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How Equitable Teaching Practices Impact the Mathematical Identity of English Language Learners from Teachers' Perspectives

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To my parents, who raised and taught me;

To my husband, who loves and supports me;

To my committee members who guided and encouraged me;

To the participants, who allowed me to access their knowledge and experiences;

Last and the most importantly, to my three children, who have spent hours and hours waiting for me to play with them while I was reading and writing.

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CHAPTER ONE

Introduction

According to the National Center for Education Statistics (2019), the racial/ethnic diversity of U.S. public school students has increased and it reflects the increase in the racial/ethnic diversity of the overall U.S. population. This diversity is also apparent in the number of students identified as English language learners (ELLs). According to the U.S. Department of Education (2022), a total of 3,793,764 ELLs were enrolled in public schools in kindergarten through grade 12 in the 50 states and the District of Columbia, representing 8.1% of total student enrollment during the 2000–01 school year (SY). By SY 2019–20, the ELL population had grown by almost 1 million and a half students to a total of 5,115,887 ELLs, representing 10.4% of total student enrollment. Nationally, the percentage of ELLs enrolled in U.S. schools rose by 2.3 percentage points between SY 2000–01 and SY 2019–20. Among the increasing number of the ELLs, the achievement gaps continue expanding. ELLs have significantly lower levels of education and higher dropout rates than their white peers (Waxman & Tellez, 2002).

Proficiency in core academic subjects such as reading and mathematics is considered as a key indicator that students are learning at their grade level. Although ELLs have some growth in mathematics proficiency nationally, their performance still lags far behind their non-EL peers (US Department of Education, 2019). According to The Nation's Report Card (National Center for Education Statistics, 2019), the average math score on the National Assessment of Educational Progress assessment for non-ELL fourth graders was 243, whereas the average math score for ELL fourth graders was 220. By eighth grade, this gap had widened with non-ELL students averaging 285 and ELLs

averaging 243. These gaps show an increase in the achievement gap as they get older. In order to address the needs of ELLs, a national effort must be made to close the achievement gap and to achieve equitable math outcomes for ELLs.

At the same time, supporting culturally diverse students must include understanding the perceptions and experiences of teachers regarding equity in the classroom. The classrooms are social contexts and teachers' perceptions of students influence expectations. Therefore, it is necessary to understand the perceptions that influence and so ultimately impact teachers' expectations of students. The purpose of this thesis is to explore the question, *How do equitable teacher practices impact the mathematical identity of ELLs from teachers' perspectives?* In Chapter One, I will begin with introducing my personal background and how my identity impacted my learning in the past. Then, I will share my professional experiences that are related to the research. These narratives provide a context for why I choose this research topic.

Personal Connection to the Research

Study Abroad

After teaching in college for several years, I went to Europe to pursue my master degree in educational science. My focus was in doing research on educational sociology, economics, and policy-making. That was the first time for me to study abroad, using another language as the academic language. Since I had studied English for so many years, I confidently thought it should not be so challenging for me to study and live in another culture.

But soon, I realized that I was wrong. One of the biggest challenges I had was in my statistics class. I thought I was pretty good at math although I was not majoring in it.

My grandfather was an accountant and we had a lot of math talks when I was young. I did not realize that could be the reason why I loved math until I grew up. But that self-belief as a math person did not transfer naturally to my statistics class. It was not the content that was hard for me; it was actually other factors such as language barrier (academic language), unfamiliarity with the classroom instruction strategies, and lack of knowledge of ways to communicate. Simple things became so complicated. For example, I could not understand the context when we analyzed the data because the scenarios in the case studies were not familiar to me at all. Sometimes I would just let the puzzles go because I was not sure how other students would view me if I raised my hands to ask questions in class. Complicating matters more, I wasn't sure how to ask those questions in English! I moved my seat back more and more and would sit at the very back of the classroom. I hid behind my laptop hoping that the professor would not ask me any questions. It always took me extra hours to finish the assignment because I had to reprocess the content that we were taught. My peers had more advantages than me in that classroom: they knew the language, they knew the culture and they knew the norms that are practiced in schools in the Netherlands.

My confidence was demolished. I stayed silent most of the time in class although I actually tried hard to understand. Furthermore, I started to think maybe it was a wrong choice and maybe I should not be there. I also did not think I was perceived as a strong learner by my professor and peers.

Then I met my other professor and lifelong coach, Dr. Amsing, who had a better understanding of Asian culture because her own children are from Asia. She was willing to coach me using various different instructional strategies through her course. Some case

studies and examples she applied in her teaching were so diverse and easy for students like me to understand and accept. I could share my thoughts through the lens of a different culture, which empowered me to participate in classroom discussion and sharing. So it was such a joy to attend her class. The pedagogical approach and the way she embraced the cultural difference made me feel that foreign students were valued and our background should not be a hindrance to our learning but an asset. The relationship with her, and the message that she gave me as a potential successful learner reshaped my sense of the identity as an ELL. Besides the extra hard work I had to do as an ELL, her influence was a key reason that I completed the courses and graduated.

In my licensure program in Hamline, I had the opportunity to study thoroughly about motivations and identities. This learning bridged my own experience with my theoretical interest: How does equitable practice impact students' mathematical identity?

Notice of Identity in Classroom

University Work

When I was an instructor at a college in China teaching language and culture, I had the opportunity to be involved in our international project; this was designed for students who intend to study in Britain for the last two years of their college. The students in this International Class would study in our college for the first two years and then go to Britain to complete their degree. That means they would be ELLs for the last two years of their college life in another country.

As part of the team who were helping the students preparing for the transition, I was involved in the overall planning and implementation of the process. We also had instructors who were native English speakers in our team. That was the first time I had

the opportunity to actually observe ELLs' learning. As I had seen, observed and been involved in the interactions of the students with our instructors from other countries, I noticed the students behaved and reacted quite differently in their English classes than in my class. When I asked students why they were so quiet in the classes, most of them would say that's because they did not know what to do or how to do the assignments. Although we tended to build up their confidence and self-efficiency before they left for another culture, there were still students without graduating due to the challenges they had as ELLs.

Elementary Work

While I was doing my student teaching in an elementary classroom in Minnesota, several things sparked my passion to look into how the math identity of the EL students correlates with the math learning.

J.B. In the middle of the semester that I was student-teaching in a third grade classroom, we had a new student, J.B., join us. He had just immigrated to the United States. He did not speak any English. He would get help from reading interventionists and EL teachers who could help him with reading and literacy; but he would not get extra help in math. There was no math interventionist or math specialist in the school. At that time, we were learning about fractions. Students were exploring the concepts of fractions through hands-on activities and in-class practice. For the first two days, he would sit by his desk reading a Spanish book without turning pages. I knew how he felt because I was there before. I noticed that he was more engaged when there were more illustrations that gave him access to the content such as videos, pictures, or charts. Also he showed great interest when we did our hands-on activities to explore mathematics in their own way. In

small group activities, I usually assigned J.B. with one of the students who spoke Spanish as well. He would follow instructions after I repeated the instructions to him by modeling. I appreciated the moment that he would build the fraction tiles to compare fractions and then record his answers on his whiteboard. I would praise him in Spanish *Gracias*. We smiled and he almost wanted to laugh at my awkward pronunciation.

As J.B. built up confidence and relationships, he was more engaged in class. Looking at him, I would think how many students like him would be thrown into the classroom and be expected to do well like other students. J.B. was making progress with a lot of effort. But with that start, how would he do in fourth or fifth grade in math? What are some teaching practices that could support the ELLs in general in the math classroom with building up their confidence and belief? I had a strong desire to focus on the perspectives from teachers on these equitable teaching practices.

E.V. E.V. was another ELL student who spoke some English. She was from a single parent family with very little income. Her mom was gone a lot during the time I was teaching. Every morning this student would be with the reading interventionist. She was very quiet in class. She would sit quietly and listen during the lesson, but when I asked her to answer questions, she would shake her head and say no. One day she forgot her jacket in the playground and she asked me if I could go with her to get it. I went with her. On the way to the playground we had a quick conversation. I asked her if she enjoyed learning math, and she said, "I am not so sure. Maybe. But I know I am not a math person" (personal communication, 2022). This is not a new statement to teachers; many children are labeled or label themselves as *a math person* or *not a math perso*n. She also shared that she could not do her math worksheet independently and she hardly

passed the math test every time. I asked her why she would not answer questions even though I saw her answers were correct on her white board. She said she was worried that her answer was not correct and the other students would laugh at her. She expressed her willingness to learn, but she also did not think she was expected to be a math learner.

The reality is that all the third grade teachers share the same teaching materials and content. Without changing the teaching materials, I varied the worksheet. The purpose of this design is to meet the students' needs while meeting the same standard requirements in content. Eccles (2009) posited that the expectations of individuals for success usually vary across tasks. People are much more likely to select tasks for which they have high expectations for success. This scaffolding did help E.V. pick up a worksheet and complete it by herself. But are there more things that we should do beyond just changing up the worksheet?

One third of students in our classroom were ELLs. They were not the same regarding their language and mathematical levels. But one thing they shared in common was that they did not naturally think that they were good math learners. As a teacher, what are some practices that offer ELLs equal opportunities to learn in the classroom and furthermore reshape their thoughts of capability in learning math? It solidified my intent to explore what are the teachers' perspectives on the impact of equitable teaching on students' mathematical identity.

Rationale

With the increasing number of ELLs in our schools, it is imperative to investigate ways to increase the achievement gap between the language minority and the language majority. Research on the achievement gap between the language majority and language

minority students has been done in the past. ELLs do not believe that they are capable of completing academic tasks successfully even as young elementary school students (LeClair et al., 2009). They do not think that they could reach their grade level math. As a teacher I knew the prevalent idea of not being good at math does not just reflect the math identity of the person who speaks it; it represents a large number of ELLs who believe that they do not have access to receive an equitable education, and this in turn impacts their mathematical learning and performance.

Therefore, in my capstone thesis, I studied teachers' perspective on how the equitable teaching practice impacts the mathematical identity of ELLs. In Chapter One, I talked about how my personal and professional background related to this topic. I used data to illustrate why this is a research topic that should be investigated and how it could impact many ELLs in their math achievement.

What is Next

In the next chapter, I will outline the current literature on mathematical identity, ELLs and equitable teaching practices in math classrooms. The perspectives of and challenge of implementing these teaching practices will be discussed as well. In Chapter Three, I will discuss the methodology of this research. In Chapter Four, there will be the findings and data analysis. The last chapter will be the conclusion.

CHAPTER TWO

Literature Review

Introduction

The purpose of this thesis is to answer the question, *How do equitable teacher practices impact the mathematical identity of ELLs from teachers' perspective?* Students come to the classroom with their existing cultural, language and social background. Secada and Berman (1999) affirmed that students' social and demographic backgrounds may position them to profit more or less from the teaching in the mathematics classroom.

Math is not only something that students encounter in books, but also in daily life outside school. And even in school, social processes are involved in learning math. Therefore, this process should be examined through a social perspective. Also, existing theories and practices have recognized mathematics as a social and cultural activity (Solomon, 2009). For this reason, sociocultural theory will be the theoretical framework of this research, particularly the work of Vygotsky. I will start with introducing the sociocultural theory of Vygotsky in this chapter. After that, there are four distinct areas in this section. The first part of this section provides an overview of math identity and why it is so important. Because this study focused on the teachers' perception, the teachers' role in students' identity construction will be discussed.

In order to add context to the experiences of ELLs, the second section of this chapter will focus on ELLs and the challenges they encounter in mathematics classroom. Guiding principles for teaching mathematics to ELLs in standards will also be reviewed in this section.

The final section of this chapter describes equitable practice in the math classroom that potentially promotes students' identity construction, including some pedagogical practices based on research. In the meanwhile, teachers' perceptions of and challenges in implementing equitable teaching practices will be discussed.

Sociocultural Theory

At the heart of sociocultural theory in education is attention to the context in which students learn and the complexity of these interactions. Vygotsky's sociocultural theory (1978) stressed the social origins of mental functioning and it recognized that children's development must be understood in the context of cultural, social, and historical conditions. Drawing from the theory, learning is mediated between persons and the culture. Children acquire their cultural values, beliefs, and problem-solving strategies through collaborative dialogues with more knowledgeable members in this socially-mediated process. Learning requires collaboration and interactions with teachers and peers. This allows the student to progress beyond the zone of proximal development, which was defined as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem-solving under adult guidance, or in collaboration with more capable peers" (Vygotsky, 1978, p. 86).

Vygotsky's theories emphasized the fundamental role of social interaction in the development of cognition (Vygotsky, 1978) and he truly believed that community plays a central role in the process of "making meaning". Lave and Wenger (1991) also said that "learning, thinking and knowing are relations among people engaged in activity in, with, and arising from, the socially and culturally structured world" (p. 67). Cognitive

development is a community of practice, where learning a subject domain is viewed as a process of becoming a member of a community of practice (Mason, 2007).

This social and cultural engagement is mediated by both symbolic and material artifacts in social and cultural structures. The mediating artifacts are not only conventional technical and material tools but also can be language, various systems of counting, algebraic symbol systems and all sorts of conventional signs and so on (Vygotsky, 1981). Vygotsky also stressed the powerful role that the language plays in shaping thoughts.

Vygotsky (Vygotsky, 1978) emphasized that:

> Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (interpsychological), and then inside the child (intrapsychological). This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher functions originate as actual relations between human individuals. (p. 57)

Vygotsky pointed out how people internalize practices, knowledge of, and beliefs about the outside world and also about themselves as a result of the interactions in development of mind even though the term *identity* was not used (McCarthey & Moje, 2002). In the theory, the formation of self, as well as some level of awareness of self, is a critical aspect of consciousness or mind. Vygotsky also acknowledged the importance of the teacher's role (Tzuo, 2007) in this process.

What is particularly relevant to my capstone topic from the theory of Vygotsky is that human development is a socially-mediated process and culture plays an important role in the development of mental abilities. In addition, adults in society foster children's

cognitive development by engaging them in challenging and meaningful activities. Furthermore, the theory of Vygotsky puts the emphasis on the roles social cultural tools play such as language, materials, signs etc.

Mathematical Identity

Definition

According to Martin (2009), mathematics identity is "the dispositions and deeply held beliefs that individuals develop, within their overall self-concept, about their ability to participate and perform effectively in mathematical contexts and to use mathematics to change the conditions of their lives" and "a person's self-understanding and how others see him or her in the context of doing mathematics" (pp. 136-137). Aguire and Ingram asserted that mathematics identity is "how students see themselves and how they are seen by others, including teachers, parents, and peers as doers of mathematics" (2013, p. 13).

Importance of Identity

Identity development is a social production and "developed through language, through an intentional negotiation of meanings and understandings" (Baker, 2011, p. 398). As outlined by McCarthey and Moje (2002), identity matters for the following reasons. First, it is an aspect of how humans make sense of the world and their experiences in it, including their experiences with texts. Second, it is because people can be understood by others in particular ways, and people act toward one another depending on such understandings and positioning. Last but not least, why teachers should consider identity as we think about students' learning is because the way students interact, respond and learn in the classroom are influenced by who they are. It means that the experiences they have had in their families, their previous experiences with institutions as well as

communities, have shaped their classroom interactions. It furthermore shapes who they are as individuals in terms of race, gender, and class, which contributes to the classroom interactions.

Individual Perception

Martin (2006) emphasized that a mathematics identity is not only people's self perception in the context of doing mathematics, but also how the others "construct" us in relation to mathematics. Martin further stated that "The development of particular kinds of mathematics identities reflects how mathematics socialization experiences are interpreted and internalized to shape people's beliefs about mathematics and themselves as doers of mathematics" (p.207).

Deepening Math Identity

The notion of identity in mathematics education research enables researchers to go beyond an exclusive focus on the nature of students' mathematical reasoning by also examining the ways "students think about themselves in relation to mathematics and the extent to which they have developed a commitment to, and have come to see value in, mathematics as it is realized in the classroom" (Cobb et al., 2009, p. 40).

Teacher's Role in Students' Identity Construction

According to Hayes et al. (2006), students' mathematical identities are largely impacted by the mathematics teachers and in classroom practices. Teachers who are teaching ELLs should create structure and opportunities for them to engage in scaffolded interactions which help students to develop content knowledge and communicative abilities (Heritage et al., 2015). Teachers understand that they can plan the lessons and

instruction to help students develop positive mathematical identities (National Council of Teachers of Mathematics [NCTM], 2020).

Clark et al. (2014) did research on the relationship between teachers' mathematical knowledge and teachers' awareness of the students' mathematical disposition. The research revealed that this relationship had a significant effect on student achievement. In addition, teachers with strong math content knowledge scores had stronger beliefs in their ability to teach math effectively and also that students can construct their own math knowledge.

Teachers can also reflect on their own math identity. "Knowledge and beliefs do not operate independently or in isolation; rather, teacher beliefs can act as a mediator between teacher knowledge and teacher practice" (Clark et al., 2014, p. 254). Teachers should also reflect on their own perceived biases that identities of certain groups of students may be more mathematically inclined. This perceived bias could significantly impact students' capability to identify positively with math (Nasir & de Royston, 2013). This can help ELLs have a fair opportunity in their math identity construction in the classroom with their peers.

English Language Learners

According to the U.S. Department of Education, an ELL is defined as an individual who due to any of the reasons listed below, has sufficient difficulty speaking, reading, writing, or understanding the English language to be denied the opportunity to learn successfully in classrooms where the language of instruction is English or to participate fully in the larger U.S. society. Such an individual (1) was not born in the United States or has a native language other than English; (2) comes from environments

where a language other than English is dominant; or (3) is an American Indian or Alaska Native and comes from environments where a language other than English has had a significant impact on the individual's level of English language proficiency.

Types of ELLs

According to Ferlazzo and Hull-Sypnieski (2012), there are different labels used to describe the ELLs. Here listed the ones listed are some of the most common:

ELL, or English language learner (ELL or EL) is the most current term used in the United States to describe students who are in various stages of acquiring English .

LEP, or limited English proficiency (LEP) is still used by the U.S. Department of Education for ELLs, age 3– 21, who have not yet demonstrated proficiency in English, and for whom this affects their ability to perform on state standards and assessments, to access classroom content, and/or to participate fully in society (Ferlazzo & Hull-Sypnieski, 2012).

Dual language learner(DLL) is a child between the ages of 0 and 8 who is in the process of learning English in addition to his or her home language(s). These children may or may not also be considered ELLs by their schools, depending on their performance on English language proficiency assessments (Ferlazzo & Hull-Sypnieski, 2012).

English as a second language (ESL) refers to “a program of instruction designed to support ELL students” and is often still used at the postsecondary level to refer to multilingual students (National Council of Teachers of English, 2008).

Some Challenges that ELLs Face in Mathematics Classroom

ELLs do have extra challenges because they need to learn the language while learning the cognitively demanding, abstract mathematical concepts (Chamot & O'Malley, 1996). But the equity principle requires that we accommodate learner differences to help everyone learn mathematics (NCTM, 2000).

Math Language. According to the California Department of Education (1990, as cited in Garrison, 1997), many educators hold the misconception that math uses symbols so it is not related with any language or culture and is ideal for facilitating the transition of recent immigrants into English instruction. The fact is that language is important to mathematical development. We use language to explain mathematical concepts and carry out mathematical procedures. Students at all levels are not only expected to listen, talk and read using mathematical language, but also to write about their work in mathematical language (National Council of Teachers of Mathematics, 2000). The Standards for Mathematical Practice (SMP) in the Common Core State Standard for Mathematics (CCSSM) emphasize the need for language: Mathematically proficient students need to be able to read and discuss mathematical problems, critique the reasoning of others, and use mathematical language precisely (2010).

Mathematical language is more difficult for ELLs. Schleppegrell (2007) outlined the linguistic aspects of mathematics that distance it from ordinary use of language. Schleppegrell notes that math uses multiple semiotic systems such as mathematics symbolic notation, oral language, written language and visual displays. This brings together symbolic representations and visual images that do not match up exactly with

their ‘‘translation’’ into the oral and written language used to develop the meanings they present.

Schleppegrell (2007) also pointed out that the use of technical vocabulary in math distinguishes it from ordinary use of language. Mathematics is “highly technical, with characteristic patterns of vocabulary and grammar” (p. 142). She offered a few examples of the technical vocabulary such as *sum* or *fraction*. Some words are not solely mathematical but have particular meanings, such as *place* and *product*.

Similarly, what makes the math language different from ordinary use of language is the grammatical patterning in math, according to Schleppegrell (2007). The grammatical patterning brings together long, dense noun phrases in clauses and sentences constructed with being and having verbs that present a variety of meaning relationships. An example offered by Schleppegrell of the grammatical patterning was *the volume of a rectangular prism with sides 8, 10, and 12 cm*.

In addition, Schleppegrell (2007) stressed that the use of conjunctions in math language also distinguishes it from ordinary use of language. These conjunctions have meanings different from their everyday uses, or include implicit logical relationships that are not spelled out. Schleppegrell explained furthermore with examples such as in math word problems, conjunctions like *if*, *when*, and *therefore* are used in precise ways, while constructions such as *given* and *assume* act differently.

Shleppegrell (2007) recommended that it is critical to focus on language in the classroom which will support students' move to the more formal register of math from everyday language. Martiniello (2008) also noted that teaching of mathematics to ELLs can no longer be perceived as separate from the teaching of language.

Cultural Difference. Math has been considered a “universal language” and composed of a static body of knowledge; mathematics is characterized as “culture free” (Burton, 1994). However, more studies directly address social cultural concerns, especially the nature of teachers' beliefs and instructional approaches in effective classrooms or programs (Janzen, 2008).

One of the studies that addresses social cultural concerns is Gutstein et al. (1997), who affirmed that an important aspect of effective teaching is for teachers to build “connections with families to create classroom cultures that mirror student's own” (p.733). Teachers can use students’ first language to empower the ELLs in the classroom. They also emphasize that teachers should have critical perspectives on cultures while noticing the positive aspects that promote academic progress.

In order to understand what are some of the attitudes and classroom practices of teachers that promote ELLs’ learning of mathematics, Gutierrez (2002) analyzed how three mathematics teachers in a high school were successful in getting large numbers of their students to take calculus by their senior year and to consider college as a realistic option after graduation. Gutuierrez summarized that the attitudes and practices that teachers have that positively impacted students were: the teacher's keen understanding of students, value of students’ language and the willingness to understand students.

Gutierrez (2002) explained that the teachers’ understanding of students’ linguistic backgrounds and mathematical needs lay behind the development of effective teaching practices. That is, rather than assuming what students might need or counting on research conducted in other settings, these teachers watched, listened, and interacted with their

students in respectful ways that allowed the organic unfolding of an active and positive classroom environment.

Gutierrez (2002) also described that in these teachers' classrooms, students helped each other to make sense of mathematics, used Spanish and English (as well as hybrid language) to do mathematics, worked in groups to solve problems and explain their reasoning, and used teacher-designed materials that made the mathematics concepts accessible. In these classrooms, their home language was a valued resource, and individual students were active agents in the classroom. Teachers suggested they valued students' language and were allowing them to construct mathematical identities that were not necessarily in conflict with their cultural identities.

Teachers' willingness to understand their students in ways that respected students' identities (not identities externally projected onto them) opened the door to the development of effective instructional practices and genuine relationships with students. They were willing to reflect on teaching and students (alone and with colleagues), and willing to learn from students.

In summary, teachers should be aware of the difficulties that ELLs have in learning math while learning language and also notice the sociocultural challenges that ELLs have in math classrooms.

Equitable Practice in Mathematics Classroom

Definition

Equity can be defined as a fair distribution of opportunities to learn or opportunities to participate (Esmonde, 2009). Equity does not mean that every student should receive identical instruction; instead, it demands that reasonable and appropriate

accommodations be made as needed to promote access and attainment for all students. (NCTM, 2000, p. 11)

Cobb and Hodge (2011) proposed a definition of equity that stressed the significance of exploring students' identity as it relates to mathematics. They claimed that equity "encompasses students' development of a sense of efficacy (empowerment) in mathematics together with the desire and capability to learn more about mathematics when the opportunity arises" (p. 181). In their proposed definition, they also included what the equity is traditionally referred to as "students' motivations to continue to study mathematics and their persistence while doing so" (p. 181).

The Importance of Equity in Mathematics

According to Esmonde (2009), mathematics plays a central role when the government and corporations make decisions. These decisions disproportionately impact marginalized people, who are less likely to have access to quality mathematics education. Mathematical knowledge can therefore be an important component of struggles for social justice. In addition, mathematical knowledge is necessary for many careers, and it currently serves a key gatekeeping function for academic achievement as well as high school and college graduation. For these reasons, mathematics educators must find ways to equitably provide powerful mathematics instruction. Esmonde (2009) posited that equity-oriented reforms in mathematics education must tackle two questions: first, what students learn; second, how do they learn.

The Principles and Standards for School Mathematics according to the NCTM (2000) includes an Equity Principle reflecting this reform:

> Excellence in mathematics education requires equity-high expectations and strong support for all students. Educational equity is a core element of this vision. All students, regardless of their personal characteristics, backgrounds, or physical challenges, can learn mathematics when they have access to high-quality mathematics instruction. Equity does not mean that every student should receive identical instruction. Rather, it demands that reasonable and appropriate accommodations be made and appropriately challenging content be included to promote access and attainment for all students. (p.12)

Furthermore, the Equity Principle (NCTM, 2000) demands the communication of high expectations in mathematics learning verbally or in actions to all students. Also, the principles require accommodating differences to ensure that all students have access to the equitable mathematics program that supports their learning. The ELLs may need special attention to allow them to participate fully in classroom discussions as well as assessment accommodations. Their mathematical proficiency may not be accurately evaluated if they are only assessed in English. Lastly, equity requires resources and support for all classrooms and all students in order to create an equitable mathematics classroom.

NCTM (2000) also stressed the importance of the professional development of teachers. Teachers can better accommodate the differences by understanding the diverse backgrounds of students. Teachers should also know and challenge their own beliefs and biases.

Standard Expectations for Teaching Math to ELLs

Drawing from the two standards: Eight Effective Mathematics Teaching Practices (NCTM, 2014) and Guiding Principles for Teaching Mathematics to English Language Learners (NCTM, 2020), I will discuss the teaching practices proposed in those standards. Those standards show the importance of a supportive environment to ELLs in learning math. The elements that constitute this kind of environment are to be linguistically and socially sensitive, to support learning English while learning mathematics, and to provide cultural and linguistic differences as intellectual resources.

Additionally, the standards offer guidance for teaching practices in mathematics. According to Eight Effective Mathematics Teaching Practices (NCTM, 2014), the structure of the goals and tasks should be clearly stated and should promote mathematical reasoning and problem solving. Student communication of the mathematical concepts can be encouraged through using tools and modeling. Moreover, teachers can engage students in discussion through questions and by prodding their responses further. This helps students better understand the learning materials, which helps teachers assess students' learning. Teachers should make sure to thoroughly build on concepts so that students gain fluency.

In summary, teachers should strive to provide a culturally and linguistically sensitive environment that supports ELLs by implementing the teaching practices outlined. In addition to the standards, there are also some frameworks and dimensions in current research that could guide teachers in teaching ELLs in math classrooms.

Framework and Dimensions of Equitable Teaching Practice to Support ELLs

For attending to issues of equity of ELLs, Borgioli (2008) proposed a framework of guiding questions to enable purposeful practice toward classroom equity which supplements Carpenter and Lehrer's (1999) three critical dimensions of mathematics instruction that promote understanding which are tasks, tools, and classroom norms and communication. Jorgensen and Nieschie (2008) identified two dimensions that shape the learning environments for ELLs' mathematics study: teachers' expectations and the discourse of "ability". Furthermore, Bresser et al. (2009) stressed the importance of focusing mathematical language on concepts and modifying lessons to accommodate the needs of ELLs. I will consolidate and discuss the aspects of equity-based practice in the following paragraphs.

Tasks

Stein and Smith (1998) differentiate between tasks of lower and higher level cognitive demands. In the tasks with lower level cognitive demands, students are asked to perform a memorized procedure in a routine manner leading to one type of opportunity for students to think. Tasks with higher level cognitive demands require students to think conceptually and stimulate students to make connections that lead to different sets of opportunities and thinking. One that presents higher-level demands might also use procedures, but in a way that builds connections to the mathematical meanings.

The guiding questions from the framework provided to the mathematics teachers by Borgioli (2008) enable meaningful practices toward classroom equity. The guiding questions for the teachers to refer to regarding tasks are: whether the tasks are linked to the students' backgrounds and experiences; whether the tasks are problematic,

investigative in nature, and of high-level cognitive demand; whether the tasks have multiple entry points and more than one solution, and do they validate multiple intelligences; whether the tasks are rich in their opportunities for mathematics as well as language development; and lastly whether the tasks require students to make their own sense of the situation or apply only externally prescribed procedures.

In order to create meaningful tasks that validate students' experiences, teachers must get to know their students' background and current or past life experiences (Gonzalez et al., 2001). By consistent questioning and close listening, teachers attending to equity can informally assess students' conceptual development and then create open-ended tasks with the potential of challenging students' current thinking and encouraging knowledge construction (Fosnot & Dolk, 2001). Jorgensen and Niesche (2008) further discussed that rather than aiming to equip students with only the learning necessary to perform each mathematical task or grasp each concept in isolation, teachers must also focus on instilling horizon thinking (an awareness of the larger mathematical landscape), on moving students to the next level, and on developing critical thinking through rigorous tasks and assignments.

To ensure a balance between access and mathematical rigor, teachers need to take a hard look at what students are asked to do such as whether the tasks are worthy of time and effort. Students should be producing tables, graphs, and mathematical arguments (productive language) instead of reading them. Through their tasks and assignments, teachers should ensure that they build experiences that are both receptive (learning and understanding the mathematics) and productive (doing, explaining, clarifying,

connecting, and illustrating evolving understanding) (Council of the Great City Schools, 2016).

Tools

Borgioli (2008) defined tools broadly to include concrete manipulatives (such as coins, blocks, tangrams, number cubes, spinners, calculators, protractors, string, etc.) or pictorial or graphical representations (such as students' representations, tree diagrams, area models, ratio tables, bar graphs, hundreds charts or grids, graphing calculators, etc). Tools used to represent mathematical ideas and problem situations which are meaningful to students and teachers encourage students to reflect explicitly on the characteristics of these representations (Carpenter & Lehrer, 1999). Mathematical tools and modeling should be used as resources and also provide a resource for ELLs to engage in mathematics and communicate their mathematical understanding and are essential in developing a community that enhances discourse (NCTM 2020).

Borgioli (2008) listed guiding questions for using mathematical tools to equitable practice. When using tools in the math classroom, teachers can check whether students are able to choose the tools or representations and whether there are opportunities for students to use any tool and language available to explain their thinking to others. In addition, teachers can determine whether there is an effort to bridge students' representations with conventional notation and vocabulary.

Borgioli (2008) further explained that in an equitable classroom, students could decide which tools they wanted to use and the methods to represent them. Instead of using tools as a way to get to the answer, students should see the tools as means of communication and extending their mathematical thinking.

Classroom Communication and Participation Norms

Borgioli (2008) defined the classroom communication and participation norms as the ways in which students and teachers are expected to act, interact, and respond during instructional situations. Classroom norms promote students' engagement in discourse and share their different ways of viewing important mathematical ideas (Carpenter & Lehrer, 1999).

The framework regarding classroom communication and participation norms from Borgioli (2008) guides us to equitable practice in the math classroom. The framework is summarized here. First, students are making and justifying mathematical conjectures. Second, class members negotiate mathematical meaning by listening to one another's thinking with a respectful atmosphere and a low affective filter. Third, there is collaboration emphasized over competition. Next, there is broad student participation and a conscious effort to equalize participation within groups and any language mode in the communication supported and valued in the classroom. Finally, there is a visual trail of important concepts created and also the lesson includes language objectives together with mathematics objectives.

Carpenter et al. (1997, as cited in Borgioli, 2008) stressed the importance of spending time listening to and understanding the speaker, and discussing differences between the strategies of students, and allowing the students to find out the right strategies reasoned from mathematical thinking (Fosnot & Dolk 2001). In this sense, the classroom becomes a mathematical discourse community (Borgioli, 2008) and talk therefore is the way through which an individual internalizes meaning and develops the sense of personal power in mathematics (Khisty, 1995).

Banes et al. (2018) affirmed the benefits of discussion that can be associated with improved performance on achievement measures for ELLs. Drawing on the work of Forman et al. (1998), they defined classroom discussion in mathematics as an academic activity in which students actively participate by listening, speaking, and engaging in thinking about mathematical ideas. They also identified five key features of effective math discussion: a variety of approaches, opportunities to speak, equitable participation, explanations, and connections between ideas.

According to Jorgensen and Niesche (2008), the processes of exclusion operate to disadvantage students along social class, race and gender lines. For students from backgrounds that are not part of the success regime, significant scaffolding by teachers is needed if they are to be successful. Banse et al. (2016) described the following five strategies for scaffolding ELLs during mathematical discussions. First, ask open-ended questions. Second, follow open-ended questions with close ended questions, as needed. Third, scaffold students' responses by repeating, extending, and rephrasing. Fourth, model mathematical vocabulary in context. And the last one is to strive to include ELLs in mathematical discourse each day.

ELLs are often left on the periphery of mathematics discussion, while native English speaking students tend to have more talk time (Ball, 1993). It is crucial that teachers facilitate communication in all four language modes—listening, speaking, reading, and writing (de Jong & Harper 2005) and support the use of native languages in discussion. Khisty (1995) recommended that teachers should emphasize the meanings of words by using variations in voice, tone and volume. In order to get students' attention, teachers could pause before or after a word, they can also point to the words that are

prepared before or write the words while speaking them. Teachers can also frequently revisit the mathematical ideas and terms with synonyms or other ways of saying them. Teachers can present visual or pictorial displays of main ideas together with any oral presentation such as a pictorial wall or a museum walk of samples of student work labeled with key words which are in English and the native languages.

Language Objective

Bresser et al. (2009) pointed out that language plays an important role in learning mathematics. Language objectives were also emphasized in the classroom communication and participation norms of Borgioli (2008). Language is used to explain mathematical concepts and carry out mathematical procedures. Students can deepen their understanding of mathematics by using language to communicate and reflect on their ideas. Bresser et al. furthermore stated that although communication is important, the discussion may bring disadvantages to ELLs due to their lack of vocabulary or partial understanding of syntax or grammar.

Bresser et al. (2009) stressed the importance of setting language objectives and content objectives due to the fact that ELLs have to learn the English language and also content language. Regardless of the fact that students are provided with tools or visuals to understand the concepts, they still need linguistic support to discuss their thinking which could deepen their understanding of the content.

Bresser et al. (2009) also informed that language supports are needed for ELLs to communicate their mathematical thinking if they are expected to compare and contrast numbers, data sets or geometric figures, hypothesize while playing a number guessing game, or summarize a strategy they used to solve multiplication problem.

Modify the Lessons

In addition, Bresser et al. (2008) proposed that in order to meet the linguistic needs as well as content learning, teachers could modify lessons in ways that help us explicitly structure experiences to benefit ELLs. Bresser et al. recommended teachers to make sure that language goal will support students' understanding of this mathematical goal. Moreover, they suggested that there should be support when students are required to talk about their mathematical thinking. In addition, there are ways to accommodate students with different levels of English language proficiency. Furthermore, there are vocabulary words that students are not familiar with, we can explicitly teach these words. Teachers know the ways that we can build opportunities for discussion.

Modifying lessons and providing language support can promote equity and help ELLs to fully participate in the class learning. The goal is to ensure that everyone has equal access to the mathematical content being taught (Bresser et al., 2008)

Teacher's Expectations and the Discourse of Ability

According to Jorgensen and Niesche (2008), teachers' expectations have been seen to be a significant factor in the success of learners. Students come to school with particular learning experiences and they see themselves within those framings set by teachers. If students can not *crack the code* of classroom mathematics and teaching practices, they will not consider themselves as successful learners. Consequently, the corresponding dispositions towards learning mathematics will be developed and they set low expectations for themselves.

Raising expectations of teachers and learners is critical in mathematics classrooms (Jorgensen & Niesche, 2008). When teachers believe in students' ability to learn

mathematics, it enables teachers to provide rich learning experiences rather than impoverished ones and in the process provide appropriate learning environments to develop conceptual knowledge that is well connected with other areas of math and knowledge beyond the discipline.

Jorgensen and Niesche (2008) further stated we usually think from the perspective of innate abilities when examining why some students are successful while some are not. But this discourse has been questioned as it fails to consider the ways in which practices in school mathematics align with some features of cultures and deny others. Jorgensen and Niesche also indicated that students could articulate greatly the expectations of them from teachers and the implications of those expectations for them as learners in a classroom where the students were streamed according to perceived ability.

Perceptions of and Challenges with Equitable Practices

In this section, I will discuss the perceptions of and challenges teachers have with implementing the equitable practices in the existing literature.

Jenelle (2006) conducted a study on the attitudes of 279 subject-area teachers on ELLs in the classroom. Jennelle examined four categories of the attitudes and perceptions toward ELLs in the classroom. The four categories were ELL inclusion, coursework modification, professional development for working with ELLs, and perceptions of language and language learning. Although these dimensions were not completely corresponding to the framework in equitable practices discussed in my thesis, they can reflect some aspects of the perceptions and challenges in the classroom with ELLs.

First, the survey reflected a neutral to slightly positive attitude of teachers toward ELL inclusion but with inconsistency between teachers' general attitude towards ELL

inclusion and their attitudes towards specific aspects of ELL inclusion (Jennelle, 2006). The author further explained that the findings suggested that an overall welcoming attitude may mix with a reluctance to work with particular ELLs, such as those with limited language proficiency.

Second, the survey showed a partially positive attitude of teachers toward coursework modification, which may be influenced by the concern of educational equity (Reeves, 2006). Whether teachers support the coursework modifications or not depends on the perceived equitability of specific modifications. According to the survey, teachers perceive that the modifications can be irrational not only because they think the modifications undermine the integrity of coursework standards but also because making such modifications may limit ELLs' access to the rigorous curriculum necessary for future educational opportunity.

Next, teachers' perception of a lack of sufficient training to work with ELLs is disturbing, considering the increasing number of ELLs (Reeves, 2006). Almost half the teachers who took the survey were uninterested in receiving such training. There are multiple possible reasons for teachers' ambivalence toward professional development that have been discussed by several researchers. One of the reasons discussed by Valdes (2001) was that subject-area teachers might believe that ESL or bilingual teachers are primarily responsible for teaching ELLs. However researchers argued that subject-area teachers should be actively involved in all students' education in order to provide equitable learning opportunities. In a word, the lack of training to work with ELLs is a potential challenge for equitable teaching to be practiced in the classroom.

Finally, teachers' misconceptions regarding second language acquisition were also revealed in this survey (Reeves, 2006). Two misconceptions were addressed in the article. One was that ELLs should be able to master the second language within 2 years which in fact should be 7 years. Another misconception was that ELLs should avoid using their native language while acquiring another language. These misconceptions are contrary to the research and potentially pose a challenge in practice equitable teaching because it can largely impact the expectations of teachers on the ELLs and also the ways they communicate with ELLs. The study recommended that teachers should have a basic knowledge of second language acquisition in order to effectively teach ELLs.

In conclusion, the survey of Reeves (2006) indicated both negative and positive perceptions from teachers towards including ELLs in the classroom. On one hand, some of the results are promising; on the other hand, there are still challenges for teachers to integrate equitable teaching practices in the classroom. This points to the importance of further exploring teachers' perceptions and challenges toward equitable practice with ELLs in order to help ELLs in the classroom.

Conclusion

Acknowledging and addressing factors that contribute to differential outcomes among groups of students is critical to ensuring that all students routinely have opportunities to experience high-quality mathematics instruction, learn challenging mathematics content, and receive the support necessary to be successful. Addressing equity and access includes both ensuring that all students attain mathematics proficiency and increasing the numbers of students from all racial, ethnic, linguistic, gender, and

socioeconomic groups who attain the highest levels of mathematics achievement (NCTM, 2014).

However, in current literature, there is not much research on whether and what are some equitable teaching practices that could impact and reinforce the math identity of ELLs. With the understanding of the gap in the current research, there is a need to explore my research topic: *How Equitable Teaching Practices Impact the Mathematical Identity of English Language Learners from Teachers' Perspectives.* We need to see if the concepts actually work practically in the classroom from teachers' perspectives.

Summary

Education reform has always been an ongoing process. Over the years, ELLs have been moved into sheltered English classes, blended classes, and back again. As discussed earlier in this chapter, equity in the mathematical classroom is the process of providing the students with what they need in order to achieve their learning and it is elusive both as a concept and as an outcome of practice.

This chapter reviewed a number of areas and topics that are important as foundational concepts to the research topic. First, sociocultural theory of Vygostky (1978) was introduced. In the theory, he recognized that children's development was shaped by the people, interactions, and environment around them which was highly relevant to this thesis. Second, the mathematical identity and its importance were discussed which provided the reason why this research was necessary. In addition, the challenges ELLs have in learning math in the classroom urged us to find solutions to better support this marginalized group of students. Next, the current literature on equitable practices was discussed with the purpose to reveal the existing research about the equitable practices in

the math classroom. Finally, the perspectives of and challenges in implementing these equitable teaching practices were discussed. This section also helped formulate the research survey and interview questions.

Building off of all of the research listed above, the next chapter describes the methodology and parameters of this study. It includes an introduction to methodology; a rationale for the study design; setting and participants of the study; a description of the data analysis; and an overview of the fourth chapter.

CHAPTER THREE

Methodology

Introduction

Cross (2011) posited that teachers "hold a body of expert knowledge about what constitutes effective pedagogy based on their own personal professional knowledge and experience" (p. 167). Using a mixed method research approach, the study has been designed to answer the question, *How do equitable teacher practices impact the mathematical identity of ELLs from teachers' perspectives*? I believe that a better understanding of this topic could provide educators with different possibilities that can empower ELLs in the mathematics classroom.

This chapter describes the methodology employed to seek answers to the question. First, a description of the mixed methods sequential explanatory design is presented. Second, the data collection techniques are provided. Third, the context of the study is presented through a description of the participants. Next, the methods of data analysis are discussed following the ethical considerations related to the study.

Mixed Methods Sequential Explanatory Design

An explanatory sequential mixed methods design was used in this study. It included collecting quantitative data as the first phase and further exploring the topic with in-depth qualitative interviews in the second phase. A mixed methods approach allows the research to produce a broader, deeper understanding of participants' perceptions than what would surface from merely using a single approach (Ivankova & Creswell, 2009). In the first quantitative phase of the study, questionnaire survey data were collected from 10 participating teachers to assess their perceptions on how the equitable practices impact

students' math identity. The second qualitative phase was a semi-structured interview to have in-depth ideas of the teacher's perception on the study topic. Two participating teachers agreed to be interviewed in this phase. The strength of mixed methods in drawing on both qualitative and quantitative research and minimizing the limitations of both approaches while ensuring a better understanding of the research problems and questions (Creswell & Creswell, 2018) gave me a strong rationale to use this research method.

Survey Research Design

According to Creswell and Creswell (2018), collecting survey data should occur first and also had a stronger emphasis in this research design. Surveys are important tools in gathering quantitative data while providing a quantitative description of trends, attitudes, and opinions of a population (Creswell & Creswell, 2018). In the survey section, I used a non-experimental, quantitative survey research design approach. A non-experimental research design, defined by McMillan and Schumacher (2010), was used to "describe phenomena and examine relationships between different phenomena without any direct manipulation of conditions that are experienced" (p. 22). Also there were advantages of the survey design such as the economy of the design and also rapid turnaround in data collection (Creswell & Creswell, 2018).

Because I did not find any appropriate instrument to measure the teachers' perspectives of how equitable teaching practice impacts the ELLs' math identity, I constructed a survey instrument generated from the concepts covered in the existing literature discussed in Chapter Two. The full survey consisted of three sections. In the first section, there were five close-ended questions for collecting the demographic data of

the participants. The second section was a 18-item, 5-point Likert-style survey with responses ranging from 1 (strongly disagree) to 5 (strongly agree) to examine the perspective of teachers on equitable practices. I consolidated the six dimensions which were proposed in the literature review about the purposeful practice toward classroom equity into five themes: mathematical tasks, mathematical tools, norms and communication, modifying lessons and language support, teachers' expectations and the discourse of ability. Eighteen items comprised all five themes in the second section. The third section in the survey consisted of two open-ended questions where the participants could share their thoughts.

Surveys were sent out to the participating teachers through Google Form. The first mail-out was a short advance-notice letter to the teachers explaining about the questionnaire. The actual survey was sent out in a week.

Semi-Structured Interviews

Weiss (1995) wrote that interviewing gives access to the observations of others. Qualitative interviews represent the conversations in which researchers could guide a conversational partner in an extended dialogue (Rubin & Rubin, 2012). The benefit of a qualitative interview was that, unlike a fixed survey, questions can be modified to accommodate the knowledge, experience, or comfort level of the participant (Rubin & Rubin, 2012).

The semi-structured interviews were conducted in this phase. These interviews gave me further insight into the five themes of equitable teaching practices that were examined in the survey. Additionally, I asked additional clarifying questions covering the topics of their perspectives on math identity, equity in the classroom, challenges in

teaching ELLs math, successful practices they had with ELLs, and also their thoughts on professional development in teaching ELLs.

Two out of 10 participants who completed the survey were selected to be interviewed**.** Each session of the interview was approximately 30 minutes in length to afford time for depth of responses. Each interview was audio-recorded, transcribed and thematically coded and analyzed.

Research Participants and Setting

For quantitative research, data was collected through surveys. Since the educators taking the survey were anonymous, I referred to them simply as participants. I first contacted the potential participants through email or phone to ask if they were willing to take the survey. Ten participants responded with willingness to take the survey.

The participants varied in age, demographics and cultures. Among all participants, two were self-identified as ELL as well as bilingual, and the rest self-identified as only English speaking. The participants were all teaching in schools in Minnesota. They taught grades ranging from kindergarten through high school. Among the participants, two (20%) were from the immersion school where I did my student teaching, two (20%) were from charter schools where I have been working with supporting ELLs, one (10%) was known to the author, and the other teachers (50%) were from public schools recruited through my content reviewer. The number of years of teaching experience of the participants ranged from 2 years to 20 years. Participants had remained anonymous and their names were changed in the study.

For the strand of qualitative study, I interviewed two participants. I initially selected three teachers from different types of school and asked them by email whether

they would like to be the candidates for the interview. Two participants responded with willingness to be interviewed. Both were from public schools. The teacher participants were interviewed by phone or virtually, whichever way was more convenient for the participants.

Data Analysis

Two phases of data collecting were conducted in this research. One was the survey questionnaire and another one was the interview. Before commencing with data analysis, the guiding questions of the study were entered into an Excel spreadsheet in which they were correlated with the items of the questionnaire.

Interviews were conducted with two participants. Participants were given the option of interviewing in-person or virtually. After recording the interview, I generated a list of potential themes to help with the data analysis. The themes from the interviews were cross-analyzed with the questionnaire results to fully investigate the main guiding questions of the study.

Significance of the Study

As discussed in the previous chapter, identity plays a central role in children's learning. The framework and dimensions of the equitable practices in mathematics classroom guide us with some teaching practices that could potentially promote equity in the mathematics classroom. However, there is limited research on the impact of equitable classroom practice on mathematical identity of ELLs from the perception of the teachers. This study stemmed from the recognition that understanding the ways in which equity is understood from the teacher's perspective could provide insight for future practice.

Ethics

Several actions were employed to ensure the participants' privacy rights. First, I sought approval through Hamline University's Institutional Review Board. Next, participants were guaranteed anonymity concerning the presentation of the data collection. At last, the collected data was filed and kept in a secure location to which only I could have access.

Subjectivity

As an English language learner as well as a teacher, this research was very significant to me. To make sure I was not placing strong personal values or beliefs into the research, I wanted to reflect on my own subjectivity. During the design and analysis, I limited my subjectivity to "selecting data that fit my theory, goals, or preconceptions and selecting data that stand out to me as a researcher" (Maxwell, 2013, p. 165).

Conclusion

This chapter has presented the methodology employed to seek answers to the guiding questions of this capstone. A description of the mixed methods sequential explanatory design, its participants, the data collection techniques and processes and the data analysis methods were discussed. Meanwhile, although the risks of participating in this dissertation were minimal, appropriate ethical considerations, including obtaining IRB approval to conduct the study, participant confidentiality and data security were presented. In the upcoming chapter, I will examine the results of the research process and the data collected.

CHAPTER FOUR

Results

Introduction

The purpose of this study was to explore the perspectives of teachers on how the teaching practices impact the math identity of the ELLs. Specifically, the primary question is: *How do equitable teaching practices impact the mathematical identity of English language learners from teachers' perspectives*?

Chapter Four has been organized into two parts: summary and analysis of the survey results, and summary and analysis of the qualitative interviews. This chapter concludes with an overview of the themes derived from the participants' personal perspectives.

Survey Data Analysis and Results

The study was carried out during the month of May, 2023 using the online survey (Appendix A). A total of 10 participants were emailed the survey link and 10 responses were received which resulted in a return rate of 100%.

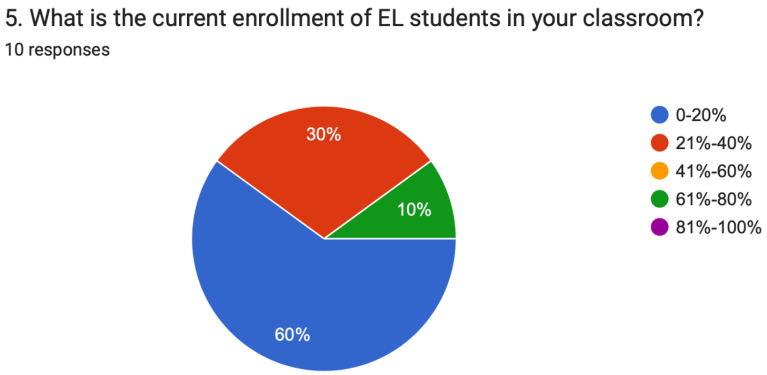
Section one of the survey included demographic information, years of teaching, the grade they were teaching and also the current enrollment of EL students in the classroom. Section two of the survey included two sets of questions which were labeled with letters "a" and "b". The a-series questions were to find out the frequency participants implement these teaching practices and b-series questions were to research teachers' perspectives on how these teaching practices positively impact the math identity of ELLs. I grouped the survey questions into five themes based on the research literature. The themes were: mathematical tasks, mathematical tools, norms and communication,

modifying lessons and language support, teachers' expectations and the discourse of ability.

Survey Participants Demographics

Demographic information was collected from participants including participants' gender, the total number of years taught, grade levels teaching and also the current enrollment of ELLs in the classroom. Of the 10 participants who completed the survey, 10 participants (100%) identified as females. The total number of years teaching was collected and analyzed. The analysis indicated that 30 % of the participants had been teaching for 4-7 years, 30% had 8-11 years teaching experience, 20% had 12-15 years and 20% had 16 years or above.

Of the 10 participants, 10% were teaching kindergarten, 40% were teaching 1st grade, 20% were teaching 2nd grade and 20% were teaching 4th grade. There were also 10% teaching 5-11th grade. The information of the current enrollment of ELLs in the classroom was also collected. Fifty percent of the participants who took the survey had between 1%-20% of ELLs in their classrooms, 30% of participants had between 21%-40% ELLs and 10% had 61-80% ELLs.



Summary of Survey Results

There were a total of 18 sets of questions that were focused on the inclusive teaching practices being researched. Mathematical Tasks consisted of three questions. Mathematical Tools consisted of two questions. Communications and Norms consists of six questions. Expectation and Discourse consisted of two questions. Modifying Lesson & Language Support consisted of five questions. The full survey questionnaire can be found in Appendix A.

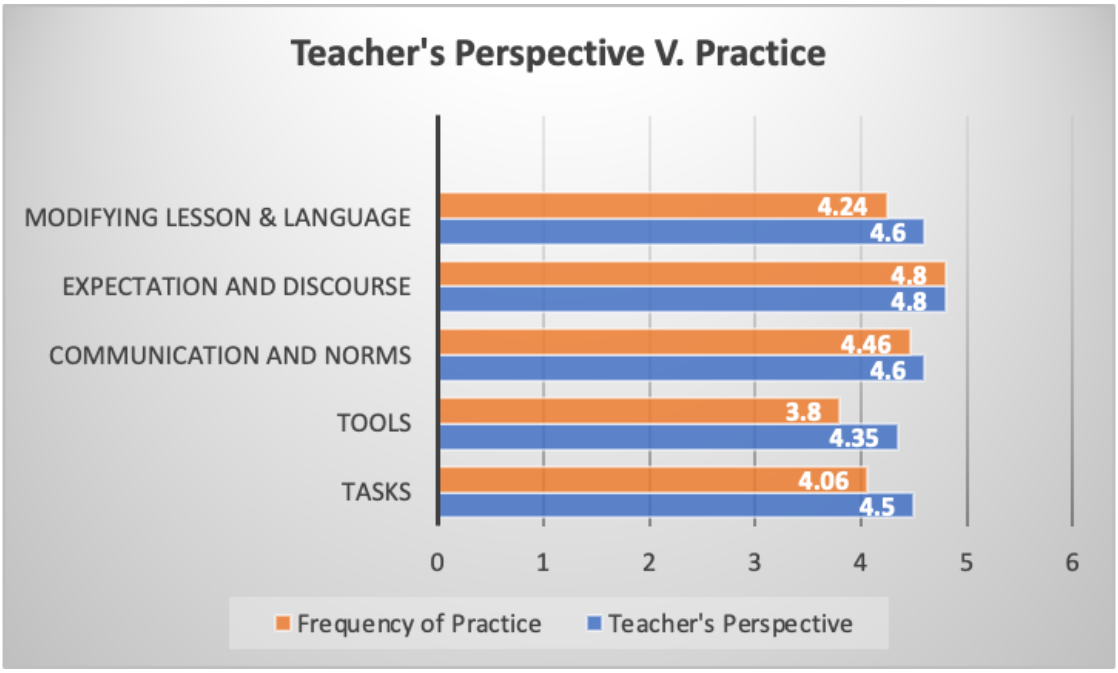
There were 18 a-series questions in the survey using a frequency scale to indicate how often the teachers practiced the specific teaching strategies in the classroom. These questions were asked using a frequency scale, which included a possible range from *never use this practice*=1, *rarely use this practice*=2, *sometimes use this practice*=3, *often use this practice*=4 and *use this practice frequently*=5. There were also 18 b-series questions in the survey reflecting the perspective of teachers on how the specific inclusive teaching practice impacts the math identity of ELLs. These questions were asked using a five point Likert scale which included a possible range from *strongly disagree* to *strongly agree*. The comparison of the participants' perspectives and the frequency of practice is shown in Figure 4.1. The mean results for the a-series questions in five themes are included in Table 4.1 in Appendix C. The mean results for the b-series questions in five themes can be found in Table 4.2 in Appendix C.

Figure 4.1 provides a comparison of the mean of the participants' perspectives on how equitable teaching impacts the mathematical identity of ELLs and the mean of the frequency of each practice. Of all five themes, only the question of the Expectation and Discourse resulted in the same value, with a mean of 4.8 for both teacher's perspective

and frequency of practice. For the rest of four themes, the mean of the participants' perspectives were all higher than the mean of frequency in practice. Using mathematical tools scored the lowest both in participants' perspective and in actual practice which indicated that their perspective did impact their frequency of practice.

Figure 4.1

Comparison of the teacher's perspective and frequency of practice



Results for the Questions Relating to Each Survey Themes

Because the purpose of this research was to find the teacher's perspective on how equitable teaching practices impact the math identity of ELLs, I focused on and categorized the response of b-series questions into their corresponding themes to better illustrate the results.

Mathematical Tasks. The factor of tasks was examined using three survey questions that combined had a mean score of 4.5. The question within the tasks which

resulted in the highest favorable response, with a mean of 4.7, by survey participants was about the tasks rich in the opportunities for mathematics as well as language development positively impacting the mathematical identity. It is closely followed, both with a mean of 4.4, by the items that the tasks connect to students' background and experience positively impact the mathematical identity of ELLs, as well as the tasks with more than one strategy positively impact the mathematical identity of ELLs. Detailed full results for the mathematical tasks are shown in Table 4.3.

Table 4.3

Mathematical Tasks

Question	Min	Max	Mean
2b. The tasks connecting to the students' experiences positively impact the mathematical identity of ELLs.	3	5	4.4
11b. Tasks rich in the opportunities for mathematics as well as language development positively impact the mathematical identity of ELLs.	4	5	4.7
16b. The mathematical tasks with multiple entry points and more than one strategy positively impact the mathematical identity of ELLs.	3	5	4.4

Mathematical Tools. The question within the Mathematical Tools which resulted in the lowest favorable response, with a mean of 4.3, by survey participants was related to the statement that the opportunities for students to use any tool and preferred language to explain their thinking to others positively impact their math identity. The statement that has a comparatively higher favorable response, with a mean of 4.4 was that bridging

students' representations with conventional notation and vocabulary positively impacts the mathematical identity of ELLs. Combined mean of items relating to mathematical tools was 4.35, which was lowest of all themes. Detailed full results are presented below in Table 4.4.

Table 4.4

Tools

Question	Min	Max	Mean
7b. Bridging students' representations with conventional notation and vocabulary positively impacts the mathematical identity of ELLs.	4	5	4.4
13b. Opportunities for students to use any tool and preferred language to explain their thinking to others positively impact the mathematical identity of ELLs.	2	5	4.3

Communication and Norms. There were two questions within the Communication and Norms portion of the survey which resulted in the highest favorable response, with a mean of 4.9. These scores were related to the statement that a visual display of important concepts and having opportunities to make and justify mathematical conjectures positively reinforces the math identity of ELLs. Two questions which resulted in the lowest favorable response, with a mean of 4.5, by survey participants were related to the statement that scaffolding students' responses by repeating, extending and rephrasing while discussing positively impacts the math identity of ELLs and also the statement that negotiating mathematical meaning by listening to one another's thoughts impacts the math identity of ELLs. Detailed full results can be seen below in Table 4.5.

Table 4.5.

Communication and Norms

Question	Min	Max	Mean
5b. Emphasizing collaboration over competition positively impacts the mathematical identity of ELLs.	3	5	4.6
6b. Scaffolding students' responses by repeating, extending and rephrasing while discussion positively impacts the mathematical identity of ELLs.	3	5	4.5
8b. Negotiating mathematical meaning by listening to one another's thoughts positively impacts the mathematical identity of ELLs.	3	5	4.5
10b. A respectful atmosphere with a low affective filter in the math classroom positively reinforces the math identity of ELLs.	3	5	4.6
12b. A visual display of important concepts positively impacts the mathematical identity of ELLs.	4	5	4.9
18b. Having opportunities to make and justify mathematical conjectures positively reinforces the math identity of ELLs.	3	5	4.9

Expectations and Discourse. In this section, the question which resulted in the highest favorable response, with a mean of 4.9, by survey participants was related to the statement that conveying an expectation of high levels of student effort positively impacts the math identity of ELLs. The question within the Expectation and Discourse section which resulted in the less favorable response, with a mean of 4.7, by survey participants was related to the statement that having high expectations of ALL students positively impacts the mathematical identity of ELLs. The combined mean of the questions relating

to Expectation and Discourse was 4.8. Detailed full results can be found below in Table 4.6.

Table 4.6

Expectation and Discourse

Question	Min	Max	Mean
1b. Having high expectations of ALL students positively impacts the mathematical identity of ELLs.	4	5	4.7
14b. Conveying an expectation of high levels of student effort positively impacts the mathematical identity of ELLs.	4	5	4.9

Modifying Lesson and Language Support. Within this section, the question which resulted in the lowest favorable response, with a mean of 4.1, by survey participants was the statement that lessons with both language objectives and mathematics objectives positively impact the math identity of ELLs. The question which resulted in the highest favorable response, with a mean of 4.9 was the statement that explicitly teaching vocabulary that is new to students impacts the math identity of ELLs. The combined mean of the questions relating to modifying lessons and language support was 4.6. Detailed full results can be found below in Table 4.7.

Table 4.7

Modifying Lesson and Language Support

Question	Min	Max	Mean
3b. Various ways for students to communicate their thinking and all students have opportunities to speak positively impact the mathematical identity of ELLs.	4	5	4.8
4b. Lessons with both language objectives and mathematics objectives positively impacts the mathematical identity of ELLs.	2	5	4.1
9b. Explicitly teaching vocabulary that is new to students positively impacts the mathematical identity of ELLs.	4	5	4.9
15b. Providing language support to students when they talk about their mathematical thinking positively impacts the mathematical identity of ELLs.	4	5	4.8
17b. Accommodating students with different levels of English language proficiency positively impacts the mathematical identity of ELLs.	4	5	4.6

Summary of Responses to Questions in Section 3

In addition to the demographic questions and the Likert scale items, the survey also included two open-ended questions. This section summarizes themes in participants' responses to each question. The first open-ended question was "*In your opinion, what are the greatest benefits of implementing equitable teaching practices in the math classroom*?" In summary, teachers responded with the following benefits from the equitable teaching practices in the survey. First, the greatest benefit was students actually learning! All students made more progress. The things that were recommended to do for ELL students were also really great for all students, especially students who were lower

in math. Secondly, one response from the participants was that the greatest benefit of equitable teachers was to help deepen students' understanding of mathematical concepts versus just memorizing procedures/steps. Next, the benefit was for all students to be able to develop and strengthen their own voice in math but also in life. They were able to develop their positive math identity and deepen their skills. What's more, everyone would feel confident and comfortable sharing, explaining their thinking and taking risks. Students could gain success at the level they were at when they had multiple entry points to solve problems. Last but not least, all students would feel safe and voluntarily share their thinking and or questions.

The second open-ended question was "*What are the greatest challenges of implementing equitable teaching practices in the math classroom?*" The summary of the answers in the survey from participants showed the challenges that teachers had in implementing the equitable teaching practices. First**,** participants shared that it took a great deal of time and effort to implement. More time was needed to share their ideas and understand others' ideas. Secondly, there was not always enough staffing to support math in this way. Next, it was hard to create permanent visuals to assist ELLs due to lack of space in the room and visual clutter. What's more, it was also a challenge that some students who had answers quickly became frustrated at times while they were waiting. Last but not least, it was hard to try to be conscientious of using comprehensible language while also growing their language skills while currently teaching math at the same time. It was just hard to juggle it all.

Semi-structured Interview Results

Besides the survey, two interviews were also conducted in May and July, 2023 which allowed me to have an in-depth investigation on the research topic. The following sections include an explanation of the interview participants as well as sections that contain the results from each interview. The interview questions were framed in a way to provide further exploration and insight into the survey results. The interviews were conducted via phone call and Google Meet. The interviews were recorded and auto-transcribed. Once final corrected transcripts were produced, the original audio recordings were deleted so that the participants' confidentiality was preserved as outlined in the research protocol agreed to in the IRB.

Participants were sent an invitation email with a link to an online consent form. Each participant completed the consent form before the interview process started.

Summary of Interview

The first interviewee was a first grade teacher in the largest school district in Minnesota. She had a high percentage of ELLs in the classroom. She would be labeled as Teacher A in the following context. The second interviewee was a fifth grade teacher and she would be labeled as Teacher B in the following context. In this section, some of the overall trends that came out of both interviews are discussed to give a general overview and tone of the responses. The overarching themes were: noticing mathematical identity in the classroom, impact of mathematical tasks, the effect of mathematical tools, classroom communication and norms, the impact of language accommodation, and ways to model high expectations.

Noticing Mathematical Identity in the Classroom. Both of the interviewees indicated that math identity is important for all of the kids, regardless of their racial and socioeconomic background. Teacher A stressed the importance of math identity:

> If students don't see themselves as mathematicians, if they don't see themselves as being successful with math, they're more likely to give up. They are significantly less likely to be engaged with what the content is.

Teacher A shared the story of an ELL student who was a newcomer. At the beginning of the year she only wanted to rely on Spanish. Teacher A talked to her in English and Spanish. As the year has gone on, this student relied less on her Spanish and took more risks in English to share her math although it took her a little bit longer to process and translate in her head. She wanted to take that time because she knew her ideas were important and she wanted to challenge herself, which reflected the development of the math identity. This ELL student demonstrated tremendous growth both in the comfortability of sharing but also confidence in capabilities as mathematicians. Both interviewees indicated that what is good for some students is usually good for everyone.

Impact of Mathematical Tasks. Interviewees shared the idea that tying the mathematical tasks to ELLs' experience is really important. They both stressed that when teachers know things about students' home, life and their culture and incorporate those things, it definitely increases engagement in the math classroom. "When students see themselves and things that are important to them in the curriculum, it validates them and their own experience in life," Teacher B further explained.

What's more, they conveyed the thoughts that it helps if students see themselves being successful in that field or they see someone like themselves in that area. An example was shared to further explain this. Teacher B said her team recently had to change up one of the questions that was on a big unit test because it was talking about snowshoeing. The reason was because they had a large number of immigrants in the classroom who did not know what snowshoeing was. Students couldn't be successful with that question because they didn't know the content of the question. It was so difficult for students.

Interviewees clearly expressed how tying the mathematical tasks to ELLs' experience could impact students' math identity.

The Effect of Mathematical Tools. Participants emphasized the impact of using mathematical tools on the mathematical identity of ELLs.

First and foremost, participants shared that the number one thing that a teacher could normalize to promote equity in the classroom was to really normalize the use of manipulatives such as unifix cubes, etc. The access to manipulatives gave students opportunities to develop content knowledge and math identity. For example, when teachers were working with younger learners composing and decomposing numbers, the mathematical tools could help them visualize the problem. Secondly, mathematical tools could help students' discussion because there was something concrete in front of them. In addition, mathematical tools also helped students to catch any mistakes while they were working on their math problems.

Communication and Norms. Both interviewees were able to present a number of convincing ways how classroom communication and participation norms could reinforce

the mathematical identity of ELLs. First, interviewees shared that it was beneficial to emphasize the importance of the journey of the learning and how students got there rather than the answer. Interviewees also stated that in the classroom students were able to justify their thinking and de-stress the importance of the answer. “Because speed truly isn't important and they should think deeply,” Teacher A stated. Students need to be ready to be challenged in a very respectful way for their answers and be encouraged to make mathematical arguments. But it was all about the math, not about the different individuals in the classroom. If students thought of something mathematically incorrectly, or made an error, they were able to separate that from their own value as a person. Interviewees stressed that it was really important for students in developing their math identity to know that the mistakes were so valuable.

Next, the interviewees noticed that giving students opportunities to talk in partnership or small groups before sharing with the whole group could make ELLs feel a lot safer. Providing opportunities for in-class discussion not only allowed students to share their thinking, but they were also listening to how someone else formed the sentences and shared their ideas.

In addition, both interviewees gave students the option of choosing to answer the question or they could call on someone else. Students would not panic when they did not know the answer. This strategy helped students stay focused and also be more engaged, according to the interviewees.

At last, interviewees mentioned that it was really good to have projects in math. Students would not just sit and do a workbook, they got chances to talk to others and communicate. Because they explained things differently, so they could learn from each

other and have that conversation around. However, Teacher B indicated in her conversation that unfortunately, not all math curriculum incorporated things for students to do in partners or in groups.

"Every voice in the room is important, and it's important that we are listening to everybody and it's important that we be brave to share our own thoughts too," Teacher A commented.

Language Accommodation. Both interviewees had some practices in the classroom to accommodate students' English proficiency.

First, they accommodated ELLs by providing sentence frames for everyone in the classroom. Interviewees also mentioned that they would teach the math vocabulary to students, so that everyone had practice with scaffolding. Both interviewees believed these accommodations do impact the math identity of ELLs because it increased their own confidence in math. "Because they've got practice with it and they are going to get better at it if they practice," Teacher A said.

Next, interviewees accommodated students who did not speak any English when they came to the classroom by using technology. Students could translate the word problem to their native language through ipad or using other available technology. For students who knew some English but were not proficient enough, shortened word problems or word problems with reduced-length were provided.

Both interviewees believed that the accommodations to the different language proficiency did positively impact the math identity of ELLs because students did not see language as a barrier in math.

Expectations. Both interviewees believed conveying high expectations reinforces

the mathematical identity of ELLs by helping ELLs become more confident and willing to learn. One way to model high expectations was to make sure all students receive the same problem without exceptions. Teachers might reduce some of the words on the problems , but the expectation was that they were still answering the same math problem.

Another way interviewees shared was that they praised the effort and stressed the expectations on the learning instead of the result. They communicated their expectations in a way that all students could understand and had equal opportunities to share their thinking and defended it with their own preferred language using manipulatives if they preferred.

To conclude, interviewees truly believed the practices discussed above have provided the most success for students especially ELLs. Both interviewees also expressed their thoughts that the math identity did impact the achievement of ELLs because of the accessibility to the knowledge and the confidence they build through the equitable teaching practices.

Meanwhile interviewees also stressed the importance of being mindful of other people, especially at conferences like Minnesota Council of Teachers of Mathematics or other respected people in the education world to increase the strategies that we could use to support ELLs and teach the whole student every bit of them. ELLs should walk into the classroom without needing to switch pieces of themselves, “They should be their entire self when they're there, and take that stress and burden off them of needing to and trying to fit in the class,” Teacher A said.

Summary

The analysis of the survey and semi-structured interview data together as a research method provided us access to a better understanding of the question from both the broad framework of the survey and the more reflective qualitative data.

The valuable insights into the research questions from participants showed the importance of all five themes that were being researched. Of all five themes, the expectation and discourse had a slightly higher score of all and mathematical tools scored lowest. For the interview, the participants did convey the ideas that all themes in the research were considered important. By combining the data from the surveys and the interviews, there appeared to be alignment between them.

In the following chapter, I will provide an interpretation and summary of the findings as well as how the results tie to the literature review. The limitations of the study and how this study might be valuable to various stakeholders will be discussed after. Lastly, I make suggestions for potential further research to be done on this topic to benefit ELLs.

CHAPTER FIVE

Discussion

Introduction

The research question that was investigated during the study was: *How do equitable teacher practices impact the mathematical identity of ELLs from teachers' perspective?* The first chapter introduced how I became interested in the math identity of ELLs followed by a literature review of the theory in Chapter Two. Chapter Three laid out the design of study and the survey items that were inspired by researchers mentioned in the literature review. Chapter Four analyzed the quantitative and qualitative results to indicate the themes and ways that could impact the math identity of ELLs through equitable teaching practices. The concluding chapter includes the summary of the major takeaways of my research. I start by discussing the most prominent findings that emerged within the data and possibilities as to how they might answer the research question. Limitations to the study and implications and suggestions for future research are also discussed.

Summary of the Research Study

The research question of this study focuses on how the five themes, which were mathematical tasks, mathematical tools, norms and communication, modifying lessons and language support, teachers' expectations and the discourse of ability, impact the math identity of ELLs. In order to study this research question, a mixed method research study was used that consisted of a quantitative survey followed by semi-structured interviews.

Findings and Connections to the Literature

The survey results were analyzed and the full findings were reported in Chapter Four. The results indicated that the rank of importance of the themes, starting with the highest to lowest, were communication and discourse, expectations and norms, modifying lessons and language, mathematical tasks and mathematical tools. For the interviews, two participants shared their thoughts and practices on these themes as well. In order to understand the meaning of these results, it was important to surface the statements that were most and least favorably scored. The following were the major findings from the results. It was then examined in comparison with the result of the interview and literature review to see if there was any alignment of opinions that took place.

Conveying High Expectations

Participants in both survey and interview expressed a strong opinion that conveying expectations of high levels of student effort would be the teaching practice that impacted the math identity of ELLs most. The interviewees shared the thoughts that the expectation of students' effort played a critical role in the mathematical identity development of ELLs in their teaching. What they noticed was when teachers acknowledged students that the effort and process of learning was more valuable than the result, it helped ELLs become more confident and willing to learn. Teacher A also stressed that she would tell students that it was the effort and mathematical thinking that she was looking for instead of the results.

Also, participants agreed that teachers should have high expectations of all students. The ELLs would be working on the same level of content as their peers.

Interviewees especially remarked that they adopted multiple ways to support ELLs in math such as language support or using manipulatives etc., when students were required to share their mathematical thinking. They did see with the same expectations, ELLs were more confident in learning math. This finding adds to and aligns with previous research on how the expectation from teachers could be a crucial factor in developing the math identity of students (Jorgensen & Niesche, 2008). Jorgensen and Niesche indicated that students could articulate greatly the expectations of them from teachers and the implications of those expectations for them as learners in a classroom where the students were streamed according to perceived ability. This statement was very obviously reflected in the conversation with interviewees.

Strongly Advocate in Using Language Support

The survey results indicated that teachers strongly believed that explicitly teaching vocabulary that was new to students and providing language support to ELLs when they were sharing mathematical thinking would impact the math identity of ELLs most. Interviewees also stated that besides teaching new vocabulary, they would also have the sentence stems posted, so that students could see and practice together or they would have sentence frames built in so that ELLs could respond to questions without having to think through the exact sentence structure.

Teacher A stressed the importance of the language support because "it helped reduce the language barrier in learning math. Although they didn't understand the language, they still could answer the questions. They still could feel successful in math." Both interviewees also noticed that it empowered ELLs when they were allowed to use

their first language in the classroom. The goal of these practices was to ensure that everyone has equal access to the mathematical content being taught.

As discussed in the literature, Bresser et al. (2008) pointed out that modifying lessons and language support can promote equity and help ELLs to fully participate in the class learning. Bresser et al. also informed that language supports were needed for ELLs to communicate and share their mathematical thinking. The findings of the research were aligned with the literature review.

Modifying Lessons and Visual Display of Important Concepts

Participants highly agreed that having a visual display of important concepts in the class was one of the practices that would reinforce the mathematical identity of ELLs most. The existence of visual displays of important concepts provided more opportunities for ELLs to engage in conversation and share their ideas. They also mentioned that these strategies not only helped the ELLs, but also all the students, especially students who were low in math.

Meanwhile, the findings continued to demonstrate that whether ELLs had opportunities to make and justify their mathematical conjectures was seen as an influential factor as well. These findings were aligned with the equitable teaching practices discussed in the framework from Borgolia (2008) that students were making and justifying mathematical conjectures and also there was a visual trail of important concepts created.

But in the survey, participants did point out that the possible challenges in having a visual display in the classroom could be due to lack of space in the room and visual clutter.

Mathematical Tasks

There was a strong voice from participants that mathematical tasks rich in the opportunities for mathematics as well as language development was a major factor that could positively impact the mathematical identity of ELLs, while there was less support shown that tasks connecting to the students' backgrounds and experiences positively impact the mathematical identity of ELLs.

On the contrary, the interviewees highly stressed the importance of the tasks connecting to the students' background. In their practice, the interviewees noticed students would be more engaged and successful when they saw themselves and things that are important to them in the curriculum, it validated them and their own experience in life. But in order to do this, teachers needed to know their students as a person.

This finding aligned with the statement in the literature that in order to create meaningful tasks that validate students' experiences, teachers must get to know their students' background and current or past life experiences (Gonzalez et al., 2001). It was also aligned with the guiding questions from the framework by Borgioli (2008) discussed in literature review enabling meaningful practices toward classroom equity was whether the tasks were linked to the students' backgrounds and experiences.

At the same time, participants in both surveys and interviews communicated the importance of how the tasks could encourage students' engagement to have critical thinking in discussion as well as promoting their language development.

Validating Using Mathematical Tools

The use of mathematical tools was not considered to have a major impact on the math identity of ELLs as other themes in the survey. Consequently, there had been considerably lower opportunities to practice it according to the survey results.

The interviewees shared in the conversation that the number one thing that a teacher could normalize to promote equity in the classroom was to really normalize the use of manipulatives. The whole multi-sensory approach of needing to manipulate and move them could support students both visually and manipulating kinesthetically with their hands. They agreed that the use of mathematical tools, in their many forms, supported the ELLs in their practice. The mathematical tools were so powerful to support students in their voice and to validate what they're thinking. When using mathematical tools, students had a physical connection to whatever that concept was. They use tools as the ways to communicate and help them to expand their mathematical thinking. Even if students were missing a word in their language or they're not exactly share how to correctly explain everything, they were able to have a visual demonstration to show what they did. " If ELLs are able to use tools they don't necessarily need to verbalize everything that they do. They can still be engaged without talking. And they still have a voice, " Teacher B shared.

Interviewees witnessed that the ELLs in the classroom were proud to be able to share their work to someone else using tools in their classrooms. Teacher A stated " It is

the feeling of the importance of their own contribution that reinforces their math identity."

It was emphasized that using mathematical tools not only helped the ELLs but also all students. The important thing was there was tangible support for every kid, especially kids that were still trying to learn a language.

The perspectives from the interviewees were aligned with the guiding questions for using mathematical tools to equitable practice by Borgolia (2008) that in an equitable classroom, students could decide which tools they preferred to use and the methods to represent them. Students should see the tools as means of communication and extending their mathematical thinking.

One of the possible reasons to explain the lower support for using mathematical tools in the survey could be that teachers who teach higher grades might not be using tools as often as teachers in the lower grades. Another possible reason could be the survey respondents had varying levels of access to the mathematical tools while the interviewees had more support to the mathematical tools. This reason was also mentioned by the participants to the survey question on what are the greatest challenges of implementing equitable teaching practices in the math classroom reported in Chapter Four. Another possible concern that teachers had was there would not be enough time in the math classroom for students to use mathematical tools to explore math.

It is worth noting that the frequency of practice in using mathematical tools scored the lowest in the survey as well. The perspectives of teachers in using mathematical tools did directly impact their practice in the classroom. According to NCTM (2020), mathematical tools and modeling should be used as resources and also

provide a resource for ELLs to engage in mathematics and communicate their mathematical understanding and are essential in developing a community that enhances discourse. In order to better support ELLs in the math classroom, using mathematical tools in the classroom should be validated.

From the survey results, a trend was shown that the perspective of teachers did have an impact on their frequency of practice. The higher the score on the teacher's perspective, the higher the score on their frequency in practice. It indicated the importance of research on teachers' perspective in the future to improve practice.

Limitations

Upon commencement of my research, I quickly discovered that there were a number of factors that hampered my research. These factors include a small sample size, limited duration of the study and lack of diversity.

Firstly, in order to get a more accurate idea of how equitable teaching impacts the math identity of ELLs, it would have been beneficial to expand the setting and demographics. Specifically, instead of having 10 teachers in surveys and two interviewees, it would have been valuable to have a larger pool of teacher participants. These numbers were too low to find statistically significant results. Also, there could be different views from male participants because all 10 participants were female teachers.

The second limitation was that of the teachers who participated in the individual interviews, the participants all had positive views on the five themes which could impact the mathematical identity of ELLs, but the interviewees were likely all motivated teachers. This assumption is based on the fact that they were all willing to offer a

considerable amount of time to be part of a research study to have a rich conversation around teaching and learning.

Finally, it would be more accurate if I could collect data after the teachers' were exposed to the relevant concepts in this research and have a recheck on their thoughts to compare their perspectives. A longer study that would continue to check in with the teachers on their perspectives after their exposure on the research topic would certainly add to the information already collected and potentially yield more results.

Implications

The findings here indicated that the equitable teaching practices do have an impact on the mathematical identity of ELLs from the teacher's perspective. Despite shortcomings, the study still yielded valuable data and insight into my research question. This capstone has enabled me to explore this topic in a much greater detail. Going into this capstone, I knew that I wanted to learn more about my ELLs. After careful analysis of the research findings in this study, it is evident that there are several implications for educators and administrators of schools serving ELLs. In this section I will present some of these implications in the following.

Implications for Teachers

First, and perhaps the most important implication from this research is the simple fact, as one of the interviewees mentioned, that teachers need to know their ELLs. Knowing the ELLs does not only mean knowing their name. My argument here is that teachers should spend time to know ELLs as individuals and their cultural background to provide opportunities where students can share their identities as mathematicians in the

classroom. At the same time, these opportunities give students access to reflect on their own experiences and allow them to discuss how those experiences have influenced their own views as math learners. As interviewees mentioned that they both made sure they provided time in the math classroom for ELLs to speak and communicate their thinking. When teachers have the potential insights into how the ELLs view themselves as math learners, teachers could have more necessary information they need to plan purposeful instruction. More importantly, it grants ELLs a venue for them to react to the ways they are often categorized.

Secondly, the discussion indicated that the math classroom with equitable teaching is where mistakes are allowed and could be used as opportunities for learning. Teachers of ELLs must strive to provide a balanced curriculum, teaching in a way that sends ELLs the message that doing math is more than simply getting the answers correctly, but exploring the relationship of numbers, shapes, patterns in the real world. Understanding the world around them will help ELLs to positively evaluate their own self perceptions as mathematicians and learners.

Implications for Administrators

Discussions above demonstrated how teachers can create a venue for ELLs to explore their own identity as mathematicians and in doing so learn how to address the unique needs of ELLs. Based on the findings, there are several implications for administrators. One way that administrators can support teachers of ELLs is by ensuring that both math instructions and evaluation consider the varying levels of English

language proficiency for ELLs. It will help foster ELLs' identities as strong math learners without worrying about language as a hindrance in learning math. Another thing that schools could help is to ensure and routinize the use of the resources of mathematical tools which support students' learning as we mentioned in findings.

Undeniably, there are challenges in practicing the equitable teaching as we discussed. Teachers have a curriculum they usually need to teach and follow, and also the presence of high stakes testing is another factor. Administrators could convey the message to teachers that the thoughtful planning and instruction should highlight ELLs' genuine identities in the math classroom. Administrators should allow teachers the opportunity to endeavor beyond the confinement of math test taking skills but allow ELLs to share their own stories.

Recommendations for Future Research

At this point, my research is completed. However, there are still numerous areas in need of exploration by future researchers. One area of focus for further research could be to explore the perspective of ELLs on how the teaching practice could impact their mathematical identity, as my original intention was to explore both teachers and students' perspectives on the impact of equitable teaching practice. However, not long after I started research, I changed my focus to teachers' perspective due to the scope of research, multiple research designs and limited time. If research could be done from the perspective of ELLs, it would give educators opportunities to understand and hear ELLs' voices and furthermore to help them. This research could also be expanded to find out

how the equitable practice impacts the mathematical identity of ELLs and furthermore impacts their math achievement.

Another study that could be done is to address the ways to develop the identity of ELLs in other subjects. There would be frameworks concluded from research in all subjects to help students and teachers in the future.

Summary

In this chapter I presented the findings of both survey and interview, limitations of my research, implications based on my findings, and suggestions for future research. I stated that my research showed definite indications on how equitable teaching practice had an impact on the mathematical identity of ELLs from teachers' perspective. I believe much valuable information and data has been gained into the research question and it provides the foundation for future research on the topic. I conclude this study with a deep understanding of the influence of equitable teaching practices, and how those practices can have impacts on the mathematical identity of ELLs. Most importantly, I understand that in an equitable classroom, all students are invited to endless possibilities to imagine and reimagine their future and are allowed to maintain pride in their cultural and linguistic backgrounds. I take with me the personal stories and thoughts participants shared with me, their stories of endeavor and hopes, and in doing so understand that in this process, participants have come to explore the potential impact of their teaching practices in the classroom on the ELLs. I'm looking forward to learning more on this topic!

REFERENCES

Aguire, J., & Mayfield-Ingram, K. (2013). *The impact of identity in K-8 mathematics learning and teaching: Rethinking equity-based practices*. The National Council of Teachers of Mathematics, Inc.

Baker, C. (2011). *Foundations of bilingual education and bilingualism* (5th ed.). Multilingual Matters.

Ball, D. L. (1993). With an eye on the mathematical horizon: Dilemmas of teaching elementary school mathematics. *The Elementary School Journal, 93*(4), 373-397. doi:10.1086/461730

Banes, L. C., Ambrose, R. C., Bayley, R., Restani, R. M., & Martin, H. A. (2018). Mathematical classroom discussion as an equitable practice: Effects on elementary English learners' performance. *Journal of Language, Identity, and Education, 17*(6), 416-433. doi:10.1080/15348458.2018.1500464

Borgioli, G. M. (2008). Equity for English language learners in mathematics classrooms. *Teaching Children Mathematics, 15*(3), 185-191.

Bresser, R., Melanese, K., & Sphar, C. (2009). Equity for language learners: Reflect and discuss. *Teaching Children Mathematics, 16*(3), 170-177. doi:10.5951/TCM.16.3.0170

Burton, L. (1994). Whose culture includes mathematics? In S. Lerman (Ed.), *Cultural perspectives on the mathematics classroom* (pp. 68–83). Kluwer Academic.

Carpenter, T. P., & Lehrer, R. (1999). Teaching and learning mathematics with understanding. In E. Fennema & T. A. Romberg (Eds.), *Mathematics classrooms that promote understanding* (pp. 19-32). Lawrence Erlbaum Associates. DOI: 10.4324/9781410602619-3.

Chamot, A. U., & O'Malley, J. M. (1996). The Cognitive Academic Language Learning Approach: A model for linguistically diverse classrooms. *The Elementary School Journal, 96*(3), 259-273. 10.1086/461827

Clark, L. M., Neumayer DePiper, J., Frank, T. J., Nishio, M., Campbell, P. F., Smith, T. M., Griffin, M. J., Rust, A. H., Conant, D. L., & Choi, Y. (2014). Teacher characteristics associated with mathematics teachers' beliefs and awareness of their students' mathematical dispositions. *Journal for Research in Mathematics Education, 45*(2), 246-284. 10.5951/jresematheduc.45.2.0246

Cobb, P., Gresalfi, M., & Hodge, L. L. (2009). An interpretive scheme for analyzing the identities that students develop in mathematics classrooms. *Journal for Research in Mathematics Education, 40*(1), 40-68. doi:10.5951/jresematheduc.40.1.0040

Cobb, P., & Hodge, L. L. (2011). Culture, identity, and equity in the mathematics classroom. In Y.Erna, G.Koeno, & S.Anna (Eds.), *A journey in mathematics education research: Insights from the work of Paul Cobb* (pp.179-195). Springer. DOI: 10.1007/978-90-481-9729-3

Council of the Great City Schools. (2016). A framework for re-envisioning mathematics instructions for English language learners.

https://www.cgcs.org/cms/lib/DC00001581/Centricity/domain/4/darrell/FrameworkForMath4ELLs_R10_FINAL.pdf

Creswell, J. W., & Creswell, J. D. (2018). *Research design : Qualitative, quantitative, and mixed methods approaches*. SAGE Publications, Inc.

Cross, R. (2011). Monolingual curriculum frameworks, multilingual literacy development: ESL teachers' beliefs. *The Australian Journal of Language and Literacy, 34*(2), 166-180. doi:10.1007/BF03651854

de Jong, E. J., & Harper, C. A. (2005). Preparing mainstream teachers for English-language learners: Is being a good teacher good enough? *Teacher Education Quarterly, 32*(2), 101-124.

Eccles, J. (2009). Who am I and what am I going to do with my life? Personal and collective identities as motivators of action. *Educational Psychologist, 44*(2), 78-89. 10.1080/00461520902832368

Esmonde, I. (2009). Ideas and identities: Supporting equity in cooperative mathematics learning. *Review of Educational Research, 79*(2), 1008-1043. doi:10.3102/0034654309332562

Ferlazzo, L., & Hull-Sypnieski, K. (2012). *The ESL/ELL teacher's survival guide ready-to-use strategies, tools, and activities for teaching English language learners of all levels* (1st ed.). Jossey-Bass.

Forman, E. A., Larreamendy-Joerns, J., Stein, M. K., & Brown, C. A. (1998). “You're going to want to find out which and prove it”: Collective argumentation in a mathematics classroom. *Learning and Instruction, 8*(6), 527-548. doi:10.1016/S0959-4752(98)00033-4

Fosnot, C. T., & Dolk, M. L. A. M. (2001). *Young mathematicians at work: Constructing number sense, addition, and subtraction*. Heinemann.

González, N., Andrade, R., Civil, M., & Moll, L. (2001). Bridging funds of distributed knowledge: Creating zones of practices in mathematics. *Journal of Education for Students Placed at Risk, 6*(1-2), 115-132. doi:10.1207/S15327671ESPR0601-2_7

Gutierrez, R. (2002). Beyond essentialism: The complexity of language in teaching mathematics to latina/o students. *American Educational Research Journal, 39*(4), 1047-1088. doi:10.3102/000283120390041047

Gutstein, E., Lipman, P., Hernandez, P., & de los Reyes, R. (1997). Culturally relevant mathematics teaching in a Mexican American context. *Journal for Research in Mathematics Education, 28*(6), 709-737. doi:10.2307/749639

Hayes, D., M. Mills, P. Christie, & B. Lingard. (2006). *Teachers and schooling making difference: Productive pedagogies, assessment and performance*. Allen & Unwin.

Heritage, M., Walqui, A., & Linquanti, R. (2015). *English language learners and the new standards: Developing language, content knowledge, and analytical practices in the classroom*. Harvard Education Press.

Ivankova, N. V., & Creswell, J. W. (2009). Mixed methods. In J. Heigham & R. A. Croker (Eds.), *Qualitative research in applied linguistics: A practical introduction*, *23*, 135-161. Palgrave Macmillan.

Janzen, J. (2008). Teaching English language learners in the content areas. *Review of Educational Research, 78*(4), 1010-1038. doi:10.3102/0034654308325580

Jorgensen, R., & Niesche, R. (2008). Equity, mathematics and classroom practice: Developing rich mathematical experiences for disadvantaged students. *Australian*

Primary Mathematics Classroom, 13(4), 21-27. doi:10.3316/informit.985808330914957

Khisty, L. L. (1995). Making inequality: Issues of language and meanings in mathematics teaching with Hispanic students. In W. G. Secada, E. Fennema, & L.B. Adajian (Eds.), *New directions for equity in mathematics education* (pp. 279-298). Cambridge University Press.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge University Press.

LeClair, C., Doll, B., Osborn, A., & Jones, K. (2009). English language learners' and non-English language learners' perceptions of the classroom environment. *Psychology in the Schools, 46*(6), 568-577. 10.1002/pits.20398

Martin, D. B. (2006). Mathematics learning and participation as racialized forms of experience: African American parents speak on the struggle for mathematics literacy. *Mathematical Thinking and Learning, 8*(3), 197-229. 10.1207/s15327833mtl0803_2

Martin, D. B. (2009). Does race matter? *Teaching Children Mathematics, 16*(3), 134-139.

Martiniello, M. (2008). Language and the performance of English-language learners in math word problems. *Harvard Educational Review, 78*(2), 333-368. 10.17763/haer.78.2.70783570r1111t32

Mason, L. (2007). Introduction: Bridging the cognitive and sociocultural approaches in research on conceptual change: Is it feasible? *Educational Psychologist, 42*(1), 1-7. doi:10.1080/00461520709336914

Maxwell, J. A. (2013). *Qualitative research design: An interactive approach* (3rd ed.). SAGE Publications, Inc.

McCarthey, S. J., & Moje, E. B. (2002). Identity matters. *Reading Research Quarterly, 37*(2), 228-238. doi:10.1598/RRQ.37.2.6

McMillan, J. H., & Schumacher, S. (2010). *Research in education: Evidence-based inquiry* (7th ed.). Pearson.

Nasir, N. S., & de Royston, M. M. (2013). Power, identity, and mathematical practices outside and inside school. *Journal for Research in Mathematics Education, 44*(1), 264-287. doi:10.5951/jresematheduc.44.1.0264

National Center for Education Statistics. (2019). *Indicator 8: English language learners in public schools*. *National Center for Education Statistics.* https://nces.ed.gov/programs/raceindicators/indicator_rbc.asp

National Council of Teachers of English. (2008) *English Language Learners*. https://prod-ncte-cdn.azureedge.net/nctefiles/resources/policyresearch/ellresearchbrief.pdf

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.*

National Council of Teachers of Mathematics. (2014). *Principles to actions: Ensuring mathematical success for all*.

National Council of Teachers of Mathematics. (2020). *Standards for the preparation of middle level mathematics teachers*. https://www.nctm.org/uploadedFiles/Standards_and_Positions/NCTM_Middle_School_2020_Final.pdf

Reeves, J. R. (2006). Secondary teacher attitudes toward including English-language learners in mainstream classrooms. *The Journal of Educational Research (Washington, D.C.), 99*(3), 131-143. 10.3200/JOER.99.3.131-143

Rubin, H. J., & Rubin, I. (2012). *Qualitative interviewing: The art of hearing data*. SAGE.

Schleppegrell, M. J. (2007). The linguistic challenges of mathematics teaching and learning: A research review. *Reading & Writing Quarterly, 23*(2), 139-159. doi:10.1080/10573560601158461

Secada, W.G. & Berman, P. (1999). Equity as a value-added dimension in teaching for understanding in school mathematics. In E.Fennema & T.A.Romberg (Eds.), *Mathematics classrooms that promote understanding* (pp. 33-42). Lawrence Erlbaum Associates. DOI: 10.4324/9781410602619-4

Solomon, Y. (2009). *Mathematical literacy: Developing identities of inclusion*. Routledge.

Stein, M. K., & Smith, M. S. (1998). Mathematical tasks as a framework for reflection: From research to practice. *Mathematics Teaching in the Middle School, 3*(4), 268-275. doi:10.5951/MTMS.3.4.0268

Tzuo, P. W. (2007). The tension between teacher control and children's freedom in a child-centered classroom: Resolving the practical dilemma through a closer look at the related theories. *Early Childhood Education Journal, 35*(1), 33-39. doi:10.1007/s10643-007-0166-7

U.S Department of Education. (n.d.) *Academic performance and outcomes for English learners*. https://www2.ed.gov/datastory/el-outcomes/index.html#one

Valdés, G. (2001). *Learning and not learning English: Latino students in American schools*. Teachers College Press.

Vygotsky, L. S. (1978). Mind in society: development of higher psychological processes. In M. Cole, V. John-Steiner, S. Scribner. & E. Souberman (Eds.), *Mind in society; development of higher psychological processes*. Harvard University Press. 10.2307/j.ctvjf9vz4

Vygotsky, L.S. (1981). The instrumental method in psychology. In R.W. Rieber, & J. Wollock (Eds.), *The concept of activity in Soviet psychology*. Sharpe.

Waxman, H. C., & Téllez, K. (2002). Effective teaching practices for English language learners. *The Laboratory for Student Success, the Mid-Atlantic Regional Educational Laboratory* (ED474821). ERIC. *https://files.eric.ed.gov/fulltext/ED474821.pdf*

Weiss, R. S. (1995). *Learning from strangers: The art and method of qualitative interview studies* (1st ed.). Free Press.

Appendix A
Survey

Portion One: Demographic Data

1. What is your age?
   a) 35 and under b) 36 to 45 c) 46 or older d) Prefer not to say
2. What is your Gender?
   a) Female b) Male c) Prefer not to say
3. Years in teaching?
   a) 0 to 3 years b) 4 to 7 years c) 8 to 11 years d) 12 to 15 years e) 16+ years
4. What school are you teaching?
   Answer:_____.
5. What is the current enrollment of English Language learners in your classroom?
   a) 0-20% b) 21%-40% c) 41%-60% d) 61%-80% e) 81%-100%

Portion Two: Teaching practice

Math Identity is defined as *how students see themselves and how they are seen by others, including teachers, parents, and peers as doers of mathematics.* Because of the different situations and different groups of students, equitable teaching practices may look and mean differently for teachers. For this reason, there are no right or wrong answers for the following questions. **First**, indicate how frequently you use this practice. **Then**, indicate how strongly you agree that the *Math Identity* of ELLs will be *positively reinforced* by the practice.

1a. I have high expectations for the learning of ALL students.
I never use this practice 1 2 3 4 5 I use this practice frequently

1b. Having high expectations of ALL students positively impacts the mathematical identity of ELLs.
Strongly disagree 1 2 3 4 5 Strongly agree

2a. The tasks in the mathematics class are connected to the students' backgrounds and experiences.
I never use this practice 1 2 3 4 5 I use this practice frequently

2b. The tasks connecting to the students' backgrounds and experiences positively impact the mathematical identity of ELLs.
Strongly disagree 1 2 3 4 5 Strongly agree

3a. There are various ways for students to communicate their thinking and all students have opportunities to speak.
I never use this practice 1 2 3 4 5 I use this practice frequently

3b. Various ways for students to communicate their thinking and all students have opportunities to speak positively impact the mathematical identity of ELLs.
Strongly disagree 1 2 3 4 5 Strongly agree

4a. The lessons include language objectives as well as mathematics objectives.
I never use this practice 1 2 3 4 5 I use this practice frequently

4b. Lessons with both language objectives and mathematics objectives positively impacts the mathematical identity of ELLs.
Strongly disagree 1 2 3 4 5 Strongly agree

5a. Collaboration is emphasized over competition.

I never use this practice 1 2 3 4 5 I use this practice frequently

5b. Emphasizing collaboration over competition positively impacts the mathematical identity of ELLs.

Strongly disagree 1 2 3 4 5 Strongly agree

6a. I scaffold students' responses by repeating, extending, and rephrasing while discussion.

I never use this practice 1 2 3 4 5 I use this practice frequently

6b. Scaffolding students' responses by repeating, extending and rephrasing while discussion positively impacts the mathematical identity of ELLs.

Strongly disagree 1 2 3 4 5 Strongly agree

7a. I make efforts to bridge students' representations with conventional notation and vocabulary.

I never use this practice 1 2 3 4 5 I use this practice frequently

7b. Bridging students' representations with conventional notation and vocabulary positively impacts the mathematical identity of ELLs.

Strongly disagree 1 2 3 4 5 Strongly agree

8a. The class members negotiate mathematical meaning by listening to one another's thoughts.

I never use this practice 1 2 3 4 5 I use this practice frequently

8b. Negotiating mathematical meaning by listening to one another's thoughts positively impacts the mathematical identity of ELLs.

Strongly disagree 1 2 3 4 5 Strongly agree

9a. I explicitly teach vocabulary that is new to students.

I never use this practice 1 2 3 4 5 I use this practice frequently

9b. Explicitly teaching vocabulary that is new to students positively impacts the mathematical identity of ELLs.

Strongly disagree 1 2 3 4 5 Strongly agree

10a. There is a respectful atmosphere with a low affective filter in the math classroom.

I never use this practice 1 2 3 4 5 I use this practice frequently

10b. A respectful atmosphere with a low affective filter in the math classroom positively reinforces the math identity of ELLs.

Strongly disagree 1 2 3 4 5 Strongly agree

11a. The tasks are rich in the opportunities for mathematics as well as language development.

I never use this practice 1 2 3 4 5 I use this practice frequently

11b. Tasks rich in the opportunities for mathematics as well as language development positively impact the mathematical identity of ELLs.

Strongly disagree 1 2 3 4 5 Strongly agree

12a. There is a visual display of important concepts created and often it is permanent.

I never use this practice 1 2 3 4 5 I use this practice frequently

12b. A visual display of important concepts positively impacts the mathematical identity of ELLs.

Strongly disagree 1 2 3 4 5 Strongly agree

13a. There are opportunities for students to use any tool and preferred language to explain their thinking to others.

I never use this practice 1 2 3 4 5 I use this practice frequently

13b. Opportunities for students to use any tool and preferred language to explain their thinking to others positively impact the mathematical identity of ELLs.

Strongly disagree 1 2 3 4 5 Strongly agree

14a. I convey an expectation of high levels of student effort.

I never use this practice 1 2 3 4 5 I use this practice frequently

14b. Conveying an expectation of high levels of student effort positively impacts the mathematical identity of ELLs.

Strongly disagree 1 2 3 4 5 Strongly agree

15a. Language supports are provided when students talk about their mathematical thinking.

I never use this practice 1 2 3 4 5 I use this practice frequently

15b. Providing language support to students when they talk about their mathematical thinking positively impacts the mathematical identity of ELLs.

Strongly disagree 1 2 3 4 5 Strongly agree

16a. The mathematical tasks have multiple entry points and more than one strategy.

I never use this practice 1 2 3 4 5 I use this practice frequently

16b. The mathematical tasks with multiple entry points and more than one strategy positively impact the mathematical identity of ELLs.

Strongly disagree 1 2 3 4 5 Strongly agree

17a. I accommodate students with different levels of English language proficiency in my class.

I never use this practice 1 2 3 4 5 I use this practice frequently

17b. Accommodating students with different levels of English language proficiency positively impacts the mathematical identity of ELLs.

Strongly disagree 1 2 3 4 5 Strongly agree

18a. The students have opportunities to make and justify mathematical conjectures.

I never use this practice 1 2 3 4 5 I use this practice frequently

18b. Having opportunities to make and justify mathematical conjectures positively reinforces the math identity of ELLs.

Strongly disagree 1 2 3 4 5 Strongly agree

Section C

1. In your opinion, what are the greatest benefits of implementing equitable teaching practices in the math classroom?

2. What are the greatest challenges of implementing equitable teaching practices in the math classroom?

Appendix B

Interview Questions

1. Do you think math identity is important? What observations do you have about the math identity of ELLs in your classes?
2. What equity considerations and concerns do you have about teaching ELLs mathematics?
3. Have you noticed any of your teaching practices that impacted the mathematical identity of ELLs? Examples? Does math identity impact ELLs' achievement?
4. How does tying the mathematical tasks to ELLs experience impact students' math identity if it does? (Example)
5. How can using mathematical tools help students understand the math concepts and discuss their thinking? What does that mean to ELLs?
6. In what ways can we build opportunities for discussion for ELLs to positively impact the math identity of ELLs?
7. How do you accommodate students with different levels of English proficiency? How do you think this type of accommodation impacts their mathematical identity?
8. What are some concrete ways that you model high expectations for all students? How do you think that will impact the ELLs' mathematical identity?
9. How can we best support ELLs in the mathematical classroom to reinforce their mathematical identity?
10. Have you had any professional development training regarding equitable teaching and mathematical identity of ELLs?
11. Please share anything else you would like to share.

Appendix C

Table 4.1.

Teacher's perspective

Theme	N	Min	Max	Mean
Mathematical Tasks	10	3	5	4.5
Mathematical Tools	10	2	5	4.35
Communication and Norms	10	3	5	4.6
Expectation and Discourse	10	4	5	4.8
Modifying Lesson & Language Support	10	2	5	4.6

Table 4.2

Frequency of practice

Theme	N	Min	Max	Mean
Mathematical Tasks	10	3.7	4.4	4.06
Mathematical Tools	10	3.5	4.2	3.8
Communication and Norms	10	4.3	4.7	4.46
Expectation and Discourse	10	4.7	4.9	4.8
Modifying Lesson & Language Support	10	3.8	4.6	4.24