nepantla pedagogy. Throughout this study, teacher candidates often found themselves in situations where they began to be aware of multiple realities. Most notably, this occurred when the discourses they have come to learn through the methods course, as to what constitutes effective teaching, begins to contradict itself. To demonstrate, for one teacher candidate, her discourse for what a "worthwhile" task should be able to do for students failed to live up to its expectations (i.e., tasks have

multiple entry points for students to enter in and access the mathematics) as another reality began to manifest, which was, a student who she was working could not find a way into this task. That produced a tension for this teacher candidate as what do you do when students do not have a way into a task that is supposed to be accessible by all students. This produced two realities that the task was accessible while yet not accessible for a student at the same time.

There were several other instances throughout this study where teacher candidates experienced tensions from multiple contradicting realities. The bolded phrases indicate the contradictions between the two realities. Those involved: (1) positioning students as competent sense makers of mathematics, **while at the same time**, positioning the teacher in control of making sense of the mathematics; (2) knowing students through commonalities, **yet at the same time**, not really knowing them personally; (3) teacher candidates are expected to teach students and be evaluated on their teaching ability like fully credential teachers, **yet at the same time**, they are really not teachers as they face barriers to engaging as legitimate members of the teaching community; (4) the mathematics textbook holds much power as it is positioned as the source from which mathematical knowledge flows, **yet at the same time**, the text can be read as powerless in its ability to have knowledge about the students to consider it of value by the very students it seeks to educate; and (5) viewing teaching mathematics as the teacher *"doing the right thing"*, **yet at the same time**, metacognitively aware a teacher's attention should be on *"being human"* with students. Such experiences described by teacher

candidates in this study and outlined here are what Gloria Anzaldúa refers to as being in a space called *nepantla*.

For Anzaldúa (1987), *nepantla* (i.e., literally meaning "neither here nor there") is a space where one's perspective collides with the perspective of another thereby causing inherent tensions as one struggles with competing ideas, opposing discourses and multiple realities. According to Anzaldúa (2002),

> Nepantla is the site of transformation. The place where different perspectives come into conflict and where you question the basic ideas, tenets, and identities inherited from your family, your education, and your different cultures. Nepantla is the zone between changes where you struggle to find equilibrium between the outer expression of change and your inner relationship to it. Living between cultures results in "seeing" double, first from the perspective of one culture, then from the perspective of another. Seeing from two or more perspectives simultaneously renders those cultures transparent. (p. 548-549)

Teacher educators can utilize Anzaldúa's notion to prepare teacher candidates to develop a *nepantla* pedagogy. It is a pedagogy that will help teacher candidates learn to embrace the messy space of being here nor there–where multiple realities about teaching mathematics, understandings of students, mathematics pedagogical practices, mathematical ways of knowing, all collide together. What a *nepantla* pedagogy does is it allows teacher candidates to "see double"–that is seeing other perspectives alongside theirs and that there is room for both perspective to cohabitate together. This does not

mean their perspective is subsumed or must conformed to the other perspective. Rather, it is a both and perspective.

A *nepantla* pedagogy means recognizing the value of staying in that messy place, sitting with contradictory ideas, questioning, wondering and not to try to immediately resolve an issue. Staying long enough to birth something new– a new framing of mathematics (Gutiérrez, 2012) for teacher candidates. This often is the case for teacher candidates, as they seem to quickly want a solution, answer, or antidote to "fix" a teaching/learning situation or student issue. Most candidates are often not comfortable "sitting" with a situation or issue and interrogating it. Thus, a *nepantla* pedagogy simultaneously deconstructs and constructs teacher candidates' discourses as well as complicates their understandings of the teaching and learning mathematics.

Humanizing mathematics teacher education. In efforts to prepare teacher candidates for the realities of teaching mathematics much attention is given to practices for teaching mathematics, such as, implementing tasks that promote reasoning and problem-solving and facilitating meaningful mathematical discourse. While this attention is essential, what often happens is teacher candidates can become overly focused upon doing these practices correctly that they loose sight of the humanity in teaching. This was evident data for many teacher candidates; however, I will highlight the words of one teacher candidate to frame this discussion. Camryn explains, *"I was more focused on me doing the right thing [that was making sure she was creating a task or doing a discussion correctly] rather than like really getting to know, like I got to know a lot about students*

but really getting…well…and just being a human with…you know just being a person with them."

This focus on practice is not surprising as teacher candidates are often under the weight of the "pedagogical gaze" where their teaching actions are observed and evaluated. Nevertheless, look at the heartfelt cry of the teacher candidate as she expresses her desire to be human with students. What might teacher education and educators learn from this genuine cry? Might the "weight" of performing mathematical practices keep teacher candidates from doing the very thing that is critical to equity in teaching mathematics? Also, it is important to consider what is not being said in Camryn's words– if she just desires to be a human with students then what does that indicate about her current relationship with students. Is mathematics teaching preventing her from being a human or a person? If so, then it begs to ask the question, how is it asking her to be with students?

In the mathematics education literature, "knowing" students is seen as essential to support the teaching and learning of mathematics in multiple ways, such as, building students' mathematical identities (Aguirre et al., 2013; Boaler & Greeno, 2000; Cobb, Gresalfi, & Hobb, 2008), building students' agency (Turner, 2003), drawing on students' cultural, linguistic, community backgrounds and experiences (Aguirre, 2009; Gay, 2000; Gutiérrez, 2012; Ladson-Billings, 1994; Martin, 2003; Nasir et al., 2008) including funds of knowledge (González, et al., 2005; Moll & González, 2004) for accessing mathematics and the creation of relevant tasks, and taking up social justice issues related the lives of students (Gutstein, 2006; Martin, 2003). This large literature-based is fairly typical

content that appears to some degree in most mathematics methods courses. Yet, it is worth thinking about how and to what extend "knowing" students is taken-up with teacher candidates.

Could "knowing" students being conceived as a "tool" by teacher candidates used to "fix" mathematics instruction? A "tool" that quite possibly could stabilize notions of equity. Camryn said that she *"knows a lot about them"* and Piper previously stated that if she gets to know them then she could use it to teach mathematics. Did Camryn pick up on this and realized that using the "tool" does not really allow you to be a human with students? Can or should "knowing" students be consider a stable practice? Teacher educators should examine their practices and discourses as well as other discourses that maybe operating in the program, institution, field experiences schools, and society in general. Do the practices we use gloss over what it means and requires of teachers to "know" their students? What might be barriers for teacher candidates that prevent them from "knowing" students in humanizing ways? Attention to mathematics practices is essential in a methods course, as they are the instruments teachers' use for students come to understand mathematics. However, without knowledge of students those instruments might only produce empty sounds. If "knowing" students is essential to equity then we may inadvertently be undoing the very thing that is going to make a difference in teaching mathematics for students, particularly marginalized students, in the classroom.

Fighting for equity. Attention to equity in the mathematics methods course caused teacher candidates to take note of their newly acquired discourse operating in their field experience classrooms and schools. An unexpected tentative manifestation was the

effect the teacher candidates' field experience practicum had upon cultivating equity-mindedness as inequities were brought into sharp focus under the "pedagogical gaze" of teacher candidates. These mismatches or inconsistencies bring about incongruences and influence the teaching and learning that takes place between teachers and students. This is made evident by the statement of one teacher candidate, *"You set our standards so high on what we could see in the classroom and we get there and we are very much like this is not equitable."* Moreover, focusing in on equity stirred up feelings of advocacy towards students, *"we are already so defensive and protective over our students that we don't even know."*

Through this purposeful attention to equity, teacher candidates began to recognize the implications of their practice in which they lack agency to change due to their positionality as teachers in training. However, this difficult position that they are placed in resulted in knowing that they might have to someday *"challenge it," "stand against it," "resist it,"* or *"go out on a limb"* when they enter schools as full fledged teachers. What is produced here is almost a preparation to "fight" against inequities in the teaching and learning of mathematics.

While there is much value in field experiences, it needs to be acknowledged that these are presented from the teacher candidates' perspective and the mentor teachers or schools were not part of this study. However, the intended message to teacher educators is that a focus on equity may produce teacher candidates' who have a critical lens for inequities in mathematics teaching. As mathematics methods instructors, we should consider the implications that field experiences may upon cultivating equity-mindedness

for teaching mathematics. How might teacher educators better prepare teacher candidates for their courses and field experiences to handle situations that they perceive as inequitable? How can we prepare teacher candidates to be advocates for equitable practices considering their positionality? Also, it is worth considering how might teacher educators help teacher candidates resist discourses and practices that work against equity.

Milner (2006) suggests practicum experiences need to be offered in conjunction with such courses to scaffold and bridge learning and to help teachers situate theory with practice. Moreover, theoretical notions need to be tested or more deeply understood in the actual practice of teaching and learning so teachers can build their repertoire to inform their practice"(p.351). The words of one teacher candidate demand attention and inspire action for teacher educators to consider how we might better design field experiences that allow teacher candidates some agency to practice equity-oriented practices in mathematics.

> *So I guess it is just hard to implement these ideas, I wish that I was able to use these ideas right now while I'm learning them - to make them stay stronger in my brain but by the time I'll have my own classroom and have the ability to do it I'm afraid that these will be kind of pushed back and you know maybe some day I will think about one or two but I won't think about maybe all of them like I am now.*

Practical Implications

The tentative manifestations hold some practical implications for a mathematics methods course that has a prominent focus on equity. The initial and significant tentative manifestations that were identified through the teacher candidates' accounting and written course work can be used to suggest practices for teacher educators to help cultivate equity-mindedness for the teaching and learning of mathematics. Enacting practice is not a static event, that once established it is ready to use. Rather practice is

always in the process of becoming and must always be reproduced (Gutiérrez, 2002). Drawing on this notion of practice, two practices are offered to teacher educators and one to teacher education programs that might help in cultivating an equity mindset: (1) continued critical reflection that draws on post-structural notions, (2) creating *nepantla* opportunities, and (3**)** purposeful integration of equity in teacher education program.

Continued critical reflection that draws on post-structural notions. Reflective practice has been characterized as a hallmark of quality teachers and the foundation of their professional growth. In critical reflection the word "critical" denotes another level of reflection which requires calling into question one's own taken-for-granted frames of reference, that is, one's experiences, ways of thinking, beliefs, assumptions, privileges, struggles and positions.

Post-structural notions might support the process critical reflection for teacher candidates. In post-structuralism meanings are seen as partial, fleeting, and evolving. A post-structuralist viewpoint considers the individual a product of discourses (Foucault, 1977, 1980; Walshaw, 2007) and not the source of his or her own meaning, reasoning, knowledge and action. Post-structuralism works against singular meanings and truths. Rather, it works to destabilize or decenter them.

Such notions may provide a way for teacher candidates to seek multiple perspectives, challenge their own truths, and recognize oppressive discourses. As well as, provide teacher candidates with the means to challenge these discourses or re-inscribe them with alternative meanings (Gutiérrez, 2012). Ultimately, reflecting post-structurally

is a way to assist with examining one's frames of reference. Paying careful attention to the ways mathematics learning gets framed through the acts of teaching.

So what does it mean to critically reflect post-structurally for teacher candidates? It means having teacher candidates ask themselves questions, such as: what are my assumptions of normality, what discourses are in circulation, what counts as knowledge, how did I come to "know" things, who is privileged by this knowledge, who is silenced by this knowledge, how have gender, race, ethnicity, ability, and class influenced my understanding of others, and might there be other perspectives that I'm not seeing. In the same way, teacher candidates need to acknowledge their beliefs, perspectives and opinions that they are unwilling to abandon. These are just some examples that can help teacher candidates begin the process of uncovering underlying meanings and taken for granted ways of knowing.

This type of reflection is important to do throughout a course by having teacher candidates' return to it often by re-reading and synthesizing their reflections. The more teacher candidates critically reflect post-structurally the better the chance they will have at taking ahold of the things that might cause inequities in teaching mathematics. Thus, equity requires an interrogation of how we have come to know all things.

This process is even important to engage teacher candidates in during readings about teaching mathematical concepts and children's mathematical thinking. Particularly if teacher candidates have come to know mathematics in a proceduralized way, they often lack the frames of reference for conceptual understanding and how children might think about a concept. For instance, they may privilege one method for solving a division

problem thereby marginalizing other ways that students' maybe thinking. For this reason, it is important for teacher candidates to see multiplicities in the ways of knowing mathematics, as there is not a singular way to know mathematical concepts and ideas.

Creating *nepantla* opportunities. As stated earlier in this chapter, a *nepantla* pedagogy means recognizing the value of staying in a messy place, sitting with contradictory ideas, questioning, wondering and not to try to immediately resolve issues. Teacher candidates need opportunities to "see double"–that is seeing multiple perspectives alongside theirs. Teacher educators can purposefully create situations in the classroom to force teacher candidates deal with contradiction by predicting areas in the course content that lend themselves to multiple realities. To demonstrate, teacher educators could engage candidates in examination of mathematics textbooks by looking for ways it simultaneously constructs and deconstructs mathematical understanding.

It is also important to be attentive to situations that may arise in the classroom that may become *nepantla* moments as teacher candidates share experiences, perspectives, and opinions. Equally important in these moments is making sure the teacher candidates realize that they are experiencing *nepantla*. For this reason, creating *nepantla* opportunities might be a way to help push teacher candidates' acceptance of multiple realities, which in turn could result in more equitable teaching of mathematics.

Purposeful integration of equity in teacher education program. It was evident in this study that for some teacher candidates this was their first time to even consider equity, let alone in the context of mathematics education. Teacher candidates need more time to develop conceptions of equity for teaching. Due to the nature of most teacher

education programs, courses are typically just a semester long, thereby, limiting an instructor's efforts with candidates to that semester only. Therefore, it is recommended equity issues and concerns be integrate throughout the entire program, especially each methods course taking up some aspect. Also, with each course having a particular focus on equity that affords teacher candidates opportunities to build upon their understanding of equity across multiple courses and subject areas.

Limitations

A potential limitation to this study was the limited diversity of the teacher candidates. The vast majority of teacher candidates were white monolingual females from middle class backgrounds. This may have had an impact upon the phenomenon, cultivating equity-mindedness, as other candidates from different racial, cultural and linguistic backgrounds might have had variant perspectives and perhaps shifted the ways in which they tentatively manifested.

Additionally, my positionality as course instructor and interviewer may have influenced what the teacher candidates shared about their lived experiences. A few times during the interviews, candidates would make a comment like, is that what you what. In their efforts to please me they may have been telling me what they perceived that I wanted to hear.

Future Research

Future research directions for this study include further exploration into whether teacher candidates' conception as *equity as an outcome* was related to equity in general or because it was situated in the context of mathematics. Could the context of mathematics

be a contributing factor in why they may have come away with this conception? Often candidates have strong conceptions about mathematics being a product produced, therefore, this warrants further inquiry into conceptions of mathematics and how this relates to conceptions of equity.

One area of interest that warrants further investigation was produced through a teacher candidate's statement about *"just being a human"* with students. I am fascinated with these words and want to know what exactly do they mean as well as what is hidden or absent within them. This teacher candidate was sharing her struggles with getting to know students and made the distinction about getting to know about them and being a human with them. This distinction of "knowing" students needs more attention, as having knowledge of students is essential to creating equitable mathematics instruction. Perhaps, a study on what does it mean to "know" students for the teaching and learning of elementary mathematics.

Another area of inquiry that necessitates more attention is examining the ways in which teacher candidates discuss students and their understandings of equity. There were clear connections between the teacher candidates' understandings about equity and the discourses they used to talk about students. Candidates that appeared to have a deeper understanding of equity talked about the particulars of students by giving detailed examples and rarely using the term equity. Whereas, candidates who had more superficial understandings of equity often spoke of students by essentializing them and continually used the term equity. It would be worth further examination into this possible connection.

Along the same lines, future research might include a tracing of the language teacher candidates used to describe the term equity and their conceptions of equity in mathematics. Teacher candidates' discourses for equity appear to imply certain conceptions, however, an inquiry is necessary to explore the possible meanings and connections between them.

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Appendix A

The Task Analysis Guide. (From Stein & Smith [1998])

Lower-Level Demands	Higher-Level Demands
Memorization Tasks • Involves reproducing previously learned facts, rules, formula, or definitions OR committing facts, rules, formula, or definitions to memory. • Cannot be solved using procedures because a procedure does not exist or because the time frame in which the task is being completed is too short to use a procedure. • Are not ambiguous—such tasks involve exact reproduction of previously seen material and what is to be reproduced is clearly and directly stated. • Have no connection to the concepts or meaning that underlie the facts, rules, formulae, or definitions being learned or reproduced.	Procedures With Connections Tasks • Focus students' attention on the use of procedures for the purpose of developing deeper levels of understanding of mathematical concepts and ideas. • Suggest pathways to follow (explicitly or implicitly) that are broad general procedures that have close connections to underlying conceptual ideas as opposed to narrow algorithms that are opaque with respect to underlying concepts. • Usually are represented in multiple ways (e.g. visual diagrams, manipulatives, symbols, problem situations). Making connections among multiple representations helps to develop meaning. • Require some degree of cognitive effort. Although general procedures may be followed, they cannot be followed mindlessly. Students need to engage with the conceptual ideas that underlie the procedures in order to successfully complete the task and develop understanding.
Procedures Without Connections Tasks • Are algorithmic. Use of the procedure is either specifically called for or its use is evident based on prior instruction, experience or placement of the task. • Require little cognitive demand for successful completion. There is little ambiguity about what needs to be done and how to do it. • Have no connection to the concepts or meaning that underlie the procedure being used. • Are focused on producing correct answers rather than developing mathematical understanding. • Require no explanations, or explanations that focus solely on describing the procedure that was used.	Doing Mathematics Tasks • Require complex and nonalgorithmic thinkin there is not a predictable, well-rehearsed app or pathway explicitly suggested by the task, t instructions, or a worked-out example) • Require students to explore and understand the nature of mathematical concepts, processes, or relationships. • Demand self-monitoring or self-regulation of one's own cognitive processes. • Require students to access relevant knowledge and experiences and make appropriate use of them in working through the task. • Require students to analyze the task and actively examine task constraints that may limit possible solution strategies and solutions. • Require considerable effort and may involve some level of anxiety for the student due to the unpredictable nature of the solution process required.

Appendix B

Session	Purpose	Topics & Major Activity	Explicit Focus on Equity	Written Reflections
1	To engage teacher candidates in reflection to uncover and deconstruct conceptions and assumptions of mathematics teaching and learning. To compare teacher candidates school experiences in mathematics to NCTM/CCSSM standards.	**Topic: NCTM Standards** **Common Core State Standards** - Teacher candidates analyzed standards - Teacher candidates compared standards to personal experiences in their mathematics education.	Disrupt dominate discourse around teaching and learning of mathematics Teacher candidates engaged in personal reflection and small group discussion over: What is mathematics? What does it mean to do mathematics? How does one go about learning mathematics? How does one teach mathematics? How does one assess mathematics?	How did you learn mathematics? What was mathematics instruction like for you?
2	To expose teacher candidates to what doing mathematics really entails. To prepare teacher candidates to teach for developing conceptual understanding with children.	**Topic: Mathematical Proficiency** - Teacher candidates analyzed a case study for ways the teacher facilitated conceptual understanding in her classroom. **MKT Topic: Early Number Concepts** -Identified learning progressions -Engaged in an problem-solving task -Examined children's thinking	All children deserve the right to learn mathematics with understanding. Teacher candidates analyzed a case study for ways the teacher facilitated conceptual understanding in her classroom.	Continue to critically compare your experiences learning mathematics with the current views on teaching and learning mathematics. Use evidence from your readings to support your statements. In Class reflection: What is equity? What is equity in the context of teaching mathematics?
3	To help teacher candidates develop an initial definition of equity in mathematics education. To begin to understand the role of culture, community, language, gender, class race and prior experiences impact mathematics teaching and learning.	**Topic: Equity the Mathematics Classroom** - Teacher candidates examined and reflected how identity and culture, community, language, gender, class race and experience, are impacted by the teaching and learning of mathematics. - Teacher candidates	Framing equity: develop a common understanding of equity. Teacher candidates examined and reflected how identity and culture, community, language, gender, class race and experience, are impacted by the teaching and learning	How did your perspective on equity, you wrote about in class, compare to the definitions provided by NCTM, Gutiérrez (Framing Equity article) and Aguirre, Mayfield-Ingram and Martin (Impact of Identity authors)? What role do students'

	To help teacher candidates begin to conceptualize what teaching for equity requires in the mathematics classroom.	identified some guiding principles that would facilitate an equitable classroom. **MKT Topic: Addition, Subtraction, Multiplication & Division Concepts** -Identified learning progressions -Engaged in an problem-solving task -Examined children's thinking	of mathematics. Teacher candidates identified some guiding principles that would facilitate an equitable classroom.	identities play in the teaching and learning of mathematics? The authors of, Why isn't Miguel Learning Math, discuss the issue of status. In what ways does status impact learning mathematics?
4	To help teacher candidates learn the importance of using worthwhile, high-cognitive demand tasks in elementary mathematics. Emphasis on how mathematical tasks work towards achieving equity in the teaching and learning of mathematics.	**Topic: Setting Mathematical Goals & Creating Mathematical Tasks that Engage Students in Productive Struggle** - Teacher candidates compared mathematical tasks to determine the cognitive demand. - Teacher candidates created worthwhile mathematical tasks. **MKT Topic: Whole Number Place Value Concepts** -Identified learning progressions -Engaged in an problem-solving task -Examined children's thinking	Worthwhile mathematical tasks allow children to use what they know to start the problem thereby provides them access to the mathematics. The use of worthwhile tasks places emphasis on valuing the thinking and solution strategies of children. Teacher candidates learned to create worthwhile, high-cognitive demand tasks and explored how to integrate the lived experiences (culture, community, language, prior experiences) of children to create mathematical tasks for problem solving.	Explain how worthwhile mathematical tasks can provide students access to the mathematical concepts (this is one way to provide equitable instruction). Use evidence across multiple texts to support your ideas and also you may refer to the readings from session 3 to help explain. Also, draw on some of the examples across the different readings and use them as evidence to support your answer this question. How can integrating students' funds of knowledge into mathematical tasks build and support positive identities? You will need to draw on The Impact of Identity and the article on students' lived experiences to fully answer this question.

5	To examine the benefits of utilizing mathematical discussions. To learn how to create purposeful questions that elicit children's mathematical sense making.	**Topic: Facilitating Meaningful Mathematical Discourse & Posing Purposeful Questions** - Teacher candidates examined discussion vignettes and identified question types and purposes. **MKT Topic: Addition and Subtraction Computation Strategies** -Identified learning progressions -Engaged in an problem-solving task -Examined children's thinking	Mathematical discussions provide children opportunities to share their ways of thinking about mathematics. The discussions gives children voice thereby affirming their identities. Teacher candidates reflected on a case study about ELL children learning from and contributing to discussions	1. Explain why mathematical discussions are considered an equitable practice. 2. How do mathematical discussions contribute to student learning and sense making? 3. What are the challenges and dilemmas teachers may face when implementing discussions? 4. What big ideas did you glean about the importance of questioning?
6	To learn how to plan problem-solving lessons.	**Topic: Lesson Planning** -Teacher candidates examined the attributes of problem-based lessons and created problem-solving lesson plans. -Teacher candidates created a problem-solving lesson. **MKT Topic: Multiplication and Division Computation Strategies** -Identified learning progressions -Engaged in an problem-solving task -Examined children's thinking	Combine information learned in sessions 1-5 to create problem-solving lessons that implement equity practices.	
7	To use discussion structures to create productive mathematical discussions.	**Topic: Creating Structures for Mathematical Discussions** -Teacher candidates compared six different structures for creating productive	Structuring a discussion helps prepare for more equitable participation and focuses the discussion on the important mathematical goals of	How do the different strategies in the book allow for children to participate equitably while still maintaining the mathematics goal of the lesson during a discussion?

		mathematical discussion. -Teacher candidates prepared a mathematical discussion utilizing one of the six discussion structures. **MKT Topic: Algebraic Concepts** -Identified learning progressions -Engaged in an problem-solving task -Examined children's thinking	the lesson.	Please make sure to add in your personal connections, thoughts and feelings to your reflection. Also, you might make connections to past session readings.
8	To establish a definition of equity in mathematics education. To identify and examine practices that are designed to promote equity in the teaching and learning of mathematics.	**Topic: Equity-Based Practices** -Teacher candidates compared the five equity-based practices to the eight mathematical practices from NCTM's Principles to Actions. -Teacher candidates identified equity-based practices from a video teaching episode. **MKT Topic: Fraction Concepts** -Identified learning progressions -Engaged in an problem-solving task -Examined children's thinking	Revisit teacher candidates an initial definition of equity and compare it to current conceptions of equity. For teacher candidates to examine and articulate how the eight mathematical teaching practices promote equity.	What are your conceptions of equity? How has it changed or become more refined based on this week's readings? What practices would you need to implement to work towards achieving teaching mathematics for equity?
9	To identify what constitutes as mathematical understanding. To create assessments that allows children to demonstrate mathematical understanding.	**Topic: Assessing Mathematical Understanding and Eliciting Student Understanding** -Teacher candidates developed indicators of understanding for a mathematical concept. -Teacher candidates develop an interview protocol to assess the mathematical understanding of a	For teacher candidates to recognize and value the mathematical thinking of children and learn how to use their thinking to assess mathematical knowledge. To rethink the use of assessments in light of the five equity-based practices	

		child. **MKT Topic: Decimals and Percents Concepts** -Identified learning progressions -Engaged in an problem-solving task -Examined children's thinking		
10	To expand teacher candidates concept of teaching mathematics for equity by exposing teacher candidates to the idea of incorporating social justice issues in mathematics classroom.	**Topic: Social Justice Mathematics** -Teacher candidates viewed a video of a classroom teaching episode and reflected on the following: How did the students draw upon critical knowledge? How did (or how might have) students' mathematical activity enhance their critical understanding of important local, national, or global issues? How did (or how might have) students' critical understandings about a topic impact the way they made sense of the mathematics? **MKT Topic: Geometric Concepts** -Identified learning progressions -Engaged in an problem-solving task -Examined children's thinking	For teacher candidates to be aware that mathematics can empower children by using it to critically examine important societal issues that are relevant to them.	After reading the articles please describe your understanding of what it mean to teach mathematics for social justice. How might this promote equity within the classroom?

Appendix C

Questions Utilized to Uncover Equity-Mindedness

The following questions were used to interrogate the teacher candidates' interviews. The questions are broken down by each secondary research question and they are aimed at telling something about the particular phenomenon in focus, which is equity-mindedness. The answers reveal something about the phenomenon under investigation.

Attention to high-quality mathematical practices

- How closely are teacher candidates attending to the mathematical practices?
- What is their understanding of them, as evidenced by their written work?
- What assumptions do they make/hold?
- What misunderstandings are apparent?
- What indications of bias, stereotyping or dominant ways of teaching are evident?
- Is there evidence of resistance?

Attention to being responsive to students' identities

- What evidence of affirmation of students' identities is present?
- What assumptions to they make/hold toward the impact of culture, community, language, gender, class, race, and prior experiences on learning mathematics?
- From what lens (asset or deficit) do they view students (e.g. backgrounds, competency) or the mathematics itself?
- Are Cultural/dominant beliefs about teaching mathematics present?
- What evidence of teacher candidates understanding the influences of students' backgrounds and experiences on mathematics understanding?

- Is there evidence of resistance?
- To what extent do teacher candidates draw on multiple resources of knowledge (i.e., culture, community, language, gender, class, race, and experiences)?

Attention to a critical mindset

- Are there any biases or stereotyping apparent?
- What assumptions do they make?
- From what lens (asset or deficit) do they view students or mathematics teaching and learning?
- Is there evidence of privileging or marginalizing ideas, race, culture, gender, etc.?
- Is there evidence of color blindness?
- What degree is there evidence of racialized, gendered, and classed instruction?
- What is their understanding of how issues of participation, authority/power, and status influence learning?
- Is there evidence of resistance?

Appendix D

Possible Interview Questions for the Twelve Participants

Starting Statement: Could you describe your journey or lived experience in becoming equity minded in the teaching and learning of elementary mathematics.

Tell me about your journey towards becoming equity-minded mathematics teacher.

What was it like to learn to teach mathematics for equity?

What was becoming equity minded in regards to the teaching and learning of elementary mathematics like for you?

What does equity mean to you?

Can you tell me how you came to your current definition or understanding of equity in teaching mathematics?

What did you expect this class to be like?

What experiences lead you to believe this?

Did you come face-to-face with any assumptions you had about teaching and learning of elementary mathematics while reading, discussing or working on assignments?

When did you first become aware of…?

In what ways did you…?

Can you give me an example?

Did you experience any aha moments during this course?

Can you tell me about your biggest revelation you experienced in this course?

What things do you still question?

What is still troubling you? What ideas are still circulating around in your thoughts?

Did any assignments have an impact on you or contribute to your understanding of teaching mathematics for equity?

This course has two distinct parts: The theory, research, ideas of scholars on teaching for equity and then a very practical side which includes setting goals, creating tasks, planning a discussion, etc. How do you merge the two? Or how have you made connections between the two?

How have you come to understand theory and practice?

Final Questions:

Did this class change you? If so how has this course changed you?

Where do you see yourself going with ideas and practices you learned in this course?

Post Field Experience Interview Questions for the Four Participants

Starting Statement: What was the teacher candidates' intentional relationship like with equity-mindedness?

So what was it like to teach mathematics for equity?

What was it like to plan lessons that incorporated equity-practices or attended to equity matters?

What was it like to enact those plans? Implement them?

Do you have any moments that stand out to in regards to equity-based mathematics instruction? If so can you describe it/them?

Did you experience any challenges or obstacles? If so can you tell me about them?

What did you feel good about in regards to equity-based mathematics instruction?

Where you aware of any inequities or equities in the classroom in regards to mathematics instruction? If so can you describe them?

Did you make connections to the course topics? Did anything resonate with you? Or do you have a greater/deeper understanding of some issue/matter now?

Final Questions:

How would you define equity now?

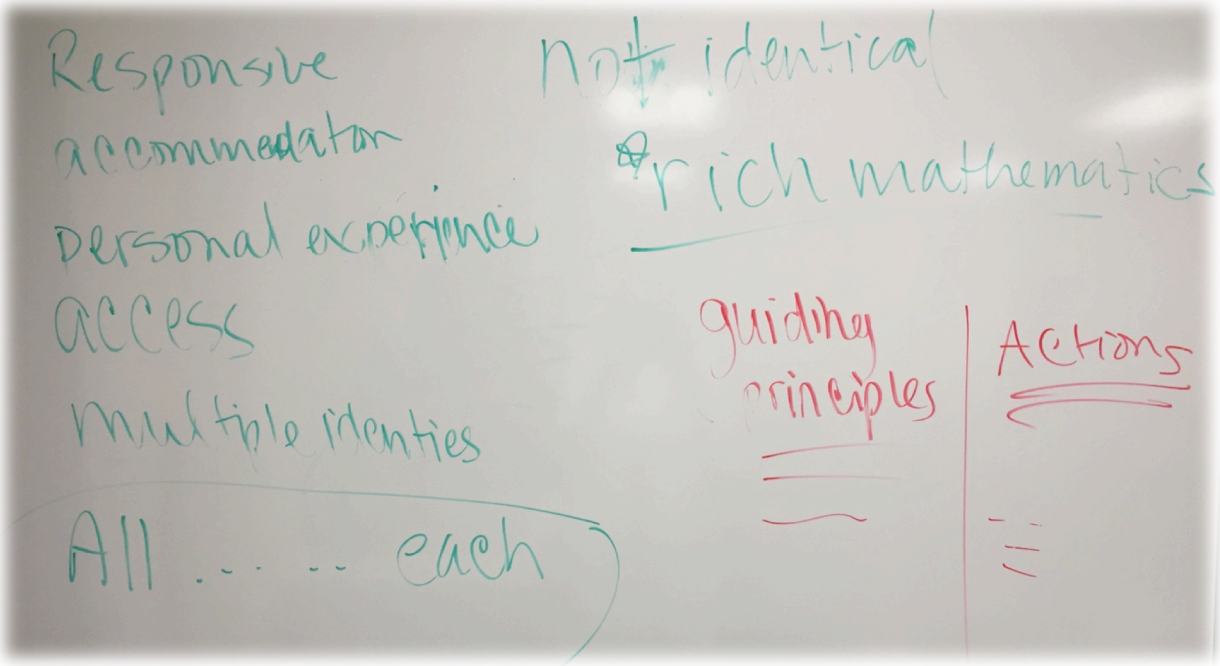
Any changes to how you view equity in mathematics instruction since being in the field?

Appendix E

Post-Reflexion Journal for Post Class Sessions

Session 3: 9-15-15

Initial noticing's about equity definitions:



Ellie's (pseudonym) observation: All…each-noticing…"What do you want the same for all children and that is to see their individual identities-each one's." I was really surprised by this noticing, as I didn't even put together myself how the definition offered up in *Impact of Identity* text starts with all and ends with each. I can't be smile at the depth she and others are starting to go as they focus on what equity means in teaching and learning.

Principles and Actions Anchor Charts:
One group not making assumptions-challenged them to think about what does that look like in action/practice? Struggled with coming up with examples of what does not making assumptions look like…I was taken back a bit that not one student didn't even have one idea. I offered up suggestions but now I'm thinking that this is probably HARD. Its sort of like equity-when asked to define it is hard but you sure can think of things that are inequitable rather quickly. I need to make note that I need to do a better job with this if I do this next semester.

Then one girl at a neighboring table spoke up about a parental situation in her last semester experience. She described a situation in which her mentor teacher and she included herself were very frustrated with a student's parent. As the mentor teacher tried on several occasions to make contact with this parent. Their overall feelings were this parent didn't want to be involved in her child's education.

It is interesting how my student started this conversation – she made some type of statement about how the student was struggling due to non-parental support at home. The feeling projected was a "blame the parent" because they did everything they could at school. She went on to say something that indicated that they can only do so much in school and home has to support their (her and her mentor teacher) efforts. In the moment I was really surprised by her comment as we were discussing making assumptions right now. Internally, I couldn't help but think why can't you make the connection. And her comment of "we can only do so much at school"...well I had to admit kind of frustrated me as she seemed to be dismissive or quick to have a negative response.

But then I immediately realized that this was a perfect opportunity to capitalize on –put the newly added guiding principle of not making assumptions to work and challenge this comment (which is her assumption about students' families). After, the student finished her story I asked well how could we put this guiding principle to action in your situation you described? There was silence on all fronts. I went on to ask the question "What might make this parent not want to those return calls?" The students were silent again as if they never considered taking this perspective. AH HELLO? I gave them a few scenarios that I recalled, from my experience working with parents that maybe there are other things going on that you do not know and this could just be masquerading as a lack of concern from YOUR perspective and we have to take the time get to know families but also not to jump to assumptions. This was a great teachable moment for this small group of students to instantly apply a principle.

I can't help but think that my students don't think about these things. There silence today really showed me that making assumptions is an area that needs much work….I have to continue to reflect.