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Engaging English Learners in Purposeful Discourse in Elementary Mathematics

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
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Walden University
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Abstract

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MEd, University of Puget Sound, 2004

BA, Seattle Pacific University, 1992

Project Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Education

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October 24, 2021

Abstract

Teachers are experiencing a change in practice, from teacher-centered to student-centered, which affects their work with English learners (ELs) in third through fifth grade mathematics classrooms. The implementation of student-centered discourse practices is essential to orchestrating productive mathematical discussions. However, the common practice is teacher-centered instruction where teacher talk is prevalent. Although the school district in this study provided professional development (PD) to address student-centered practices, PD for teaching ELs to interact in English in their mathematics classrooms remained to be addressed. The purpose of this study was to gain an understanding of teachers' experiences with new discourse practices and to identify the types of PD that would best support teachers in implementing these new practices with ELs. Knowles's adult learning theory of andragogy was the conceptual framework supporting this basic qualitative study that included semistructured interviews with 12 third through fifth grade teachers at schools with at least 10% ELs. Open and axial coding with constant comparison were used to develop themes. Findings revealed that participants continued to struggle with students' academic vocabulary and language development in mathematics. Also, participants need further PD for implementing equitable discourse practices, which includes virtual tools as well as scaffolded instruction for ELs. Lastly, most of the third through fifth grade mathematics teacher participants expressed a desire for collaborative PD learning with EL specialists. Based on these findings, 3 days of PD eLearning sessions were created. These PD eLearning sessions may also be used by other districts and educational organizations, replicating them to use in other areas to foster social change by promoting EL's academic growth.

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Dedication

This study is dedicated to two loving men in my life—my beloved husband, Jay, who passed away on November 27, 2016, and my dear Bobby who held my hand as I picked up the pieces of my life after losing my Jaybird. Both of these men have been my biggest and loudest cheerleaders.

Acknowledgments

First, I would like to acknowledge Jay, my late husband. It was he who strongly encouraged me to pursue a doctoral degree after earning a master's degree. He said that it was God's plan for my life, and so I applied to Walden. My doctoral journey has not been an easy one. As a matter of fact, it has been quite a roller coaster ride. Little did I realize that I would be getting off this ride without my Jaybird at my side. You see, during my proposal stage, my husband unexpectedly died. However, my Jaybird's last dying wish was for me to promise him that no matter what happened, I would complete this degree. I am so proud of my accomplishment! I cannot tell you how many tears I have shed while working on this degree.

Secondly, I would like to thank my dear Bobby who has become more than a life-long friend. It was my Bobby who pushed me to wrap up this degree and to fulfill a promise to myself and to my late husband. He has been there for me, holding my hand, as I moved forward in my grief. Recently, I had to laugh when he asked me if I expected him to call me "Dr. Karlyn!" Of course, I told him, "Yes!"

I am also reminded of God's great love and support. He has carried me during this difficult period in my life. He has constantly lifted me up and kept me moving forward when all I wanted to do was quit. I am forever grateful for His undying love and His promise of a future full of hope. I am looking forward to my next chapter in life.

Others I want to acknowledge and thank are my dear friends and family who cheered me on and supported me, especially after losing my husband. I personally want to thank my friends Ann and the women at the Self-Love Retreat, Belinda who made it possible for me to come back into the program and her words of encouragement, Bronwyn who mentored and improved my writing skills, Katy who was my thought partner, and Kris, Mary, and Olga as well as my other dear friends who were my greatest cheerleaders and supporters in this endeavor. I additionally want to thank my son and daughter, Zakk and Val and their families. They have encouraged me to fulfill my promise to their father and myself. I could always depend on them to provide emotional support, including my son's mother n' law, Theresa, and my late husband's parents, Layton "Pappy" and Sharon. I am also grateful for my cousin Allie. She and her family were my rock. I could always call her any time of day to receive inspiration while working on this doctorate. My mom, my two sisters, my brother and all my nieces and nephews were also there to listen and provide loving support as well as reassurance to keep moving forward, even if it was only baby steps.

Lastly, I want to thank my three committee members and the staff at Walden. I specially want to thank my chair, Dr. Joe Ann Hinrichs, for reading all my drafts and responding to my numerous texts and emails. She was an amazing support to me, and I am forever grateful for her assistance in making sure I finished this program and earn my doctorate. She knew how important this degree was to me and my late husband.

I have no doubt my Jaybird is celebrating my success in Heaven with me alongside my Bobby, friends, and family here on Earth. As my late husband would say, "Ain't God Cool!" Indeed, He is.

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Section 1: The Problem

The Local Problem

Teachers are experiencing a change in practice, from teacher-centered to student-centered, which affects their work with English learners (ELs) in third through fifth grade mathematics classrooms. The implementation of student-centered discourse practices is essential to orchestrating productive mathematical discussions. However, the common practice is teacher-centered instruction where teacher talk is prevalent. Although the school district in this study provided professional development (PD) to address student-centered practices, PD for teaching ELs to interact with peers in English as well as to capitalize on home language and cultural assets remained to be addressed.

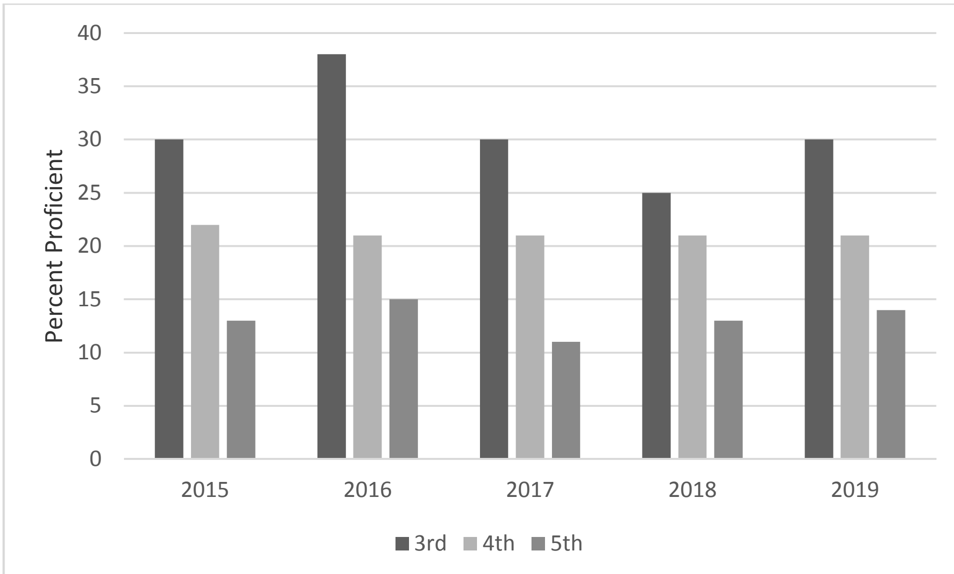
In 2019 to 2020, the district that served as the research site for this study implemented a new mathematics curriculum. The new curriculum included the English language proficiency (ELP) standards that aligned with the Common Core State Standards in Mathematics (CCSS-M). The ELP standards included language demands, such as social and academic language, to assist students in participating in student-centered discourse practices as well as meeting the content standards in mathematics. ELs needed to be able to demonstrate their mathematical understanding, construct viable explanations, as well as respond to others' arguments (Baker et al., 2014). These ELP standards required teachers to have specialized knowledge and skills in forming scaffolds and supports (e.g., visual and verbal) for ELs as they developed their academic language proficiency while acquiring more sophisticated skills and abilities in mathematics (Baker et al., 2014). Nevertheless, no formal district-wide PD was offered to assist mathematics teachers in these specific areas.

Educators and testing companies have realized that academic language cannot be ignored (Sprenger, 2017). Academic language has played an important role in students' success on standardized tests (Beck et al., 2013; Marzano, 2004). According to Tileston (2011), about 85% of the test scores are based on students' ability to understand and use the academic language on these state standardized tests. Sprenger (2017) stated that ELs need to be explicitly taught academic language because generally, ELs have smaller English vocabularies. However, many teachers have not received adequate PD in how to help students develop and use academic language as part of their instructional discourse practice (Sprenger, 2017), which has raised the question of whether this accounts for the district's and state's test scores being stagnant over the last 5 years.

The district's EL test scores on mathematics statewide assessments from 2015 to 2019 have remained stagnant and have shown little to no growth in third through fifth grades. This has been concerning because ELs have also continued to perform poorly on state mathematics assessments over the last 5 years (Office of Superintendent of Public Instruction [OSPI], 2019b). The overall performance of ELs in third through fifth grades revealed very little progress being made in improving ELs' achievement in mathematics (see Figure 1). Also, there was a noticeable decline in the district's state proficiency levels as ELs moved from third grade to fourth grade and then to fifth grade (OSPI, 2019b). These data were similar to the state's ELs' math test scores in third through fifth grades (see Figure 2). Therefore, the data suggested that this problem may not exist in isolation.

Figure 1

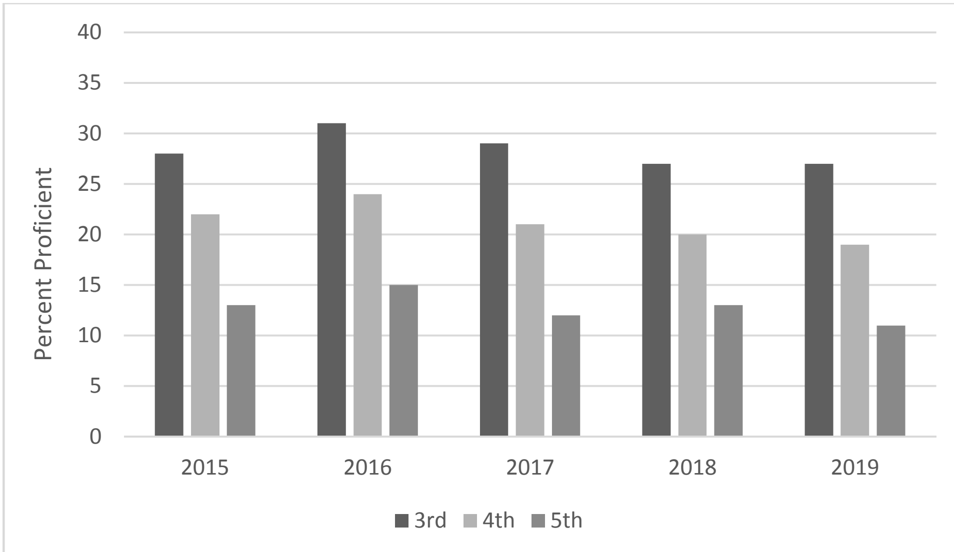
District ELs' Math Proficiency Levels 2015 to 2019



Note. Adapted from Report Card by OSPI, September 2019b.

Figure 2

Washington State ELs' Math Proficiency Levels 2015 to 2019



Note. Adapted from OSPI, September 2019b

The problem addressed by this study was that teachers are experiencing a change in practice, from teacher-centered to student-centered, which affects their work with ELs in third through fifth grade mathematics classrooms. The gap in practice that remains to be addressed is PD for teaching ELs to interact with peers in English as well as to capitalize on home language, knowledge, and cultural assets. By examining teachers' perceptions of their implementation of the new pedagogical, student-centered discourse practices with ELs as well as their specialized knowledge and skills for ELs' language development, a better understanding of the problem may be presented.

Some other contributing factors of the problem addressed by this study include beliefs about language, mathematics, and learning, specifically because many of the third through fifth grade mathematics classrooms in the study site school district were in high poverty schools with diverse spoken languages. This has been a challenge for teachers, especially those in teacher-centered mathematics classrooms who often failed to realize that mathematics was not a universal language accessible by all students (California Department of Education [CDE], 2015).

In an ethnically and racially diverse school district with over 10% ELs in third through fifth grades, many of whom have recently immigrated to the United States (OSPI, 2016), teaching ELs in a student-centered paradigm has required teachers to teach the English language as well as to provide opportunities and supports that scaffold students' thinking about mathematical ideas and to facilitate discussions about students' mistakes, misconceptions, and struggles with mathematical tasks (Kersaint, 2015). In addition, teachers have been expected to teach to the CCSS-M and learn how to teach

ELs in increasingly differentiated mathematical classrooms. According to the director of academic achievement at the study site, the teachers have found these expectations frustrating and overwhelming. Lastly, teachers have found that the pedagogical shift presses their self-efficacy and mathematical beliefs, especially because they are being asked to think more deeply about their instructional practices (Lau et al., 2018).

The Problem Within the Larger Population

New national policies and standards have influenced the work of classroom teachers in understanding and implementing a new paradigm shift in pedagogical practices in the United States. The Every Student Succeeds Act (ESSA, 2015) and the new mathematics standards in the United States (Common Core State Standards [CCSS] Initiative, 2020) have called for a shift in public school teachers' instructional practices to meet the needs of all learners, including ELs, in the mathematics classroom. Shifts in instructional practices have included the use of student-centered pedagogical approaches, such as discourse learning and problem-based learning, to increase students' verbal communication of critical thinking around mathematical concepts (Bell, 2010; Polly et al., 2014; Uribe-Flórez et al., 2014). Discourse learning is a communicative approach of purposeful, verbal interchange between student and student, student and teacher, and teacher and student to engage in critical thinking about learning (Bell, 2010; Fisher et al., 2008; Piccolo et al., 2008).

Problem-based learning is an innovative, inquiry-based approach to learning, with students individually and/or collaboratively creating a real-world project solution to mathematical problems posed, using reflective and innovative techniques (e.g., project-based learning, content-area conversations, real-world problems, and discourse learning per Bell, 2010; Fisher et al., 2008; Leinwand, 2009; Piccolo et al., 2008). Both discourse learning and problem-based learning have provided challenging, meaningful situations that increase student participation, engagement, and learning, as advocated by the National Council of Teachers of Mathematics (NCTM, 2014).

ELs (and all students) learning academic language and concepts need diverse and differentiated opportunities for speaking, listening, reading, and writing in curricular instruction and from teachers (August & Blackburn, 2019). Teachers should be using research-based proven pedagogical approaches that have been aligned to the CCSS-M (Moschkovich, 2012). The *Principles to Action* of the NCTM (2014) provided educators with eight mathematics teaching practices:

> The Mathematics Teaching Practices are (a) establish mathematics goals to focus learning, (b) implement tasks that promote reasoning and problem solving, (c) use and connect mathematical representations, (d) facilitate meaningful mathematical discourse, (e) pose purposeful questions, (f) build procedural fluency (e.g., efficiency) from conceptual understanding (e.g., number sense), (g) support productive struggle in learning mathematics, and (h) elicit and use evidence of student learning. (p. 10)

Implementation of these eight mathematics teaching practices was a priority and needed to be a part of a school-wide focus of teaching and learning for all students (NCTM, 2014).

According to Moschkovich (2012), engaging ELs in “the language of mathematics" (p. 17) means establishing communicative competence by which to assist students in mathematical discourse in the classroom. *Communicative competence* means the ability to understand and develop the proficient use of language through meaningful interactions in school and social environments (Moschkovich, 2012; State of Washington Professional Educators Standards Board [PESB], 2015). The ESSA (2015) specifically addressed ELs and related pedagogy; science, technology, engineering, and mathematics (STEM); and a focus on authentic instruction to foster meaningful learning within the K to 12 classrooms. Meaningful learning has required students to be able to construct and organize knowledge as well as to communicate effectively in the classroom (ESSA, 2015). Effective communication in the mathematics classroom involves multiple modes of discourse practices that expand beyond just basic conversation—it consists of "natural language, mathematics symbol systems, and visual displays" (Moschkovich, 2012, p. 23).

Although many school districts' linguistic diversity is growing, it remains evident that teachers continue to struggle to meet the increasing needs of the ELs as revealed by assessment scores (de Araujo et al., 2018). As teachers continue to hone their pedagogical discourse practices to increase ELs' verbal communication of critical thinking around mathematical concepts and the interrelatedness of mathematics and language, teachers need to engage ELs in mathematical discourse even while ELs are learning English (de Araujo et al., 2018). Furthermore, de Araujo et al. (2018) stated that more research is needed regarding effective PD with an emphasis on teachers working with ELs in mathematics.

Rationale

This shift of practice, teacher-centered to student-centered, has redefined the roles of teachers and ELs in the third through fifth grade mathematics classrooms. According to Kersaint (2015), teachers are expected to implement new pedagogical, student-centered discourse practices that encourage more student led interactions (e.g., productive dialog) facilitated by teachers, rather than teacher led directed talk (e.g., teacher telling students what they should know). Although recent PD has begun to address this shift in practice with teachers, according to the director of academic achievement at the study site, the district's PD has yet to address the increased language demands that are necessary when engaging ELs in student-centered discourse. Mathematics has a specialized language that differs in meaning when applied in the context of mathematics (CDE, 2015). The student-centered discourse, which is a part of the CCSS-M, requires ELs to construct viable arguments, justify and communicate their conclusions to their peers, and to ask clarifying questions beginning in the elementary grades (CDE, 2015; NCTM, 2014). This also includes ELs being able to make sense of the problems as well as interpret and explain tables and graphs (CDE, 2015; ESSA, 2015; NCTM, 2014). Therefore, teachers need to be able to explicitly teach ELs the language of mathematics as well as the academic language of mathematics by providing scaffolds of support, such as sentence frame or communication guides (CDE, 2015).

The school district at the study site has an ethnically and racially diverse population with numerous primary languages spoken by students in the third through fifth grade mathematics classrooms. ELs have been defined as students who are still learning the English language, and a majority of them are second-generation immigrants born in the United States (Quintero & Hansen, 2017). In this district, ELs often receive instruction in mainstreamed mathematics classrooms instead of in sheltered classrooms where ELs receive English instruction separate from the core content instruction in mathematics.

Currently, the United States has sought to improve the achievement of all K to 12 students because of concerns related to falling behind the rest of the world in STEM as indicated in the Program for International Student Assessment (PISA) 2015 (see Organization of Economic Co-Operation and Development [OECD], 2018b). For example, in 2013, the legislature in Washington state passed a bill, ESSB 5946—Strengthening Student Educational Outcomes—to improve education support systems for every K to 12 student (see OSPI, 2013). This bill led to the development of a technical report on best practices and strategies for mathematics (OSPI, 2019a). The expert panel who designed this menu of instructional strategies and best pedagogical practices were intentional about aligning these strategies and practices to meet the needs of ELs as outlined in the state adopted K to 12 Learning Standards for Mathematics, also known as CCSS-M (OSPI, 2019a). This report also includes strategies and best practices of intervention using a multi-tiered system of support framework to assist in addressing the opportunity gap. These new strategies and best practices were expected to be implemented beginning in 2016 to 2017 with fidelity (OSPI, 2019a). However, it was unclear how well these new strategies and best practices were being taught in the mathematics classrooms.

State of WA PESB (2015) designed an equity pedagogy unit to assist teachers in providing equitable and culturally relevant strategies to use in supporting the needs of all students, including the academic and language development of ELs (State of WA PESB, 2015). New teachers as well as certified teachers were taking mathematics and EL courses in university teacher preparation programs to increase their knowledge and skill level with the implementation of these new pedagogical, student-centered discourse practices that are relevant to increasing ELs' mathematical learning within the classroom.

Purpose of This Study

The purpose of this study was to gain an understanding of teachers' experiences with new discourse practices and their specialized knowledge and skills for ELs' language development to identify the types of PD that would best support teachers in implementing these new pedagogical, student-centered discourse practices with ELs in the third through fifth grade mathematics classroom. By examining teachers' experiences, an understanding of specific needs may be identified and addressed for future professional development that would support teachers with the implementation of new pedagogical, student-centered discourse practices to increase ELs' mathematical learning and achievement.

Definition of Terms

Barriers: Resistance and reluctance—inevitable response of a person defending the status quo when their safety and security feels threatened (Senge, 2006).

Differentiate: To adjust the students' learning activities to address the varying needs of learners (Bearne, 1996; Tomlinson, 2017).

Discourse learning: Communicative approach of purposeful, verbal interchange between student and student, student and teacher, and teacher and student to engage in critical thinking about learning (Bell, 2010; Fisher et al., 2008; Piccolo et al., 2008).

Problem-based learning: An innovative, inquiry-based approach to learning, with students individually and/or collaboratively creating a real-world project solution to mathematical problems posed, using reflective and innovative techniques (e.g., project-based learning, content-area conversations, real-world problems, and discourse learning per Bell, 2010; Fisher et al., 2008; Leinwand, 2009; Piccolo et al., 2008).

Scaffolding: A methodical approach of a teacher modeling a new math concept or skill to students and gradually releasing the students to work independently as they begin to demonstrate mastery (Anghileri, 2006).

Self-efficacy: An individual's belief in their capacity to execute behaviors necessary to produce specific performance attainments (Bandura, 1977).

Teacher effectiveness: A teacher's ability to discern their individual student's needs and apply appropriate materials and instructional strategies to improve student outcomes (Brooke, 2017).

Significance of the Study

Exploring teachers' experiences with teaching ELs in mainstreamed, differentiated third through fifth grade mathematics classrooms can offer insights to teachers' perceptions, beliefs, and understandings of their role as the facilitator in a student-centered classroom. It may also provide an awareness of how teachers are managing differentiated instruction within their classrooms, which makes allowances for differences for each individual student to ensure equal access to the academic content. Furthermore, examining specific challenges that arose for teachers who work with ELs when implementing student-centered discourse practices can provide an understanding of teachers' experiences with the new pedagogical, student-centered discourse practices and language demands with ELs in the third through fifth grade mathematics classrooms. Lastly, providing teachers an opportunity to voice their PD needs for improving academic language instruction with ELs can lead to other topics for potential PD recommendations, such as PD offerings that include not only the third through fifth grade mathematics teachers but also the EL specialists and special education teachers.

A larger population may also benefit from this study's findings. The purpose of this study was to gain a better understanding of the phenomenon in order to identify the types of PD that could best support teachers in implementing these new pedagogical, student-centered discourse practices with ELs in the third through fifth grade mathematics classroom. It is possible that the findings might benefit other mathematics teachers by giving them an opportunity to authentically reflect upon their own professional practice. Furthermore, administrative leaders may review the responses from the participants regarding the targeted areas for future professional development, especially because high quality instruction directly relates to teachers' effectiveness in the mathematics classroom (Blömeke et al., 2016). When teachers feel more confident with their level of pedagogical expertise and mastery of instructional materials, students' outcomes and achievement levels are more likely to increase (Blömeke et al., 2016). Often professional development addresses what the teachers will be teaching, rather than why certain materials and pedagogical practices were most effective as well as when to apply these materials and practices into their instruction (Brooke, 2017). Therefore, the findings may be beneficial to other school districts for future professional development in mathematics. Lastly, the application of the findings of this study on a larger scale might increase ELs' mathematical learning and their achievement levels may increase on statewide assessments.

Research Questions

The research questions (RQs) were developed to address this study's problem and purpose statements. In this study, the problem is that teachers are experiencing a change in practice, from teacher-centered to student-centered, which affects their work with ELs in third through fifth grade mathematics classrooms. Therefore, I sought to understand teachers' perceptions regarding the paradigm shift of practice, teacher-centered to student-centered, that has redefined the roles of teachers and ELs in the third through fifth grade mathematics classroom. The following questions addressed teachers' perceptions and skills as well as needs for further support in implementing the new pedagogical, student-centered discourse practices with ELs.

Three overarching RQs guided this study:

RQ1: How do teachers describe their experiences with teaching ELs in mainstreamed, differentiated third through fifth grade mathematical classrooms?

RQ2: What specific challenges arise for teachers who work with ELs when implementing student-centered discourse practices in the mathematics third through fifth grade classrooms?

RQ3: What are teachers' PD needs for improving their academic language instruction with ELs in the mathematics third through fifth grade classrooms?

Review of the Literature

Conceptual Framework

The conceptual framework for this study was Knowles's adult learning theory of andragogy. *Andragogy* is defined as "the art and science of helping adults learn" (Knowles, 1980, p. 43). This theory places an emphasis on adult learners being self-directed and taking responsibility for their own learning (Knowles, 1984). Furthermore, andragogy places an emphasis on the processes of learning rather than the content of learning (Knowles et al., 2015). Therefore, instruction for adults might include role playing, simulations, and self-evaluations with the instructor's role as a facilitator, rather than as a lecturer (Knowles, 1984). These processes of learning resemble the foundational beliefs of student-centered pedagogical practices that teachers were experiencing in their own practice, which affects their work with ELs in third through fifth grade mathematics classrooms.

As related to how adult learners approach their own learning and professional growth, andragogy includes five assumptions about the nature of adult learning: "(a) self-concept, (b) experience, (c) readiness to learn, (d) orientation to learning, and (e) motivation to learn" (Knowles, 1984, p. 12). Moreover, andragogical principles provide guidance and application to address this study's purpose. The six principles include "(a) adult learners need to know, (b) self-concept of the learner, (c) prior experience of the learner, (d) readiness to learn, (e) orientation to learning, and (f) motivation to learn"

(Knowles et al., 2015, p. 4). These andragogical principles take into consideration the characteristics of the adult learner when used in developing PD. For example, adult learners most likely have positive and negative past educational experiences and will usually have specific goals in mind for their learning. They also may have a plethora of experiences from teaching in the classroom, and they want to be able to see an immediate use for learning. According to Knowles et al. (2015), consideration of individual learners' needs, and situational differences are just as important as the PD's purpose and outcome goals, which need to be clearly stated.

In a district where mathematics teachers are experiencing a shift in their instructional practice, moving from a teacher-centered paradigm to a student-centered paradigm, this shift redefines the teachers' locus of control and necessitates a fundamental change in their thinking and behavior. Therefore, Knowles's six principles of adult learning and five assumptions best represented teachers' desire to have a voice in their PD. Capturing teachers' personal experiences in using the new pedagogical, student-centered discourse practices with ELs in the third through fifth grade mathematics classroom can provide insights for future PD recommendations for all teachers who work with ELs in the mathematics classroom, equitable accessibility for ELs with student discourse, and increased student learning.

Review of the Broader Problem

The literature review for this study covers the following topics: (a) student-centered shift, (b) implications of change, (c) new pedagogical discourse practices, (d) role of the teacher and student, (e) project-based learning, (f) ELs' language barriers and outcomes, and (g) balanced assessment system. Research articles and educational publications from 2017 to 2021 in peer-reviewed and academic journals, educational and statistical publications, and professional texts were included in this literature review. The articles and reports were accessed from Walden University and University of Washington Libraries' multiple databases as well as the web-browser, Google. Key terms used to conduct my search inquiry included *academic language in mathematics, adult learning, best practices in mathematics, compliancy and rote learning*, *differentiation, effective math teaching strategies*, *elementary mathematics instruction*, *English learners in math classrooms*, *English learners reform and policies*, *formative assessments*, *mathematics reform*, *paradigm shifts*, *problem-based learning*, *self-efficacy*, *scaffolding of learning*, *student-centered*, *student discourse*, *student engagement*, *teachers' beliefs*, *teacher-centered*, *teacher discourse approaches*, *teachers efficacy*, *teachers' locus of control*, and *teachers' resistance to change.*

Student-Centered Shift

New standards and high-stakes assessments have called for considerable use of the English language and have expanded ways of demonstrating mathematical proficiency (de Araujo et al., 2018). As a result, the paradigm shift has redefined the roles of teachers and students in the mathematics classroom (Brodie & Chimhande, 2020). In this new role, teachers and students exist as colearners, and both carry the responsibility for the learning that takes place in the classroom (Tomlinson, 2017). This transformation has prompted educators and researchers to examine ways to best support the ELs in the mathematics classroom ensuring that all learners, specifically ELs, have "equal access to a quality education when they have to juggle the cognitive demands of content-area curriculum, but also simultaneously acquire literacy skills, academic vocabulary, and English language structures" (Sistla & Feng, 2014, p. 2). There has been greater importance placed on providing students with authentic experiences in mathematics to better equip them for their future lives (Boaler, 2009). With the adoption of the CCSS-M and ELP standards, students are expected to develop sophisticated forms of communication in mathematics to engage in cognitively challenging tasks that promote rich discussion about the patterns and relationships of real-world story problems (Coggins, 2014). Students are also expected to grapple and persevere in making sense of the mathematics and to provide multiple representations of problem solutions (Coggins, 2014). Discourse practices have been known to help promote reading, writing, and discussion by providing student opportunities to engage in conversations and discussions that could help students make sense of the mathematics (Banes et al., 2018). Therefore, all learners, including ELs, need to learn how to accurately read, write, and discuss mathematical equations and tasks (Banes et al., 2018).

Implications of Change

According to Ingram et al. (2014), the implications of this shift in methodology mean that teachers, who were to relinquish their locus of control in the classroom and provide less direct instruction, may be reluctant to change. One of the implications of this new student-centered paradigm includes teachers differentiating their instruction to meet the diverse needs of all learners (Bobis et al., 2021; Tomlinson, 2017). In the differentiated classrooms, teachers engage students in instruction using various pedagogical approaches that appeal to a wide range of student interests and skill sets and offer varying degrees of complexity and support (Bobis et al., 2021; Tomlinson, 2017). According to Tomlinson (2017), teachers need to ensure that students' diverse needs are being met and that students are moving forward along the growth continuum of designated content goals. Otaiba et al. (2014) found that teachers who received training regarding the use of student data to develop and provide individualized instruction provide more effective differentiated instruction. In addition, the students' achievement increased (Otaiba et al., 2014). Student-centered practices have appeared to require more time and energy of the teacher in organizing active learning experiences for varying development levels of learning and necessitate further professional development.

Implications of Change for Mathematics Instruction. There are concerns about the implications for mathematics instruction in classrooms for monolingual and ELs (Moschkovich, 2018). Moschkovich (2018) conveyed that there are specific instructional practices that likely support mathematics learning for all students, which are (a) support ELs' participation in mathematical discussions, (b) focus on mathematical practices, such as reasoning and justifying, (c) use the students' home language and their everyday, conversational language as resources, and (d) draw on multiple nonlinguistic resources that should be available in all classrooms—such as objects, drawings, graphs, and gestures—as well as home languages, every day, conversational language, and experiences outside of school.

New Pedagogical Discourse Practices

Effective learning occurs when student-centered practices, such as student discourse, provides students opportunities to think about the math and to talk with a peer about their mathematical findings (Banes et al., 2018; Bobis et al., 2021; Luoto, 2020; Uribe-Flórez et al., 2014). Moreover, student-centered approaches may yield positive student achievement results (Polly et al., 2014). Although the development of a discourse community (Mendez et al., 2007; Trocki et al., 2014) may be difficult for teachers in relinquishing their role of being sole provider of knowledge and instruction within the mathematics classroom (Anderson et al., 2018; Banse et al., 2016; Huffer-Ackles et al., 2004; Lack et al., 2014; Leinhardt & Steele, 2005; Luoto, 2020; Sherin, 2002; Trocki et al., 2014), there has been considerable research that supports a classroom environment in which mathematical discourse practices have been used to communicate mathematical understandings through conversation and written explanations (e.g., Bobis et al., 2021; Brodie, 2011; Fiori & Boaler, 2004; Huffer-Ackles et al., 2004; Krussel et al., 2004; Michaels et al., 2008; Walshaw & Anthony, 2008). Student-centered pedagogical approaches have encouraged all students to be more actively engaged in the mathematics classroom by allowing them to have a voice in their own learning (Boaler, 2008). Therefore, teacher and student roles need to change.

Equitable Discourse Practices With ELs. According to Banes et al. (2018), the use of equitable discourse practices in mathematics has enhanced ELs' understanding of the mathematical content being taught. Teachers have played a significant role in facilitating ELs' participation in classroom discourse (Gibbons, 2015). However, teachers need to consider how to balance both the structure of the activities to reduce the language barrier that may impede ELs' participation, as well as maintain a high level of rigor in the mathematics content—conceptual and procedural knowledge (Banes et al., 2018). Thus, researchers have continued to find ways to help ELs engage in productive mathematical discussion using English as the primary language of instruction (Takeuchi, 2015).

When thinking about equitable practices in the mathematics classroom, there are four dimensions that need be addressed—access, identity, power, and achievement (Gutiérrez, 2012). Achievement is one of the four dimensions that still needs to be addressed because of the growing demands of the mathematical communication within the CCSS-M and its impact on EL's performance on mathematics achievement assessments (Banes et al., 2018). Banes et al. (2018) focused on benefits of discussion associated with ELs' improved performances on achievement assessments. They believed that students constructed their own understanding of mathematics by working on problems and then discussing their attempts while receiving guidance from the classroom teacher who orchestrated discussion. Mathematical discussions were defined as an academic activity in which students engage in listening, speaking, and thinking about mathematical ideas (Banes et al., 2018). In their study, they identified five key features for effective math discussion: "(1) variety of approaches, (2) opportunities to speak, (3) equitable participation, (4) explanations, and (5) connections between ideas" (Banes et al., 2018, pp. 417-418).

Variety of approaches. There are a variety of approaches for how to solve a story problem. Engaging ELs in meaningful conversations about how they arrived at their answers as well as the multiple strategies used to solve the problem offer ELs access to ideas from their peers because they may not have considered solving the problem using that strategy (Banes et al., 2018; Truxaw, 2020). It is also beneficial to provide ELs with multiple concrete and visual tools (e.g., manipulatives) for solving the story problems because they increase their comprehensibility and conceptual understanding, especially when ELs struggle to understand verbally (Banes et al., 2018; Echevarria et al., 2007).

Opportunities to speak. ELs have potential benefits when given opportunities to speak. Ideally, ELs should engage in student discourse daily (Banes et al., 2018). Therefore, in Banes et al.'s study, the frequency of student voices was tracked to see how many times students were given opportunities to speak in whole group and small group instructional settings as well as with learning partners.

Equitable participation. Equitable participation includes verbal and nonverbal forms of communication (e.g., hand signals to agree/disagree). This is helpful because ELs tend to have an easier time understanding their peers' explanations as their peers' language structure and vocabulary are closer to their own level of language proficiency (Banes et al., 2018; Ellis, 1999; Fink, 2019). Finally, ELs benefit in hearing the same idea presented by several speakers as the repetition enhances their comprehension (Banes et al., 2018; Chapin et al., 2009).

Explanations. When ELs are given opportunities to explain their ideas to themselves, they learn more. However, when ELs are given an opportunity to explain their ideas to a peer, they learn even more (Banes et al., 2018; Rittle-Johnson et al., 2008). Thus, explanations provided by the students rather than the teacher are more advantageous because peer explanations allow ELs to capture their thinking and to provide explanations of their conceptual understanding (Banes et al., 2018).

Connections between ideas. Banes et al.'s (2018) interpretation of connections between ideas related to the "building on and connecting of ideas" that take place during student-centered discourse rather than teacher-centered discourse (p. 419). Making connections between the applied strategies and with varied problem types enable students to transfer their knowledge to other unknown problems, such as those that appeared on assessments (Banes et al., 2018; Truxaw, 2020).

Role of the Teacher

In this new era of the student-centered paradigm of 21st-century skills and standards, the role of the classroom teacher has fundamentally changed. According to Kaput (2018), student-centered approaches present a dramatic shift for teachers who are accustomed to using teacher-centered approaches because the mathematics reform in the United States has required teachers to think differently about their instructional practices as well as their own conceptual understanding of mathematics. The teacher is no longer considered the sole provider of knowledge and controller of information. Rather, teachers are viewed as colearners with their students and colleagues around the world (Daws, 2005; Schlechty, 2011). As a colearner, teachers are facilitators, scaffold builders, and reflection enhancers of learning (Daws, 2005; Schlechty, 2011). Even these roles are fundamentally different from roles in some previous student-centered classrooms. For example, as a facilitator, the teacher's role is to guide the learning of students and provide ongoing active support during the learning process (Daws, 2005; Schlechty, 2011). As a scaffold builder and reflection enhancer, the teacher is to provide structures of support to extend the students' knowledge to broader, deeper levels of understanding as well as to offer students opportunities for reflection on what they know and still need to learn (Wilson et al., 2015).

Polly et al. (2014) studied 120 kindergarten students using manipulatives for creating an addition story problem and found that 53 of 98 students provided correct responses. Responses included the correct context for addition and the correct answer. Out of the 53 responses, most students were from student-centered classrooms ($n = 41$, 77 %). This means that over three-fourths of the students who were asked to create an addition problem contextualized into a real-life situation were successful in completing this cognitively difficult task. Teachers in student-centered classrooms allowed students to create and learn by giving students opportunities to construct their own understandings (e.g., constructivism) using manipulatives, working in a small group, asking questions, and exploring potential solutions to the problem-solving task (Polly et al., 2014). The teachers in the student-centered classes acted as facilitators and used student-centered practices. For example, the teacher as the facilitator provided manipulatives for students to use to develop their conceptual understanding and procedural knowledge, rather than the teacher modeling for the students how to use the manipulatives to solve the story problem (Polly et al., 2014). This study suggested that students in student-centered classrooms performed significantly better than students in teacher-centered classrooms when presented with the same problem-solving tasks.

Another critical component of this student-centered paradigm was the shared partnership of learning between teacher and students (e.g., colearners). Hall and Sink (2015) used a system maintenance and change scale of the Classroom Environment Scale

(CES) to examine teacher support, involvement, innovation, and affiliation variables. These variables helped to explain the influences of student-centeredness related to a shared partnership in learning between teacher and students.

Besides having a shared partnership in learning, teachers needed to provide students with real-world, complex tasks that involve thinking, problem solving, collaborating, and communicating with the intention of increasing student engagement and achievement. In a mixed-methods study, Walters et al. (2014) examined the relationship of student-centered instruction with student outcomes using a problem-solving assessment and student survey. A significant positive relationship was found between the student-centered practices (SCP) measure and survey questions related to student engagement—student self-assessment of learning and student interest. Moreover, the problem-solving assessment used in student-centered classrooms showed more growth on the PISA (OECD, 2018a, 2018b) than students in the teacher-centered classrooms; a 1% increase on the SCP scale was associated with a 2% increase on the PISA (Walters et al., 2014). These results demonstrated that there were greater student benefits (e.g., increased student engagement and higher test scores on international tests) when teachers used student-centered approaches in a student-centered classroom.

As a scaffold builder and reflection enhancer, teachers have needed to explore ways of effectively eliciting and using students' mathematical thinking within their student-centered instruction (Wilson et al., 2015). Wilson et al. (2015) analyzed 19 lessons of elementary teachers who received 60 hours of professional development designed to support one learning trajectory and framework to sustain student-centered practices. Teachers (*n* = 19) were to include five instructional practices of interest in their lessons, "(a) selecting learning goals and tasks, (b) anticipating, (c) monitoring, (d) selecting and sequencing, and (e) connecting" (Wilson et al., 2015, p. 235). In their findings, the researchers reported a lack of evidence of three of the five instructional practices in teachers' lessons. Given these findings, teachers may need further support in how to use the select and sequence protocol to promote further discussion of students' findings and potentially uncover students' own, as well as their peers', mathematical misconceptions.

Scaffolds of Support for ELs With Virtual Learning. ELs bring into the classrooms their own set of culture and language assets, and depending on their backgrounds and experiences, their instructional needs will differ (U.S. Department of Education, Office of Planning, Evaluation and Policy Development, & Program Studies, 2019). Technology was one way to transform ELs' learning experiences by providing greater equity and accessibility during instruction (U.S. Department of Education & Office of Educational Technology, 2017). Not only did technology offer new ways for educators to provide scaffolds of support to assist ELs in accessing their academic content and language (U.S. Department of Education, Office of Planning, Evaluation and Policy Development, & Program Studies, 2019), technology also met the needs of all learners (U.S. Department of Education & Office of Educational Technology, 2017). Technology resources were valuable in supporting ELs because they provided ELs access to the content as well as increased their level of engagement in instruction (U.S. Department of Education, Office of Planning, Evaluation and Policy Development, &

Program Studies, 2019). Additionally, technology resources provided ELs (a) visual images, short videos, and interactive features that presented examples and images of daily life, (b) embedded supports, such as videos or images to define new vocabulary, (c) audio recordings and translations to help ELs communicate content when engaging in conversations with their peers, and (d) differentiated instruction at the ELs' ELP levels and academic learning needs (U.S. Department of Education, Office of Planning, Evaluation and Policy Development, & Program Studies, 2019).

Aside from technology supports for ELs, there were scaffolded instructional supports that helped with the discourse interaction between teachers and ELs in mathematics classrooms (Lei et al., 2020). Lei et al. (2020) examined four types of instructional scaffolding for analyzing the exchange between the teacher and ELs in mathematics. Scaffolds were appropriate for ELs' ELP levels as they continued to acquire language skills (Lei et al., 2020). The researchers described Gottlieb's (2013) four types of instructional scaffolds to increase student engagement as well as foster a level of understanding of targeted content and language development. The four scaffolds are (a) visual, (b) linguistic, (c) interactive, and (d) kinesthetic (Gottlieb, 2013).

Visual scaffolding. Visual scaffolding used images (e.g., drawings or photographs) to convey the meaning of English words, phrases, and sentences (Lei et al., 2018). Additionally, visual supports, such as manipulatives, representational tools, real-life objects, and multimedia materials enhance ELs' academic language in the mathematics classroom (Gottlieb & Castro, 2017; Lei et al., 2020).

Linguistic scaffolding. Linguistic scaffolding provided supports for ELs' oral language (Lei et al., 2018). This form of scaffold required teachers to use language that was understandable by the ELs when introducing new knowledge. For example, teachers would speak at a slower rate, simplified their vocabulary, or used words repetitiously to reinforce the new learning (Gottlieb & Castro, 2017).

Interactive scaffolding. Interactive scaffolding took place when the teacher and students engaged in facilitated conversations about the content and language use in mathematics (Lei et al., 2020). Gibbons (2015) provided examples of this interaction when teachers and students engaged in one-on-one and small group work.

Kinesthetic scaffolding. Kinesthetic scaffolding was first introduced as Total Physical Response (Asher, 1969). This form of scaffolding allowed ELs to produce content knowledge nonverbally with some form of physical movement (e.g., Guided Language Acquisition Design [GLAD] strategies) and provided physical interaction (e.g., sign language or gestures) with language to solidify and demonstrate ELs' comprehension without limiting their participation in the mathematics classroom (Lei et al., 2020).

In summary, Lei et al.'s (2020) findings were that teachers and students used kinesthetic scaffolds with the highest frequency and interactive scaffolds with the second-highest frequency. Also, teachers were more likely to use scaffolding in small group instruction than student-to-student (e.g., learning partners) or teacher-to student (e.g., one-on-one instruction). Lastly, kinesthetic scaffolds were commonly used at the beginning stage where more concrete and physical scaffolds were needed to support ELs' building of conceptual knowledge, but their use was gradually reduced when no longer needed (Lei et al., 2020).

Role of the Student

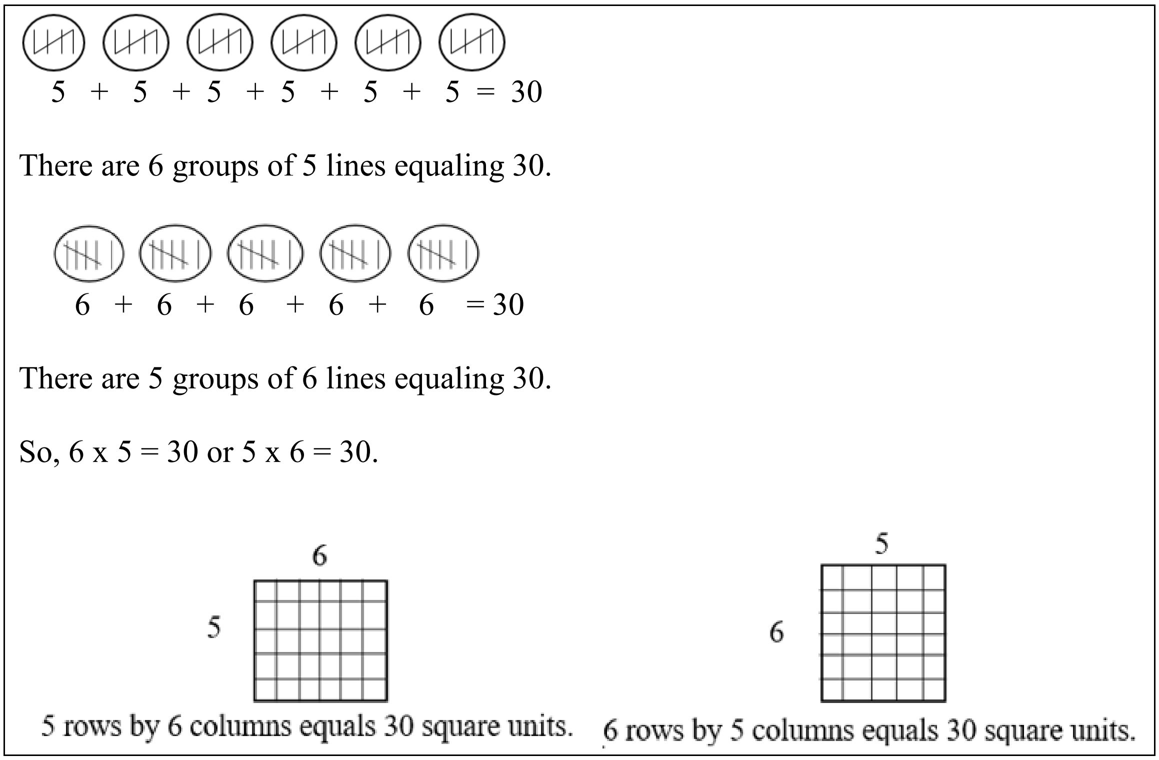
In a student-centered learning environment, the role of the students is to involve themselves in learning with their peers so that they may incorporate others' input and ideas into their own understandings (NCTM, 2014; Sias et al., 2016; Van de Walle et al., 2018). Sias et al. (2016) suggested that students being engaged in learning activities encourages them to make sense of and find meaning in what they are learning. Complex tasks allowed learners to explore, analyze, communicate, create, reflect, and apply new information (Sias et al., 2016). This form of active learning engaged the learner in the learning process (Sias et al., 2016). In Sias et al.'s (2016) study, the authors examined 39 teacher-generated, third through fifth grade STEM lesson plans. The authors were investigating to what extent the teachers had implemented nine educational innovations within their STEM lesson plans. In their findings of student-centered learning, no lessons were all teacher-centered, 14 lessons were mostly teacher-centered, 10 lessons were shared equally, 13 lessons were mostly student-centered, and two lessons were all student-centered. Although teachers struggled to develop STEM lesson plans that were student-centered, it was evident that teachers' plans reflected a desire to include students partially, especially since none of the lesson plans were solely teacher-centered (Sias et al., 2016) suggesting that teachers desired to shift towards student-centered practices.

Students also needed to engage in the use of multiple representations, such as manipulatives, pictures, number lines, diagrams, equations, etc. (Van de Walle et al., 2018). These tools were helpful in developing students' deep rational understanding of various mathematical ideas and concepts (Van de Walle et al., 2018).

The rigor of the CCSS-M included a balance of conceptual understanding, procedural skills and fluency, and application (CCSS Initiative, 2020). Therefore, students should have used these representational tools when sharing or explaining their mathematical solutions, and teachers should assist students in making connections with the different representations (Leinwand, 2009; Van de Walle et al., 2018). Figure 3 gives an example of a multiple representational tool for the commutative property of addition and multiplication.

Figure 3

An Example of a Multiple Representational Task for the Commutative Property of Addition and Multiplication



Note. Adapted from Burns, M. (1991). *Math by all means: Multiplication Grade 3.* Math Solutions Publication.

The example in Figure 3 illustrates how students used multiple representations to explain their thinking, sense making of the mathematical concepts, as well as the connections that coexisted between addition and multiplication in more than one possible solution. Students engaged in both linear and area equations, seeing the transfer of skills between concepts.

For ELs, engaging in meaningful conversations about how they arrived at their answers as well as the multiple strategies used to solve the problem, offered ELs access to ideas from their peers because they may not have considered solving the problem using that particular strategy (Banes et al., 2018; Truxaw, 2020). Also, it was beneficial to provide ELs with multiple concrete and visual tools (e.g., manipulatives) for solving the story problems because it increased their comprehensibility and conceptual understanding, especially when ELs struggled to understand verbally (Banes et al., 2018; Echevarria et al., 2007).

Project-Based Learning

Project-based learning has been defined as “learning through conceiving of, working on, and completing a project” (Sias et al., 2016, p. 2). Project-based learning allows students to solve real-world problems collaboratively with roles and responsibilities shared among the team members (Sias et al., 2016). In a project-based study conducted by Sias et al. (2016), 39 teachers’ STEM lesson plans were analyzed for evidence of long-term or large-scale projects—both student-centered practices. The authors’ findings revealed six of the lesson plans had no project; in nine of the lesson plans, the teacher demonstrated the project; 13 lesson plans included a small project that was part of a larger lesson; nine lesson plans had a short-term or small-scale project; and two lesson plans had a long-term or large-scale project. Because lesson plans were used daily by teachers to guide their instruction, Sias et al. (2016) suggested further professional development may be needed to assist teachers with student-centered practices, such as project-based learning, an educational innovation critical to preparing students for the 21st century.

In a phenomenological study, Uribe-Flórez et al. (2014) reported their findings of the lived experiences of ELs in mathematics classrooms. Students were engaged in a small group, project-based learning activity integrating mathematics and social studies. Instructional strategies that were found to be supportive of ELs included "a comfortable and safe environment, working in small groups, encouraging real communication through discussions instead of lecturing, working collaboratively, and scaffolding the lesson with demonstrations, illustrations, and real experiences" (Uribe-Flórez et al., 2014, p. 242). However, they also reported ways ELs were marginalized. For instance, lesson plans failed to include content and language objectives, there was a lack of direct instruction of content vocabulary, lessons were conducted in English only, students were not always afforded opportunities to engage in conversations in their home language, and written texts and other resources (e.g., videos) were English only (Uribe-Flórez et al., 2014).

EL Language Barriers and Outcomes

Since the development of standards-based instruction, along with the adoption of the CCSS, the ELP standards, Smarter Balanced Assessment Consortium (SBAC) and Partnership for Assessment of Readiness for College and Career (PARCC), students were expected to use a considerable amount of English language and to demonstrate a level of proficiency on the standards, not to be confused with proficiency in English (National Governors Association Center [NGAC] for Best Practices & Council of Chief State School Officers [CCSSO], 2012; Walqui & Heritage, 2012). As well, the CCSS, ELPs, SBAC, and PARCC provided teachers with an opportunity to make significant changes regarding pedagogical practices for all learners, especially the ELs in the mathematics classroom, to improve achievement outcomes (Walqui & Heritage, 2012). With ELs most likely outnumbering their non-English learners in K to12 mathematics classrooms (Shin & Kominski, 2010), it was critical to the success of ELs to participate in more complex, rigorous tasks with multiple opportunities to engage in mathematical discussions with fewer teacher-directed lessons in both English and their native languages (Heller et al., 2010; NGAC & CCSSO, 2012). Although educators recognized that the new standards and consortia assessments required a shift in teaching to provide all learners with effective learning experiences (Walqui & Heritage, 2012), few classrooms in the United States included meaningful student talk on an ongoing or even an occasional basis (Chapin et al., 2009). In most classrooms, teachers tended to lecture or ask students low-level questions that lack any thought-provoking inferences about the mathematics (Chapin et al., 2009). As teachers continued to implement the nations' new CCSS in mathematics (e.g., communication, reasoning and processes, problem solving, representation, and connections), there has been a risk that ELs may not receive the scaffolds of instructional support necessary for their success (Coggins, 2014). Therefore, teachers needed to not only be knowledgeable in what discourse looks like in the classroom, but they needed to be ready to engage all learners in meaningful mathematical conversations while fostering language development for ELs (Banes et al., 2018; Coggins, 2014). For that reason, it was important that mathematics teachers expose their students, including ELs, to a range of experiences and opportunities as part of the teachers' equitable pedagogical practice to address students' varing instructional needs.

Additionally, all teachers should be considered language and literacy teachers.

Ever since ELs constituted a growing student population and were mainstreamed in the mathematics classrooms, teachers needed to be responsive to the diversity of ELs as well as the cultural assets and resources the ELs bring from their individual contexts to the classroom (Walqui & Heritage, 2012). As well, ELs' *cultural funds of knowledge* (Moll et al., 1992), defined as bodies of knowledge which contribute to families' household functioning, has provided another context that teachers may draw upon when addressing academic language (Hedges, 2012). As a result, the development of academic language, including mathematical language, has become the responsibility of all teachers; teachers have been responsible for providing students opportunities to make meaning of the academic language by drawing upon students' background knowledge and previous participation in conversations (Crosson et al., 2020; de Jong et al., 2013; Hedges, 2012). de Jong et al. (2013) found that mainstreamed teachers did not know how to acquire their ELs' assessments and diagnostic data regarding language proficiency levels, which compromised their abilities to provide targeted instruction for ELs' language development (e.g., listening, speaking, reading, and writing). Moreover, mainstreamed teachers needed to recognize the similarities and differences between native language speakers and second language speakers in order to provide a variety of questions that were appropriate for each of the EL's language proficiency levels in English (e.g., nonverbal, one-word, or extended responses). As more and more ELs were placed in mainstreamed classrooms, such as mathematics classrooms, it raised important questions about mathematics teachers' preparation in working with ELs and teachers' abilities to provide inclusive and equitable learning environments.

Academic Language in Mathematics With ELs. Teaching academic language in mathematics gave ELs the tools they needed to engage in mathematical discussions with their peers (Crosson et al., 2020). Often ELs have limited experiences and background knowledge, so, ELs may struggle with comprehending new mathematical concepts and terms (Crosson et al., 2020). Therefore, ELs need many opportunities to practice and apply the academic language (Crosson et al., 2020). Importantly, ELs need to engage in meaningful activities that allow them to investigate and explore the new concepts rather than teaching the mathematics terms in isolation or memorizing the math vocabulary terms (Crosson et al., 2020). Also, numerous exposures would likely be needed to cement the terms and concepts being taught (Wilkinson, 2018).

Besides providing multiple experiences with academic language, it was important that ELs were taught appropriate word meanings in the context of mathematics (Crosson et al., 2020; Wilkinson, 2018). There is a tremendous amount of academic vocabulary in mathematics (Wilkinson, 2018). Potentially complicating matters, some of the math terms have multiple meanings (Hughes et al., 2018). For example, the term "mean" could be associated with a person that is "unkind" rather than the "average" of a set of numbers. Depending on the ELs' background knowledge and experiences, some words may sound like another word, such as "prism" may be confused with "prison". Also, Emergent Bilingual (EB) learners, students whose home language was not English and their ELP levels were an obstacle, presented additional challenges to accessing grade-level content materials (Crosson et al., 2020). Therefore, it was best to teach the academic language within the context of a math problem (Hughes et al., 2018).

Crosson et al. (2020), examined EBs' knowledge of 12 high frequency terms that had multiple meanings in upper-elementary mathematics instruction. Additionally, these words were introduced in previous grades. The 12 terms were used to develop two researcher-created assessments to evaluate EBs' understanding of multiple-meaning words. One of the assessments, the Semantic Web Task, required that students to discriminate target words that were related and unrelated when presented out of context. The other assessment, the Ambiguity Resolution Task, required students to select one of the meanings when given in context. In a study that included Spanish-English EB fourth graders, EBs were less certain of word meanings when encountering the words in context on the Ambiguity Resolution Task; whereas, on the Semantic Web Task, EBs were able to at least acquire some of the meanings of the words and make associations when the word meanings were given by a synonym, figure, or mathematical symbol. Crosson et al. (2020) reported that no more than one-third of the EB fourth graders knew both the everyday and mathematical meaning of the 12 target words when appearing in context. Therefore, the data suggested that it would be beneficial to design instruction that offered opportunities for EB learners to develop their understandings of mathematical words with multiple meanings.

Language Development With ELs. Learning a language along with academic content presented dual challenges for ELs in the mathematics classroom (Kangas, 2019). Often ELs appeared fluent in their oral language English skills (Morita-Mullaney & Stallings, 2018). However, ELs still needed language supports to help them with the complex academic materials that required them to use math content vocabulary when engaged in student discourse (Morita-Mullaney & Stallings, 2018). Moschkovich (2015) emphasized that language components, such as syntax, structure, and vocabulary were a part of mathematics and they needed to be explicitly taught to ELs.

Biber and Gray (2016) stated that there have been minimal studies comparing the linguistic complexity by discipline. Nevertheless, it was widely acknowledged by researchers that linguistic complexity and disciplinary literacy coexisted (Martin, 2013). In one study, researchers analyzed the complexity of word problems in mathematics textbooks and found there was not only numerical difficulty for students, but also, linguistic features, such as prepositional phrases, noun phrase length, and/or conditional clauses contributed to the difficulty of word problems (Daroczy et al., 2015). Also, the phrase level complexity (e.g., phrases with modifiers) and lexical complexity (abstract vocabulary, academic or low frequency) illustrated the quantitative complexity that existed in mathematics (Daroczy et al., 2015). Shanahan and Shanahan (2017), believed that all teachers should teach literacy and that content area teachers, such as mathematics teachers, should teach language associated with their discipline. For example, a teacher could help students strengthen their word associations (e.g., velocity, force, constant, speed, time, mass) by creating concept maps and word walls (Lei & Liu, 2018).

Wilkinson (2018) provided a framework for language education researchers and mathematics education researchers regarding the relationship between language and mathematics. The framework included "(a) the academic language register, and in particular the mathematics register, (b) the language challenges inherent to mathematics learning and teaching, (c) issues of special importance for students who are learning

English at the same time they are learning mathematics (EL students), and (d) implications of the research for mathematics instruction" (Wilkinson, 2018, p. 87).

Academic language register. The academic language register was the "language, both oral and written, of academic settings that facilitated communication and thinking about disciplinary content" (Nagy & Townsend, 2012, p. 92). For example, the everyday conversational register reflected face-to-face interactions with individuals of familiarity, whereas the academic language register involved both the oral and written communication within an academic setting (Wilkinson, 2018). Therefore, students needed to learn how to integrate the various disciplinary concepts in order to transition from everyday conversations to more academic conversations that included specialized listening, speaking, reading, and writing (Wilkinson, 2018). As for many ELs, this resulted in a disparity because their first language conceptual schemas (e.g., vocabulary and funds of knowledge) were needed to enrich the development of new ideas (e.g., mathematical procedural and conceptual knowledge) in order to begin to grasp the complex language within disciplinary-specific registers (Uccelli et al., 2014).

Language challenges inherent to mathematics. Mathematics was characterized with language challenges due to the combination of natural language, symbolism, models, and visual displays (O'Halloran, 2015). When solving story problems, students relied on all these resources, especially when providing written and oral explanations due to the disciplinary language having highly technical vocabulary, semi-technical terms, dense noun phrases, complex subordinated clauses, and including discourse-level organization (Moschkovich, 2015; Wilkinson, 2018). Thus, students often were required to explain their strategies for solving word problems and this could be challenging for ELs (Bailey et al., 2015; Roth et al., 2015; Wylie et al., 2018).

Issues of special importance with ELs. ELs, as well as young learners, struggled with being able to express their mathematical ideas using the formal mathematics register (Wilkinson, 2018). Additionally, O'Halloran (2015) found that ELs had difficulties grasping the linguistic features of mathematics, both language and nonlanguage aspects.

The nonlanguage aspects included symbolic notations, charts, and graphs, while language aspects included grammar, the lexicon, and discourse structure (O'Halloran, 2015). ELs also lacked the knowledge of mathematics vocabulary, which could be a potential obstacle to their mathematics academic success (Bedore et al., 2011). The complex syntax was often challenging, especially in mathematics word problems, textbooks, and standardized assessments (Cheuk et al., 2018).

Balanced Assessment System

A balanced assessment system included three levels of measurable forms of assessments, summative, interim, and formative (Gong, 2010). These assessments provided essential information to educators for purposes of monitoring students' progress towards meeting standards (e.g., CCSS) and for making ongoing instructional decisions (Gong, 2010; NCTM, 2014). The three levels of assessments required substantial academic language competencies for students, and all students were expected to engage in complex tasks that presented an appropriate grade level of challenge to students (Abedi & Linquanti, 2012). The summative assessments were used as an indicator of students' performance towards meeting standards as well as a school's progress in meeting accountability standards; the interim assessments were predictors of and a guide for interventions; and the formative assessments inform and enhance teachers' pedagogy and students' learning (Abedi & Linquanti, 2012; Heritage, 2010; NCTM, 2014). In the student-centered classroom, the primary purposes of assessment were to provide the teacher with students' current progress towards meeting grade-level mathematics standards, to make in-the-moment instructional adjustments during the lesson, and to provide an accurate account of teacher and student performance (NCTM, 2014). Hence, teachers' regular use of assessments, particularly formative assessments, improved students' learning.

Sistla and Feng's (2014) study supported the need for language modification on standardized tests. The researchers focused on the use of visual representations with words and phrases used in standardized tests. Students met in small groups to share their responses to the test items, to debate why an answer was correct or incorrect, and to teach some of the mathematical language using visual representations (e.g., charting a word/phrase with a symbol). Findings showed closing of the gap between ELs and non-ELs following the use of small group discussions (Sistla & Feng, 2014). Also, having EL students and non-EL students placed in mixed ability groupings for discussions has been shown to increase the overall growth rate of success (Garrett & Hong, 2012). Thus, the use of visual learning with mathematical language conducted in small mixed-ability groupings can be an effective approach to addressing the inequities of ELs' low performance on balanced assessments.

Another area to consider when addressing the academic success of ELs is supporting teachers' understanding of how to effectively increase ELs' engagement in their daily classroom instruction. As emotion and cognition interact with one another in teaching and learning, Park's (2014) study suggested the significance of emotional scaffolding, a term used in Vygotsky's concept of scaffolding and social constructivists' perspective of emotional learning. Park (2014) examined a prekindergarten teacher's use of pedagogical practices that supported ELs being coconstructors of their own learning by engaging in discussions verbally and nonverbally without the teacher's interjection of ideas. Park (2014) found that the teacher's intentionality around allowing students to coconstruct their knowledge and providing emotional support to the learners, when necessary, allowed for a more meaningful and developmental learning environment that ultimately increased the EL's academic achievement (Park, 2014).

EL, as a status, was considered a temporary category because ELs were expected to exit this category at some point in their academic schooling (Abedi & Linquanti, 2012). The ELP standards were developed to improve ELs' performance on content-based assessments aligned to the CCSS (CCSSO, 2019). An EL's ELP level will determine the length of time for the student to learn the academic content in English as well as demonstrate the student's conceptual understanding and skills in English (Abedi & Linquanti, 2012). Therefore, when ELs reached a Level 3 of ELP, ELs were exited out of the EL program in school districts and supports provided by EL specialists for ELs diminished; general education teachers were expected to be equipped in providing ongoing language support in the mathematics classroom.

Thus, opportunities for further studies, field tests, and test prototypes existed to advance the understanding of developing more appropriate EL-responsive test-item tasks (e.g., linguistic modifications) and pedagogical practices within the classroom to increase the accessibility for, and the achievement of, ELs on balanced assessments.

Implications

Teachers found the new pedagogical practices (e.g., differentiation and language support) challenging; therefore, this study's project deliverable is comprised of recommendations for teacher professional development to improve student learning in mathematics. One possible direction included suggestions for scaffolded instruction for equitable discourse based on ELs' ELP levels. Another included language supports that played a significant role in the development of academic language of ELs in the mathematics classroom.

Summary

In summary, student-centered discourse practices helped to facilitate productive mathematical discussions. This change in practice from teacher-centered to student-centered, affected teachers' instructional practices with ELs in third through fifth grade mathematics classrooms. In the United States, research has primarily focused on ELs' acquisition of the English language and literacy skills, rather than the acquisition of mathematics knowledge (Garrett & Hong, 2012). Thus, teaching academic language in mathematics has provided ELs an opportunity to increase their learning in the mathematics classroom. It has also provided a bridge to increasing their English language skills, especially when learning terms that were not part of their everyday conversations, as well as explicitly teaching mathematical terms with double meanings and idiosyncratic expressions.

The purpose of this study was to gain an understanding of teachers' experiences with new discourse practices and their specialized knowledge and skills for ELs' language development to identify the types of PD that would best support teachers in implementing these new pedagogical, student-centered discourse practices with ELs' in the third through fifth grade mathematics classroom. In the dominant culture of the United States, teachers in the mathematics classroom have historically been the sole providers of knowledge and controllers of information; students were to access and acquire the teachers' knowledge as the teacher described the procedural steps for a mathematical problem-solving task (Polly et al., 2014). Teacher-centered classrooms were organized and arranged for whole group instruction, a dominant instructional practice although there were times when heterogeneous grouping of students may have taken place. Also, teachers in teacher-centered mathematics classrooms often failed to realize that mathematics was not a universal language accessible by all students, especially ELs in a monolingual environment, and therefore, created a classroom full of obstacles (e.g., lessons presented in a lecture format, students seated in rows, and all interactions between students and teacher) that did not allow ELs to access the content knowledge necessary to be successful (Uribe-Flórez et al., 2014).

In Section 1, the local problem along with the problem within the larger population were introduced. A rationale for investigating the problem was described along with the study's purpose and potential benefits as well as RQs. Also included was the study's conceptual framework, Knowles's adult learning theory of andragogy. The literature review provided peer-reviewed resources describing (a) student-centered shifts in practice; (b) new pedagogical discourse practices; (c) the role of the teacher; (d) the role of the student; (e) project-based learning; (f) EL language barriers and outcomes; and (g) a balanced assessment system. In Section 2, the research design and approach that were used for this study will be explained along with a discussion of the findings. In Section 3, the project for this study along with its rationale and supporting literature review are presented. Finally, in Section 4, reflections and conclusions are provided.

Section 2: The Methodology

Research Design and Approach

I used a basic qualitative research design in this study to examine the problem that teachers were experiencing a change in practice, from teacher-centered to student-centered, which affected their work with ELs in third through fifth grade mathematics classrooms. Although the study site school district provided PD to address student-centered practices, PD for teaching ELs to interact with peers in English as well as to capitalize on home language, knowledge, and cultural assets remained to be addressed. The purpose of this study was to gain an understanding of teachers' experiences with new discourse practices and their specialized knowledge and skills for ELs' language development to identify the types of PD that would best support teachers in implementing these new pedagogical, student-centered discourse practices with ELs in the third through fifth grade mathematics classroom. Therefore, a basic qualitative approach was well suited because it allowed me to focus on meaning, understanding, and process (see Merriam & Tisdell, 2015), whereas a quantitative approach would have focused on numbers and statistics rather than words and meanings. According to Merriam and Tisdell (2015), a basic qualitative research design has been used by researchers who are interested in "(1) how people interpret their experiences, (2) how they construct their works, and (3) what meaning they attribute to their experiences. The overall purpose was to understand how people make sense of their lives and their experiences" (p. 24).

Three overarching RQs were used to allow for a deeper understanding of how teachers make sense of their experiences with these new pedagogical, student-centered discourse practices. The RQs were as follows:

RQ1: How do teachers describe their experiences with teaching ELs in mainstreamed, differentiated third through fifth grade mathematical classrooms?

RQ2: What specific challenges arise for teachers who work with ELs when implementing student-centered discourse practices in the mathematics third through fifth grade classrooms?

RQ3: What are teachers' PD needs for improving their academic language instruction with ELs in the mathematics third through fifth grade classrooms?

A basic qualitative study has been commonly used interchangeably with the term *qualitative research* found in education (Merriam & Tisdell, 2015). It includes a purposeful sample, in-depth interviews, and audio recordings (Merriam & Tisdell, 2015). Furthermore, the data analysis process is inductive and comparative to assist the researcher in identifying recurring patterns and themes within the collected data as well as deriving comprehensive insight into the participants' understanding and interpretation of their experiences (Merriam & Tisdell, 2015). Finally, the researcher's findings are richly descriptive and presented in the form of themes and categories (Merriam & Tisdell, 2015).

Creswell and Poth (2018) and Merriam and Tisdell (2015) described other types of qualitative research methods with additional dimensions, such as phenomenology, ethnography, grounded theory, narrative inquiry, and qualitative case studies. While phenomenology has been used to describe how events appeared or how they may have appeared to the person living the experience, such as judgments, perceptions, and emotions (Smith, 2018), the emphasis of the study was to capture the lived experiences of the participants. In phenomenology, the researchers' tasks are to depict the essence of the experience as well as to explore their own personal prejudices, viewpoints, and assumptions related to the phenomenon (Merriam & Tisdell, 2015). However, in this study, my intention was to interview participants to gain an insight into their own personal experiences regarding their implementation of new discourse pedagogical practices. In ethnography, the purpose is to capture (through observations and interviews) the data in the natural setting of the participants to answer either "what is?" or "what could be?" for a culture and to analyze the data, by identifying themes about the group to develop a description of how this culture works (Creswell & Poth, 2018). This research design seemed unsuitable because this study included interviews only, rather than classroom observations and interviews. In grounded theory, the purpose is to develop a substantive theory based on the views of many participants (20 to 60) and to analyze the data through open coding, axial coding, and selective coding to design a figurative model (Creswell & Poth, 2018). Given the nature of this study, only 12 participants were included and, therefore, grounded theory was not selected. In a narrative inquiry, the researcher captures thick and rich descriptions, usually focused on one participant looking at threads and influences throughout their life, such as in a biography, and the words used may or may not have been data from interviews (Creswell & Poth, 2018). Due to the nature of this study, more than one participant was interviewed and, therefore, narrative inquiry was not chosen. Lastly, in a case study, the purpose is to develop an in-depth description by using contextual materials (interviews, observations, documents, and artifacts) to examine an occurrence, activity, or more than one person and to analyze the data through descriptions and themes of the case to develop a detailed analysis (Creswell & Poth, 2018). According to Merriam and Tisdell (2015), a case study is defined as “an in-depth description and analysis of a bounded system” (p. 37) used by researchers who are interested in “(1) how people interpret their experiences, (2) how they construct their works, and (3) what meaning they attribute to their experiences. The overall purpose was to understand how people make sense of their lives and their experiences” (p. 24).

Although, it appeared that case study could be used for this qualitative research, a basic qualitative study was more appropriate because a bounded case was not defined and the research included only semistructured interviews, with no additional data sources. Thus, a basic qualitative approach stood as the best methodological choice for this study.

Participants

Participants included 12 content-oriented teachers in third through fifth grade elementary mathematics classrooms with a minimum of 3 years of certified teaching experience. This included four content-oriented teachers in each of the grade levels, third through fifth grade. In this district, there were more than 1,500 K to 12 teachers who averaged 10 to 15 years of experience and over 60% had a master’s degree (OSPI, 2019b). Participants did not include emergency-certificated teachers or substitutes. Additionally, each participating teacher had taught more than one grade level in mathematics, taught at least 3 years, worked with ELs during these 3 or more years, and may also have held an EL endorsement. I had intentionally narrowed my focus to third through fifth grade elementary mathematics teachers for this study. The elementary mathematics teachers in these grades were experiencing shifts in required instructional practices since the implementation of ESSA (2015) due to accountability measures (e.g., test scores) of elementary students in Grades 3 to 5 who had taken the annual statewide assessment, Smarter Balanced, at the end of each school year.

Selection Process

When selecting participants for this research study, purposive sampling was used to identify participants (see Welman & Kruger, 1999). This type of sampling is "characterized by the incorporation of specific [inclusion and exclusion] criteria" (Padilla-Díaz, 2015, p. 104). These criteria were necessary due to the number of new teachers hired to work at high needs elementary schools. A recent Washington state report indicated that the number of teachers with 1 to 2 years of teaching experience doubled over 6 years, from 3,387 in 2010 to 2011 to 6,918 in 2015 to 2016 (Elfers et al., 2017). The inclusion and exclusion criteria are explained below.

Inclusion Criteria for Teachers

For teacher participants, inclusion criteria were that the teacher (a) worked with ELs in a third through fifth grade mathematics classroom, (b) had a minimum of 3 years of teaching experience at more than one grade level in mathematics, (c) had a minimum of 3 years with teaching ELs or held an EL endorsement, (d) could participate in English language interviews, (e) did not need American Sign Language accommodations, and (f) did not practice in the same school where I worked.

Exclusion Criteria for Teachers

Exclusion criteria for teachers were that the teacher (a) did not work with ELs in a third through fifth grade mathematics classroom, (b) had fewer than 3 years of teaching experience and/or only taught at one grade level, (c) had fewer than 3 years of teaching experience with ELs or did not hold an EL endorsement, (d) did not speak English fluently (interviews were conducted in English), (e) required American Sign Language translators (the study site school district colocates deaf students with deaf teachers and generally separates them from ELs), and (f) practiced in the same school where I worked.

Demographic Questionnaire to Assess Inclusion/Exclusion Criteria

The demographic questionnaire (see Appendix B) was completed by teachers who expressed an interest in this study via email. The questionnaire helped to discern if teacher candidates had worked in third through fifth grade mathematics classrooms with ELs. Likewise, selected participants with an EL background (e.g., teaching experience with ELs or held an EL endorsement) were more likely to understand the complexities of the ELs in the mathematics classroom. The demographic questionnaire also helped to determine which of the teachers were unlikely candidates for this study due to their lack of experience in teaching mathematics in third through fifth grade classrooms, and/or the candidates' lack of experience in teaching more than one grade level.

Gaining Access to Participants

Before my study formally began, the study proposal and an application for review of protection of human subjects were submitted to Walden University's Institutional Review Board (IRB), as well as the school district's IRB. Upon the agreement and receipt of a letter of cooperation from the school district, a participant invitation letter was emailed to potential participants' work accounts that were obtained from the school's website at each of the eight elementary schools. The initial email included an introduction of myself, information about my study's purpose, and an invitation to interested teacher candidates, third through fifth grade, to participate. Potential participants were invited to reply if interested and to include their personal email addresses. Details related to this study's time commitment (e.g., an audio-recorded phone call for a 1-hour interview and transcript verification) were also described. Lastly, terms of confidentiality (e.g., all data deidentified) were explained. However, the response to the first participant invitation letter was limited due to environmental factors. Therefore, a second participant invitation letter was emailed to the same eligible group of teachers, third through fifth grade, to participate.

Informed Consent

After receiving emails indicating interest in my study, a demographic questionnaire and consent form were emailed to potential participants' personal accounts so that they could read the forms at their leisure. It was imperative to include the consent with the demographic form because one cannot obtain any data prior to consent. Interested participants completed their demographic form and emailed the form back along with the statement, "I consent." Also, participants were reminded that they would not be paid or gifted for their time to prevent participants' misconception of coercion. Once selected, participants were emailed to confirm their participation as well as their consent for this study. The participant who was placed on a waitlist was contacted as well.

Researcher/Participant Working Relationships

To build trust with the potential participants, insider/outsider status (a member within the community versus a member outside the community) was disclosed in the initial invitation to participate. I addressed potential candidates' questions using home emails or cell/home phone numbers and maintained clear communication throughout the study. With the consent of the interviewees, all interviews were conducted using audio-recorded telephone conversations. The date and time for the interview was selected by the participant upon receiving their consent form. At the beginning of the interviews, introductions were exchanged, and interview procedures were reviewed. Also, any additional questions were addressed prior to starting the audio-recorded telephone interviews. Throughout the interview process, participants were encouraged, questioned, and asked to clarify without adding my own experiences into the interviews. After the interviews were completed, I emailed each participant asking them to review their transcription from our audio-recorded conversation and to approve it as is or to make any changes or additions they felt needed. Each participant had 7 calendar days to respond; otherwise, I assumed all information was correct in the transcription. All 12 participants confirmed their transcriptions without any changes or additions being needed. Participants were later sent statements of appreciation for their participation.

Confidentiality

Conversations were audio-recorded and remained confidential. Interviews were not held at the schools to ensure the participants' confidentiality as well as to protect them from harm. Data were also deidentified to protect the confidentiality of the participants. Reports resulting from the study used pseudonyms for participants and sites. According to the American Psychological Association (2020), "research is complete only when scholars share their results or findings with the scientific community" (p. 3). My data, findings, conclusions, and implications for practice will be shared with other professionals at conferences and trainings. If participants' descriptions were too specific and could serve to identify the participant, participant's words were edited or paraphrased to maintain confidentiality.

The participants' personal information was aggregated to prevent identification. Data were kept secure in a locked file cabinet; all electronic documents were password protected; and codes were used in place of names. Data will be kept for a period of 5 years, as required by Walden University.

Risks and Benefits to Participants

Risks. One potential risk factor to consider was participants' time involved with the study. It was essential to provide a sensible time range because loss of time may be a discomfort to participants. Also, participants of minority groups and others may not have wanted to participate if they felt a group was targeted in the study. Therefore, participants were well informed about the purpose of the study. Participation was voluntary, and participants had the choice to leave this study at any time.

Benefits. This study allowed participants the opportunity to share their own personal experiences in using the new pedagogical, student-centered discourse practices with ELs in third through fifth grade mathematics classrooms. The interview gave them an opportunity to authentically reflect upon their own professional practice.

Data Collection

Data Collection Tools

Merriam and Tisdell (2015) explained that the data collection for a basic qualitative study usually involves one data collection method which may be interviews, observations, or document analysis. The data collection tools used in this study consisted of a demographic questionnaire, an interview protocol used for 12 in-depth semistructured interviews with transcript verification. A field journal was also used to record basic notes before and after the interviews.

Demographic Questionnaire

I created the demographic questionnaire (see Appendix B) to assist in the selection of potential participants for this study. This demographic questionnaire set the tone for participants being the experts of their own experience. There are four primary reasons why a researcher gives the participants a demographic questionnaire: (a) demographic data help to answer the researcher's questions, (b) the questionnaire aides in describing the participants, (c) the questionnaire ensures that participants meet inclusion criteria, and (d) the questionnaire provides an aggregated description of the demographics (Kostoulas, 2014). The questions for this study related to the participant's highest level of education, certification level, length of time spent teaching in a third through fifth grade mathematics classroom, grade levels taught in mathematics, specific experience with teaching ELs, and possibly having an EL endorsement. I selected participants who worked with ELs in third through fifth grades as my focus because these grade levels were most affected by the changes in mathematical pedagogical approaches and statewide assessments.

Interview Protocol

Interviews provide in-depth, detailed qualitative data for researchers as they seek to understand participants' experiences (see Rubin & Rubin, 2012). According to Castillo-Montoya (2016), it is helpful to have an interview protocol refinement (IPR) framework (see Appendix C), which includes a four-phase process to ensure "interview questions align with the study's research questions, organizing an interview protocol to create an inquiry-based conversation, having the protocol reviewed by others, and piloting it" (p. 811). This four-phase process was implemented through (a) the development of an interview protocol to ensure that interview questions aligned with the study's RQs, (b) the creation of interview questions designed to elicit specific information, (c) the guidance of feedback from a colleague to check clarity, simplicity, and answerability of the questions as well as whether or not the questions addressed what I intended or expected, and (d) the experimentation with a simulated interview to see whether the order of questions were appropriate. In this study. I employed the IPR framework because each phase provided congruency—my interviews were "anchored in the purpose of the study and the research questions" (Castillo-Montoya, p. 812). For Phase 1, I developed an interview protocol, which aided in checking for an alignment between my interview questions and overarching RQs. Phase 2 included the construction of the interview questions. Phase 3 offered guidance because a retired colleague provided feedback for clarity of interview questions and Phase 4 provided a simulated practice because another retired colleague participated in a mock interview to check each question for clarity, simplicity, and answerability. Thus, this IPR framework (Castillo-Montoya, 2016) assisted in acquiring in-depth, detailed interview data.

Interviews

A semistructured interview format was used in this study. Semistructured interviews allowed for open-ended and less structured questions (Merriam & Tisdell, 2015). Although there was some flexibility with the questions, all questions were asked in the same order to ensure that all items were covered, unless the conversation moved ahead, and a question was covered in an earlier response (see Merriam & Tisdell, 2015).

The selected participants were contacted by personal email or phone to set up a date, time, and location. Interviews were conducted by telephone. A follow-up letter was emailed (using participants' personal email addresses only) to the participants who agreed to participate in the study confirming the date and time for the phone interview. Before the interview began, I explained the interview process, including that there would be 10 questions related to student discourse with ELs in the mathematics classroom. All interviews were audio recorded using Rev's audio recording app (citation needed), a common practice to ensure that everything that was shared was preserved for analysis (Merriam & Tisdell, 2015). after the interview was completed, I immediately uploaded the recording within Rev for transcription with a turnaround time of 48 hours. Rev is a reputable company based in San Francisco, CA that was established in 2010. The company provides a voice recorder app for iPhones and Androids and transcriptions made by humans with 99% accuracy.

The semistructured interviews were approximately 45 minutes in length which gave interviewees an expectation of the approximate length of time for their participation. Creswell and Poth (2018) stated that specific information needed to be reviewed prior to the start of the interview. Therefore, a confirmation email sent to the participant acknowledging their consent prior to the date of the interview. At the beginning of the interview, the purpose of the study was reviewed as well as the procedures, risks and benefits, and confidentiality as mentioned in my invitational letter and informed consent document. Next, any questions regarding the study were answered and then the interview process began.

Interview questions (see Appendix C) were constructed to allow the participants to be critically reflective in their responses. As the researcher, I encouraged and questioned to clarify, but did not insert my own experiences into the interviews. The interview was intended to be conversational—a dialog between participant and researcher. Therefore, I restated or summarized information provided by the interviewee during the interview to determine the accuracy of responses to increase the credibility and validity of the study. After the interview, the audio recording was submitted to Rev to be transcribed. Upon receipt of the transcription, usually within 48 hours, the transcription was emailed to each interviewee's personal email address for them to verify the accuracy of the transcription. Each interviewee had seven calendar days to verify the transcription, add additional comments, and reply. If there was no response provided regarding the accuracy of the transcription, I assumed all information was correct. It has been found that participants generally appreciate this opportunity because it helps to build trust between the researcher and the participants (Denzin, 1973).

Field Journal

A field journal was used to record my notes before and after the interview. For instance, how the conversations went during the interview was noted in the field journal, such as whether it was easy or challenging, if we laughed a lot, whether the participant was nervous, etc. Affective responses and any interruptions that took place during the interview were documented. Berg and Lune (2017) noted four elements of field journals: "cryptic jottings, detailed descriptions, analytic notes, and subjective reflections" (p. 231). Merriam and Tisdell (2015) suggested also including descriptions of the physical setting (e.g., physical environment, context, space), the participants (e.g., relevant characteristics, patterns, and frequency of interactions), subtle factors (e.g., nonverbal communication), and my own behavior (e.g., thoughts during the interview, "observer comments") because it provides a context of additional data that is highly descriptive and reflective. Importantly, field journals are comparable to the interview transcriptions (Merriam & Tisdell, 2015). In general, the field journal provided a means of capturing the ambiance of each interview, as well as my own thoughts to be reflective and reflexive in my ongoing thinking.

Systems for Keeping Track of Data

All collected data were kept track of by using a clear file system for each participant which included the following (a) acknowledged consent sent by email, (b) completed demographic questionnaire, (c) interview audio-recording downloaded and saved on a USB device, (d) interview transcription, (e) notes related to the interview from the field journal, (f) coding of the transcription, and (g) coding from the interview field notes.

Procedures for Recruitment of Participants

Procedures for gaining access to the participants for this study involved recruitment at eight elementary schools. This section will include an explanation of how attrition was managed.

Recruitment

Invitational letters were sent to 150 teachers, third through fifth grade, at eight elementary schools by school email. Potential participants taught at schools with a minimum of 10% of the school population being ELs. Details of my study were included in my invitational letter (e.g., issue, purpose, time commitment, and follow up of their acceptance to participate in the study). Potential participants were invited to reply if interested and to include their personal email addresses. However, the response to the first participant invitation letter was limited. A world-wide pandemic was sweeping the nation, and a "stay-at-home" mandate was imposed. Schools were closed and students as well as school employees were told to stay home. Teachers were providing virtual instruction from home rather than in-person instruction at school. A second participant invitation letter was emailed to the original 150 potential teacher participants, third through fifth grade, to participate. After receiving emails indicating interest in my study, copies of the consent forms and demographic questionnaire (see Appendix B) were emailed to the interested teacher candidates' personal email addresses. The consent form described the study, confidentiality, voluntariness, timing, and contact information.

Demographic questionnaires were completed and emailed directly to my Walden email address along with the statement, “I consent”.

A total of 13 demographic questionnaires were received, four for Grade 3, four for Grade 4, and five for Grade 5. The demographic questionnaires were reviewed; the inclusion and exclusion criteria were used in selecting the 12 interested teachers to participate in the study. They consisted of four mathematics teachers at Grades 3, 4, and 5. All 12 teacher candidates were contacted using their personal email addresses confirming their participation in this study as well as inquiring about a date and time for the phone interview.

The remaining teacher candidate who had expressed interest, completed the demographic questionnaire, and met the selection criteria, was placed on a waitlist in case of attrition. The interested teacher candidate was notified about being placed on the waitlist and later thanked for their interest in the study when notified upon the completion of the final interview that the interested teacher candidate was no longer needed.

Attrition. Participation in this study was voluntary. Participants were free to accept or decline the invitation. If participants decided to be in the study, they could withdraw at any time. If any participants decided to withdraw, they were instructed to contact me by phone, email, or by simply discontinuing participation. However, all 12 participants chose to be a part of this study and there was no attrition.

Role of the Researcher

Relevant to this study, I have served the district being studied in the roles of teacher, assistant principal, and building-based instructional coach/collaborative K-3 teacher at the elementary level. My insider/outsider status was acknowledged to the participants. Presently, I have not performed any teacher annual evaluations. As an instructional coach, I have provided professional development and observational feedback in my building as a member of the professional learning community. Also, I cotaught with K to 3 teachers providing whole group and small group instruction in literacy and mathematics.

My role was as a building-based instructional coach and collaborative teacher in the professional setting of this study. However, to avoid any effects on the data collection or any undue influence, the participants in this study did not practice in the school in which I practiced, thus eliminating any perceived power or influence on the participants and the data collected from them.

Also, relevant to this study, I have provided professional development institutes for teachers and principals participating in the Washington Student Achievement Council Educators for the 21st Century Professional Development Grants: University of Washington Tacoma (UWT) Smarter Balanced Assessment Grant and UWT Project Core Time Digital Grant (2015 to 2017). I have as well served as a guest lecturer for the School of Education at UWT (2015 to present). Both roles, along with my elementary public-school experience, have afforded me the experience to hone my interview skills in eliciting honest and critical responses in a safe teaching and learning environment. Finally, being associated with the UWT School of Education has afforded me access to professional dialogues with other researchers from novice to highly experienced levels.

Some potential biases I brought into this research included (a) the application of student discourse in the mathematics classroom influenced by my own training and teaching experiences, (b) teachers' resistance to student discourse based on observations in the mathematics classrooms as well as teacher conversations as an instructional coach and administrator, (c) the necessity of scaffolding during the implementation of student discourse based on my own training, teaching experiences, observations, and discussions, (d) my professional experiences as an elementary instructional coach and administrator, and (e) my innate ability to be reflective in my practice as an educator; I can't assume that others were as reflective.

To maintain impartiality with the participants as well as minimize potential biases, interview notes for all interviewees were recorded in my field journal. I read each participant's transcriptions, listened to the interview recordings, reviewed my notes in my field journal, and afterwards read all the transcriptions again to ensure that I have captured all the participants' critical thoughts and ideas. Finally, I asked myself questions to determine if I have captured an accurate picture of my study. The first question prompted me to be mindful of remaining impartial during the interview, whereas the second question served as a reminder to check the transcriptions for validity and to ensure that the transcriptions captured the central meaning of what was said during the interview. The third question reminded me to review the transcriptions again to see if there were other conclusions that need to be identified. The final question checked for the triangulation of the data collected to increase this study's credibility and trustworthiness. This included transcriptions with field journal interview notes, transcript verifications, and cross-checking coding, themes, findings, and conclusions.

Data Analysis

The data used for this study included (a) audio recorded interviews, (b) transcribed interview texts, (c) field journal commentary, and (d) hand coded analysis of transcriptions (e.g., open coding and axial coding). Open coding was defined as creating tentative labels or finding common themes from participants' words (see Merriam & Tisdell, 2015). This coding included distinct concepts and categories as well as concepts that may become headings and categories that may become subheadings. Axial coding was defined as the process of grouping open coding used to confirm concepts and categories as well as to explore how the concepts and categories relate (Merriam & Tisdell, 2015).

Description of the Data Analysis

At the beginning of my analysis, the first transcription was read as well as the field journal entry for the first interview. The comments in the field journal provided additional analysis that was comparable to the transcription, especially because it included my initial interpretations, speculations, and questions raised during the interview. After rereading the transcription, notes were made in the margin of the transcription. Then, my reflections were written down noting potential themes and ideas. All this information was recorded in my field journal that was used after each interview. After completing my coding, collected data were compared; the comparison provided information for coding the next interview. This process continued until all interview transcriptions were analyzed and coded. Throughout this process a list of significant statements identified in the transcriptions were created and grouped by theme (see

Merriam & Tisdell, 2015; Moustakas, 1994). A code book, which includes the operational definitions of the themes, was used to group like data (participants' statements) into the identified themes. This code book, used for coding interview data (see DeCuir-Gunby et al., 2010), also allowed for revision of thematic operational definitions as the nuances of participant experiences were described by the participants. Next, a *textual description*, a description of "what" the participants' experienced, was written including verbatim examples (see Moustakas, 1994) from the audio recordings and transcriptions. Textual descriptions also included key words, phrases, emotions, idioms, metaphors, tones, symbols, and other linguistic or literary devices that the participants used verbally on the recordings and textually in the transcriptions. Lastly, reflexivity and an audit trail were used to increase the trustworthiness of the study (see Anney, 2014; Lietz et al., 2006). Reflexivity refers to the researcher documenting and analyzing his/her own background, perceptions, and insights (Ruby, 1980). A field journal (representing reflexivity) was used to record my recognized biases and assumptions (see Krefting, 1991; Lietz et al., 2006). The audit trail refers to a transparent description of the researcher's in-depth approach taken from the start of the research study, during the development stages, and the final reporting of the study's findings (Merriam & Tisdell, 2015).

During constant comparison, coding, categories, and themes were derived from the transcriptions. An audit trail was recorded in a separate journal to track the development of themes and codes using verbatim data. Constant comparison entailed comparing new significant statements with others to determine which category (theme) the statement belonged in as well as to decide if there was a relationship of the categories (themes) with one another (see Glaser, 1965; Miles & Huberman, 1994). After coding was completed using the constant comparative process, all audio-recordings were listened to again and all transcriptions reread to obtain a global perspective and to confirm the patterns and categories that emerged during the data analysis. If any discrepancies arose during the constant comparative process, the discrepancies were defined and explained in the study's findings.

Data Saturation

Data saturation is when data collection reveals overlapping codes and themes (see Fusch & Ness, 2015; Lietz et al., 2006). Data saturation occurred during the coding process and was documented in both my code book and audit trails (see Lietz et al., 2006). Data collected for this study included individual interview content. Saturation was determined when codes being obtained become repetitious, new themes were no longer discovered, and further coding is no longer needed (Fusch & Ness, 2015). Constant comparison helped me to substantiate data saturation.

Data Triangulation

Triangulation involves the use of two or more external methods to collect data on a specific topic (Denzin, 1973). Denzin (1973) noted that there were four basic types of triangulations—"data triangulation, investigator triangulation, theory triangulation, and methodological triangulation" (p. 301). Data triangulation includes the use of data attained from varying sources. Therefore, data triangulation was used, and the varying sources included semistructured interviews with transcript verifications, and a field journal. After receiving the transcription for each audio recorded interview, participants were given an opportunity to verify their statements in their transcription. All transcriptions were verified and accepted without changes. In qualitative research, transcript verifications helped to establish credibility, contribute to trustworthiness, and improve the validity of the study's findings and conclusions (Creswell & Poth, 2018).

Credibility

Credibility is the believability of the final document. Thus, the modes of presentation have to be accessible and descriptive, resulting from the researcher's willingness to write in a literary manner (Anney, 2014). Credibility was achieved through the accurate use of rich descriptions to facilitate determination of transferability (see Creswell, 2007), such that readers could draw parallels from what they read or heard to another context. Audit trails, created to determine whether the findings, interpretations, and conclusions were supported by the data (see Creswell, 2007), assisted me in reaching conclusions and drawing implications for practice from the data. The actual words of the participants were accurately presented in my findings. My writing was vivid with the data broken down into small units. The findings were derived from the critical voices of the participants, not from my own beliefs. The conclusions and implications for practice logically proceeded from the findings derived from the participants' interviews.

Trustworthiness

Lietz et al. (2006) defined trustworthiness based on the traditions of Lincoln and Guba (1985), writing that "trustworthiness was established when findings as closely as possible reflect the meanings as described by the participants" (p. 444). During the data analysis process, reflexivity and an audit trail was used to increase the trustworthiness of the study (see Lietz et al., 2006). A field journal was used to document and record my own feelings, thoughts, and insights as well as biases, and assumptions (see Krefting, 1991; Lietz et al., 2006). An audit trail refers to a transparent description of the researcher's in-depth approach taken from the start of the research study, during the development stages, and the final reporting of the study's findings (Merriam & Tisdell, 2015).

Validation

Validation is the congruency between the process of the research and the results (Sousa, 2014). Validation is achieved when the researcher employs multiple methods of data collection, data analysis, and coding to document the accuracy of the study (Creswell, 2007). Supported by Sousa (2014), researchers' validation of a study connoted dependability of method and trustworthiness of evidence. For example, each participant's transcription was read, the interview recordings were heard, my notes in my field journal were reviewed, and afterwards all the transcriptions were read again to ensure that I had captured all the participants' critical thoughts and ideas. Finally, I asked myself questions to determine if I had captured an accurate picture of my study, such as was I mindful of remaining impartial during the interviews, did the transcriptions capture central meaning of what was said during the interview, and were the transcriptions reviewed again to see if there were other conclusions that needed to be identified.

Data Analysis Results

The purpose of this data analysis was to organize this study's collected data into larger themes and categories using open and axial coding to gain an understanding of teachers' experiences with new discourse practices and their specialized knowledge and skills for ELs' language development. Thus, the data analysis helped to identify the types of PD that best supported teachers in implementing these new pedagogical, student-centered discourse practices with ELs' in the third through fifth grade mathematics classroom. Following the guidance of Merriam and Tisdell (2015), the data analysis process was inductive and comparative to assist me in identifying recurring patterns and themes within the collected data. This analysis provided a comprehensive understanding of the participants' understanding and interpretation of their experiences as well as afforded the findings to be richly descriptive and shared in themes and categories (see Merriam & Tisdell, 2015). The data included (a) audio recorded interviews, (b) transcribed interview data, (c) field journal commentary, and (d) hand coded analysis of transcriptions (e.g., open coding and axial coding). Open coding assisted in identifying the larger themes while axial coding was used to confirm concepts and categories as well as to explore how the concepts and categories relate (see Merriam & Tisdell, 2015). This analysis process was broken down into incremental steps, which included (a) listening to all the audio-recordings and reading all the transcriptions, (b) conducting an audit trail in a separate journal (e.g., Word spreadsheet), (c) using constant comparison to compare new significant statements with others, (d) listening to all audio-recordings and reading all transcriptions again to obtain a global perspective, (e) checking for discrepancies during the constant comparative process to later define and explain if needed.

For this study, I conducted one-on-one semistructured interviews with 12 participants. Interviews were audio-recorded over the telephone to ensure that the data were accurately captured and transcribed verbatim. All audio-recordings and transcriptions were provided by Rev, a reputable company that provides a voice recorder app for iPhones and Androids and transcriptions made by humans with 99% accuracy

Upon completion of the interviews, transcriptions were verified by each of the 12 participants. After multiple readings of the transcriptions, the data from the transcriptions were organized into a graphic organizer using Microsoft Office 365 Word document I created. The graphic organizer consisted of three columns labeled as open coding, axial coding, and examples of participants' words. Moreover, the interview questions addressed the research problem as well as aligned to each of the three overarching RQs that allowed for a deeper understanding of how teachers make sense of their experiences with these new pedagogical, student-centered discourse practices. The RQs were as follows:

RQ1: How do teachers describe their experiences with teaching ELs in mainstreamed, differentiated third through fifth grade mathematical classrooms?

RQ2: What specific challenges arise for teachers who work with ELs when implementing student-centered discourse practices in the mathematics third through fifth grade classrooms?

RQ3: What are teachers' PD needs for improving their academic language instruction with ELs in the mathematics third through fifth grade classrooms?

During the constant comparison of participants' responses, coding, categories, and themes emerged that were derived from the transcriptions. For each RQ, themes and categories that emerged were added to the graphic organizer and then quotes from the 12 participants' transcriptions were selected for each of the major themes and categories. An audit trail was recorded in a separate journal (e.g., Excel spreadsheet) to track the development of themes and codes using verbatim data. Constant comparison entailed comparing new significant statements with others to determine which category (theme) the statement belonged in as well as to decide if there was a relationship of the categories (themes) with one another (see Glaser, 1965; Miles & Huberman, 1994). After coding was completed using the constant comparative process, all audio-recordings were listened to again and all transcriptions reread to obtain a global perspective and to confirm the patterns and categories that emerged during the data analysis. When discrepancies arose during the constant comparative process, the discrepancies were defined and explained in the study's findings.

Coding Process

Coding in qualitative research supports credibility. According to Creswell (2015), coding is the process of analyzing qualitative text data to identify overlap and redundant codes. Analyzing text data is time consuming, so, it helped me to map out the data and make sense of its relationship to the RQs (see Elliott, 2018). During my constant comparison process, coding, categories, and themes were derived from the transcriptions after multiple readings. An audit trail was recorded in a separate journal (e.g., Word document) to track the development of themes and codes using verbatim data. Notes were also kept in the margins of each transcription. Next, I created a list of themes (e.g., open coding) and categories (e.g., axial coding), that aligned to each of the three RQs. Key words and phrases were noted for each RQ. To organize my text data, I created a Word document (e.g., journal for coding) with a graphic organizer that included (a) the three RQs, (b) accompanying themes aligning to each RQ, (c) categories aligning to the themes and RQs, and (d) supporting participants' quotations for each category. I completed the coding process by rereading all the transcriptions to ensure saturation—no new codes emerged or were coded incorrectly.

All collected data were tracked by using a clear file system for each participant which included the following (a) acknowledged consent via email, (b) completed demographic questionnaire, (c) interview audio-recording downloaded and saved on a USB device, (d) interview transcription, (e) notes related to the interview from the field journal, (f) coding of the transcription, and (g) coding from the interview field notes.

Results

The following section accounts for all the data that were collected. Three themes were derived from the participant one-on-one interviews (a) learning structures, (b) discourse and equitable practices, and (c) professional development recommendations. These themes emerged during the coding process of the data analysis. Each theme aligned to one of this study's three overarching RQs (see Table 1).

Table 1

Teachers' Perceptions of Discourse Practices and Skills for ELs' Language Development

Research questions	Categories of data (axial coding)	Themes (open coding)
RQ1: How do teachers describe their experiences with teaching ELs in mainstreamed, differentiated third through fifth grade mathematical classrooms?	Whole group Small groups Partners One-on-one Scaffolds of support	Learning Structures
RQ2: What specific challenges arise for teachers who work with ELs when implementing student-centered discourse practices in the mathematics third through fifth grade mathematics classrooms?	Math talk strategies Multiple representational tools/accessibility Technology New curriculum Cultural responsiveness	Discourse and Equitable Practices
RQ3: What are teachers' PD needs for improving their academic language instruction with ELs in the mathematics third through fifth grade classrooms?	Language instruction Mathematics vocabulary EL instructional strategies Best practices in math Classroom teachers and EL specialists University support	Language Acquisition and Collaborative PD Supports

Theme 1: Learning Structures

Teachers described their experiences with teaching ELs in mainstreamed, differentiated third through fifth grade mathematics classrooms as using varying learning structures. The data for this first theme revealed that teachers were using five types of learning structures and supports, which included (a) whole group instruction, (b) small group instruction, (c) learning partners, (d) one-on-one supports, and (e) scaffold supports. This theme was derived from open and axial coding of collected data for the first RQ.

The 12 participants averaged six ELs in a classroom size of 24 students with approximately four spoken languages. Nine of the participants shared that their ELs needed further support with academic vocabulary and/or language development. Several participants mentioned using cognitive content dictionaries, such as GLAD (Education Northwest, 2018) strategy for developing Els' content mathematics vocabulary; whereas another participant described teaching their ELs how to construct a simple sentence, how to write a complete sentence, and teaching strategies to assist in decoding words (e.g., roots, prefixes, and suffixes).

In response to the question of how they meet the needs of linguistically diverse students in math, seven participants conveyed that they use student partnerships when encouraging ELs to share their responses, show how they work on a word problem, and how they share within a small group. Participant 1 stated,

> Well, during instruction, I will stop and, say, "Turn to your partner and show on your white board, using your white board and markers, how you solved this problem." From the basics. Show, circle, circle the words, um, write down the key words that you need to know. And then, write down the numbers you need to know. Then that would be a third step. The third step, now show your partner, um, what would be an equation that you would use to solve the problem? And so, turn and talk at this time.

Another participant mentioned how students' confidence played an important role in getting ELs to share their thinking. Participant 3 shared,

> I think the tough part is that the kids that are less confident, that you really have to... it's knowing, I mean, you know you need to push and prod them…obviously just letting people choose their partner versus having, you know, hey, I want you to be with this particular kid, and then you put two high kids together, if you put a

> higher kid with a lower kid, or do you put a, you know, a more motivating kid with a less motivating kid, and there's so many different, uh, arguments you could make for certain kinds of partnerships. So, I guess just being intentional about the partnerships is important and should not be overlooked.

Others responded that they used anchor charts and structured and unstructured math talk with student learning partnerships. For example, Participant 3 commented, "I have anchor charts or anchor posters up on the walls that have literal quotes or at least maybe not quotes but, like, sentence starters."

When participants were asked to describe what differentiation looked like when teaching math, 10 participants claimed they use small group instruction. Groups were set up as developmental groups depending on ELs' skill sets. Participate 2 expressed,

> I do small group, where I have half my kids with me, and I usually do low group first and then high group next. So, all my low group come down and we do a lesson together and we walk through it, um, step by step, and that group takes a little bit longer than my higher students, um, and all my ELLs are usually in that low group. When my kids are not with me, they do a lot of station work, or their independent work, where I have them do certain activities, um, at stations or table groups or, um, things like that.

Guided practice with gradual release was part of this small group instruction. Students were gradually released to perform work by themselves or with a partner when displaying a stronger understanding of the mathematical concepts. Participant 5 elaborated,

> So, with me, with my low group, I talked them through the problem and asked,

> “So, what do they want to know and how can we help them find out? What does the farmer need to feed the 32 chickens and the 15 pounds of feed?” So, we walk through it. And I tell them that it's important for them to understand if they don't understand. If they don't understand, we need to stop because we have to take all our good information and move it to the middle group, so they can plug in their holes. And then the middle group would take it to the high group and the high group will just check to see if they went the right, you know, in the right direction.

Also, small groups were constantly changing because they were based on the results of the students’ exit slips. Participant 11 stated,

> So, differentiation teaching math. Okay. So, like I said, preteaching happens and then whole group lessons will be whole group. But then usually in the afternoon I will look at their exit slips from math, and then kind of group them that way and see who got it, who has almost got it and who needs more support still? And I will poll, pull a small group towards the end of the day and we'll go over some math concepts that maybe they struggled with or that they need extra support in and we'll... And then the other kids will be working on like their MyPath or other assignments that they have.

Seven participants used whole group instruction when teaching the main lesson with new or fairly new mathematical concepts and later met with students who were struggling during intervention times. For example, Participant 7 shared, “So for me, differentiation looks like, um, I will teach a math concept to the whole class and when I have the intervention time, I will pull aside those students who are having a really difficult time, and they're not all my EL students." During the lessons, teachers explained what mathematical situations were about before engaging the students in partner talks. Six participants described using a variety of structures to support student interactions during whole group instruction. These included (a) partner talk, (b) turn and talk, (c) sentence starters or stems, and (d) student led discussions. For example, Participant 1 shared, "I use partners in math, doing partnership to share the questions, share a response, show how they work the problem and then share out to a small group." Five participants also conducted one-on-one, referred to as conferring with a student, to acquire a better understanding of the student's procedural and conceptual knowledge. Participant 7 commented,

> What I do is I just sit at the table next to those students that I know are having an especially hard time, and I'll just work one-on-one with them so that they, um, they get a better start on what we're doing. And then I will move on to the next child, so to allow them a little bit of independence and to try things on their own and see how they do.

Participant 1 also asserted,

> I also really like to, um, do little, uh, math interviews with kids where, um, they can show me and then I can later reflect on it, do a quick video of them, uh, solving the problem and then sharing it with them and going back over it, showing look at the strengths that you showed in solving this problem. And I think those kinds of strategies build confidence in the learner and it helps them to

see themselves as a learner and how strong they are and where they need to grow. Finally, two participants mentioned gallery walks, where groups of students would work together and then take a walk around the room visiting the different group tables to see how other groups solved the mathematical tasks as well as add comments and wonderings to each group's poster. Participant 12 revealed,

> Partner discussion, um, table discussions, um, we used a lot of ums, gallery walks which I do not know if a lot of people use them in math but for me, I use them for everything. And this year I used it more um, in math especially when we were uh, working with problems with a lot of steps, um, we would work together, table groups would work and then we would walk around and talk about each different table group and make some noticings and log down some wonderings that were still there and then go back and figure those out.

These varying learning structures provided ELs in mainstreamed third through fifth grade mathematics classrooms opportunities to engage in differentiated, scaffolded instruction.

Theme 2: Discourse and Equitable Practices

Participants who worked with ELs encountered challenges when implementing student-centered discourse practices in the mathematics third through fifth grade classrooms. A variety of discourse strategies were used with ELs to promote discussion and discourse during mathematics instruction. Some of the discourse strategies attempted and/or used in the mathematics classrooms included number and dot talk, Youcubed by Jo Boaler (Youcubed, n.d.), three reads from Curriculum Associates (Curriculum Associates, 2021), talk moves, GLAD (Education Northwest, 2018) strategies, and the interpret and compare protocol. Number talk was a conversation around mental math computation problems eliciting specific strategies that focus on the relationship of numbers and number theory (Parrish, 2010). Students shared and defended their solutions with their peers. Participant 2 commented,

> Still trying to work on the Number Talk. I have an activity where there is four squares. The kids solve the problem by themselves and then they come together, they share their ideas, and then they put their ideas together in one form, and then they share that one form of how they think best answer that question. Um, then we do a lot of, uh, the talking...where I have a problem, they work the problem, and then they must explain, um, their thinking.

Dot talk was another prevalent strategy mentioned in the interviews. Dot talk involves showing students 10-frame cards with a certain number of dots, such as five. Then students share the strategies (e.g., counting all, using the relationship of 6 minus 1, moving dots around on the page, etc.) they used to figure out the number of dots on the cards (Parrish, 2010). Participant 10 elaborated,

> We have done like those dot talks. So…you put something up on the board and then the students like say all the different ways that they are seeing these like groupings of, um, the dots or the numbers or you put up like, you know, an equation on the board but they don't have any pencil or paper to solve it and you talk about all the different ways they mentally solved the problem and students are just sharing out their thinking.

Both strategies—math and dot talk—were mentioned by five participants. However, only one of the five participants mentioned that the strategy was still being considered, but not currently used by the classroom teacher. The other four participants shared that these strategies were being used or tried out in the mathematics classroom. Math and dot talk, as well as other discourse strategies (e.g., talk moves) were available on Youcubed.org (n.d.). Youcubed.org was referenced by Participant 6 during the interview. These participants shared that it was important to keep the tasks interesting and engaging for students. For example, Participate 6 stated,

> The other thing is that I do, I am like a super fan of Jo Boaler from Stanford. And so, I do use um, in the past, I have tried this still, I do use a lot of the Youcubed activities. For me, what I, my personal philosophy is that kids want to talk about math, they want to engage in mathematics when they have interesting tasks. So, whether it is a three-act task or, some of the tasks from Youcubed, I would do the week of inspirational math um, whether it's a task from there, if it's interesting, kids will talk about it. Right? I mean these are most, and the things that I usually choose are known for high feelings. The kids, no matter what their language level, or their current mathematical skill, every kid can engage, and it is interesting. And they want to engage because it is interesting. Not just because that is what you do in math class.

Another math talk strategy used by Participant 11 included the Three Reads Protocol, which was part of the new math curriculum. Participant 11 shared,

> Three Reads Protocol, where they read the problem multiple times and the first read, they usually tell like, what is happening in the problem, who the characters are, what are they doing? And then second read, they might say like, what are, what are... What do the numbers represent or what units are being talked about, that type of thing. And then the third read, they would see the question, answer what the question is asking us to do, what operation might we use to solve it, and then they have some time to privately work.

The five talk moves strategies for promoting student discourse in the classroom (Chapin et al., 2009) was also mentioned. Participant 10 commented,

> Um, and, like, with the math talk, there is like all those math talk moves which is like, okay, well you can like revoice what somebody else is saying or you can repeat what they're saying, …or you can like reason, you can add on, um, that sort of thing. You can agree, you can disagree.

GLAD (Education Northwest, 2018) strategies were also applied during math discussions. Participant 6 stated,

> The other thing that I have done before too is that kids will each have a different color pencil and sign their name in that pencil, and they are both responsible for working together. But in the beginning especially when we are starting a new concept, I try to make things as low risk as possible.

Finally, interpret and compare protocol was used during lessons. Participant 11 stated,

> So, we have done like the interpret and compare, where they might swap with each other... and analyze each other's thinking and have to discuss like what they

> thought someone else did to solve the problem and then, um, vice versa. And then they share about how their thinking is similar and different. So, we have done a lot of interpret and compare, um, a lot of informal turn and talks that happen throughout every lesson that are more just turn and talk about what you noticed or what you think this represents, that type of thing.

Of the six math talk strategies discussed in the interviews, at least one or more of the strategies were mentioned by six of the 12 participants in this study. The participants using math talk strategies had received district and building-based training. Importantly, the ELs' language levels and/or current mathematical skills did not seem to hinder the ELs' engagement in the mathematical activities.

Other areas that were part of this second theme were related to equitable practices. These areas included multi-representational tools and the use of technology. The use of multi-representational tools was mentioned by six participants. Participate 10 asserted,

> Have students model their different strategies and put them on anchor charts and post them around the room. We watch math videos. So, they do not just like get it from me or their neighbors or themselves, but they also get it from video explanations. We use a lot of manipulatives and mathematical representations, like drawings and all that stuff.

Participant 1 also commented,

> So again, really going back to understanding how the child learns and using multiple intelligence to show and to allow them to express how they want to learn. I think it really is twofold because you really see where the child is

> developmentally, based on what their preference is. Like, if their preference is really a lot of symbols and manipulatives and drawings, then you can almost really tend to see that is going to be not only their area of strength, but it's also going to show you developmentally with the English language, what maybe they're trying to, you know, swerve away from, interacting more with the actual words themselves and writing out how they feel.

Lastly, given the increased use of technology, one of the participants mentioned the use of Flipgrid (Flipgrid, 2021), a free video discussion website that allows teachers to facilitate video discussions through the creation of grids. The grid resembles a message board where a teacher may pose a mathematical question to be solved and students are given the opportunity to respond by posting a video response. Participant 9 shared,

> I do use another one that is with the computer. It is Flipgrid and it’s been engaging for the kids because it’s technology. And what I do is present them with a math problem on Flipgrid, then they must solve it, and the way that they answer it is through Flipgrid. It is a video recording of themselves, and they have to be able to articulate back to me how they solved this problem. The directions are very clear, and they must be precise in every step that they do to solve this problem.

Thus, a variety of discourse strategies were applied with ELs to promote discussion and discourse in the third through fifth grade mathematics classrooms.

Theme 3: Professional Development Recommendations

Participants expressed that the district PDs had not really addressed the language needs in mathematics for ELs. The data revealed that third through fifth grade teachers would like more PD that included (a) academic language and language development, (b) new curriculum support, (c) math talk, and (d) collaborative supports. Participants were asked to describe their experiences with the district PDs regarding student talk in math, including best tips received and/or tips that were less successful in mathematics instruction. The participants were also invited to share anything else that had not been discussed or mentioned. Lastly, the participants were asked to make suggestions for future PD to support their work with ELs and ELs' academic language development.

Six participants wanted to learn more strategies that supported language development in mathematics. For example, Participant 6 stated,

> I just haven't found the district trainings that I've been to have really addressed language needs in a way I wanted. I would say that my GLAD training and other things that I had done have furthered my understandings, such as what I have learned in ELA have kind of led the way towards supporting that language in math.

Participant 10 also shared, "I guess I would like to see more PD around how to work with linguistically diverse students in a math classroom. More opportunities, more strategies, better evidence, and research base." As well, Participant 4 commented,

> Well, I think the idea of pairing the developmental process of math and connecting it to other language development would be important because the idea

> of being a concrete thinker and some of the math that they try to bring down to the primary ages is more abstract. Some of those little names that they call things. The problem with that is that they really need to understand that children don't do well with multiple names of things, and they end up having to relearn vocabulary, especially ELL…so why can't younger children learn names, such as trapezoid and quadrilateral. I think that is one of the biggest problems that I have is that PD needs to look at mathematics as a priority subject and not a secondary to something else.

A year ago, the district adopted a new curriculum. Half of the participants in the study felt that further PD training was needed to address supports for ELs as well as some of the mathematical tasks. For example, Participant 1 expressed,

> I need to go deeper into using their techniques now, to really expand on opportunities. Because a lot of the times, the EL ideas that they will give, they're really good for the whole class because they create a more visual, basic understanding for everybody, and it really clarifies their understanding.

Participant 6 commented,

> I would say that I think the new math curriculum makes meeting the needs of EL learners much more difficult. And from what I've heard, the lower grades aren't quite as difficult, but for me at the fifth grade, there are these you know, they have a try it, discuss it, connect it routine. So, let me tell you, the tasks aren't worth discussing. They're not interesting, they're not open-ended. And so why, why would we have kids discuss endlessly a question that's close-ended? Right, that's

> not a good language support, right? We want more open-ended questions; we want kids to have to justify their thinking. We want kids generalizing about math, you know, we want them engaged in the, the nitty gritty of mathematic learning. But the way that this new math curriculum is set up is basically workbook and if you look at how truly language heavy the books are, it's really a turnoff for a lot of kids. I just watch kids' faces just go blank as soon as they open that workbook.

Math talk was another topic that came up in the interviews. Five of the 12 participants mentioned teachers needing more training about math talk. The participants noted they had received some district training using the "train-the-trainer" model but felt more was need. For example, Participant 12 stated,

> I think it could have ended up being a really good professional development around student talk, but I feel like it never got there. I know that there are a lot of buildings in our district that are specifically using math workshop in a different way. Teachers who are getting more training around math talk situations depends on which direction their building is going. But honestly, I have felt let down and disappointed by the training in our district, specifically around things that should be the most beneficial, like math talk. I try to make sure I'm always using the right vocabulary no matter if it's, you know, over their heads, you know, very rigorous I never alter that vocabulary because I want that there for them. I'm sure that there's some very specific way of doing that, that would probably be even more beneficial that I just haven't gotten to yet, and so besides maybe one or two not

> very long professional developments led by a coach in the building, which were honestly not beneficial, my PD training around math talk is very minimal.

Participant 12 shared experiences with student-centered math talk. Participant 12 expressed,

> Being able to take a back seat as the teacher and let the kids be the drivers, especially when introducing a new concept. That was really hard for me to step back and say, here's a problem, what can you do with it, you know, talk with your partner about how you started it, why did you start it that way, what did you already know before you started it, why did you do this instead of doing this, without giving any instruction and that all seems very boring to me.

Participant 8 claimed,

> I guess in general, I feel like professional development is generally philosophical, yeah, it's important. But I feel like we haven't had a whole bunch of time to actually apply it. I remember watching some videos. I think they were always the most helpful PD.

Another PD topic mentioned was the need for collaborative training with third through fifth grade mathematics teachers and EL specialists. Half of the participants commented on the possibility of a collaborative effort for PD. For example, Participant 8 shared,

> I think having time and support and teaming with ELL teachers, I mean people that deliver this specialized instruction and with classroom teachers, how to best do that. I think maybe some sort of schoolwide structures in place and practicing

> that, so that everybody's using kind of common and uniform language… in discourse. Again, good training on questions to ask to elicit more talk.

Next, participant 9 elaborated,

> It would be good to see more PDs that incorporate maybe the EL department, or the staff at the school. In a PD environment, where they're sharing more with us as a teacher because I think there's a little bit of a disconnect there sometimes, with the third through fifth grade mathematics teachers and EL specialists. So, I think that would be good.

Then, Participant 2 expressed,

> I would have to say that, more along the lines of the PD is having the ELL teachers and teachers work together in a PD, not just have, I think that we should be working together. And I don't think sometimes we do. I think the ELL teachers are working by themselves. So maybe have a PD where we're all on the same page. Where we all know what's supposed to happen, and I know we can't all be at the same time but make it a PD that's just across the board, this is what we want to do, this is what we want to see happen. But we need to have more strategies and more tools for teachers to be able to help our ELL students, because... something that's mutual, something that's accessible for us, but not that we have to always, every year, oh, I got a Spanish speaking student that doesn't speak English. Okay. What do... I need to go find this, I need to go do this, I need... they need to have it already available for us.

Lastly, Participant 5 commented,

> Oh my gosh. Um, I think we need to bring in someone else other than a person who is good at math. I mean, we pay these people, and they haven't written a book. They haven't, you know, been on a panel. But, here in [city], a local university brought in all kinds of teachers, and you'd go in, and you'd do math. You'd do math the old way. And then they showed you this is how to do it in, you know, in a different way. And there were different strategies to get to the same math problem. I enjoyed that. And I don't think our district moves out to the universities and works with the professors that are teaching teachers, new teachers, or teaching a math major, or teaching a physics class. I mean, I think we need to reach out to those university professors and say, so what are you doing? Can you come in and show our teachers? Cause a lot of teachers say, "I can't do sixth grade math." And I'm like, what are you talking about? It's the same thing as third grade math. You're doing fractions, right? Yeah. Okay, well, we're doing fractions and there's mixed numbers. And a mixed number is one whole and a part of a whole. So, it is just, you know, I think teachers should kind of just stick to what they do in a classroom and don't stretch out.

Therefore, teachers would like to have ELs' language needs in mathematics discussed in future district PDs.

Discussion of the Findings

The themes derived from the data were reflective of (a) a variety of learning structures used to engage students; however, teachers continued to struggle with instructional practices to address their students' academic vocabulary and language development needs in mathematics, (b) equitable discourse practices that were attempted or used by some of the participants in the mathematical classrooms; however, teachers needed more PD in this area including virtual tools, and (c) district adopted curriculum that was being implemented; however, further PD training was needed to address supports for ELs. Lastly, most of the participants expressed the need for PD to include third through fifth grade mathematics teachers and EL specialists together.

Theme 1

In the first theme, participants conveyed that they have a basic understanding of the varying structures (e.g., whole group, small group, partners, one-on-one, scaffolds of support) and their use, but struggle with how to address their students' needs with content specific mathematical language—academic vocabulary and language development—within these learning structures. New standards (e.g., CCSS and ELPS) and high-stakes assessments call for considerable use of the English language and expanded ways of demonstrating mathematical proficiency. As a result, a paradigm shift in teaching, from teacher-centered to student-centered, has taken place redefining the role of the teachers and the students in the mathematics classroom, as well as the teacher's pedagogical practices. In this new role, educators need to examine ways to best support the ELs in the mathematics classroom ensuring that all learners, specifically ELs, have equitable opportunities to access the cognitive demands of the mathematics curriculum as well as the academic vocabulary and English language structures (Sistla & Feng, 2014). Vygotsky (1978) also emphasized the teacher's role as being a facilitator (e.g., providing guidance, otherwise known as scaffolding) for students' learning. Although participants shared their use of scaffolds of support with ELs, this is an area that could still be addressed in future PD because further learning may be needed to provide explicit delivery appropriate for ELs' English language proficiency levels.

Scaffolding plays an important role in teachers supporting their ELs' academic language development and mathematics (Coggins, 2014). Scaffolding is particularly helpful because it involves (a) verbal scaffolds to assist ELs with language development, (b) procedural scaffolds that involve mathematics teachers modeling and coaching students, as well as (c) instructional scaffolds, such as graphic organizers to enhance ELs' mathematical understandings of concepts and skills (Echevarria et al., 2007). Thus, scaffolding creates a foundation for ELs' mathematical discourse in meaningful ways.

Theme 2

In this second theme, participants conveyed the need for additional support in effectively implementing student-centered discourse practices (e.g., number talk) in the mathematics third through fifth grade classrooms. This also included equitable instructional practices to ensure that all student voices were heard. Research has shown that effective learning occurred when students were given opportunities to think about the math and to talk about it with someone else (Wilson et al., 2015). Discourse also played an important role in substantive intellectual work because classroom conversation afforded students the opportunity to extend their lines of reasoning and thinking (conception and interpretation) about a mathematical situation, and to explain and to justify their solutions (Wilson et al., 2015). All students, and especially ELs, as they all were mastering a new academic language, could ask genuine questions about other students' thinking. Ideally, they learned to generalize and to apply each other's ideas to new situations. Moreover, mathematics classroom teachers needed to model this process.

One of ESSA's (2015) core concepts was equity for all groups of students, e.g., low-income students, students of color, ELs, and other historically underserved or marginalized student groups. *Equity pedagogy* encompassed the teaching methods and learning environments that created opportunities of engagement for all students of diverse backgrounds and experiences; it was designed to increase and vary classroom participation (Banks & Banks, 1995; McVee & Boyd, 2016; Wachira & Mburu, 2019). Central to teaching practice reform around mathematics and ELs, equity pedagogy urged teachers to create challenging learning environments that engaged all learners in rich classroom dialogue to deepen the students' mathematical understandings (Van de Walle et al., 2018; Wachira & Mburu, 2019). Equity pedagogy meant to promote and sustain professional learning of culturally responsive practices related to differentiated instruction, student engagement, teacher efficacy, and student learning outcomes (Wachira & Mburu, 2019). In a mathematics classroom, equity pedagogy resembled: (a) students receiving differentiated learning with scaffolds of support, (b) students learning from one another by sharing individual methods for reaching solutions, and (c) students questioning and discussing their thinking.

Theme 3

In this last theme, participants expressed that the district PDs had not addressed the language needs in mathematics for ELs. The data revealed that third through fifth grade teachers would like additional PD that included (a) academic language and language development, (b) new curriculum support, (c) math talk, and (d) collaborative supports with EL specialists. Boss and Larmer (2018) encouraged the development of a professional learning community that afforded teachers opportunities to deepen their conceptual understanding of the mathematics and to explore new discourse pedagogical approaches to enhance the learning of all learners.

The conceptual framework for this study, Knowles's adult learning theory of andragogy, takes into consideration that adult learners wanted agency to their learning, and they needed to know the intention for their learning (Knowles et al., 2015). For example, agendas articulated learning's purpose, activities drew a connection between new learnings and district's goals, and that the adult learners' challenges with ELs in the mathematics classroom needed to be addressed. Also, adult learners needed time to practice their learnings so that they could internalize, making meaning of the new information, and have time to reflect (Knowles et al., 2015). Therefore, this framework provided a structure for how to design the project for this study, 3-day PD eLearning sessions, in meaningful ways for the adult learners.

Discrepant Situations

Discrepancies are situations where the data challenged or disconfirmed the expected findings (Merriam & Tisdell, 2015). During my constant comparison, I reviewed the patterns found within the transcriptions. I compared the patterns with less prevalent statements or statements that did not align to the emerging themes and categories, checking to see if there were any discrepancies to be found. No discrepancies were found during this process.

Research Accuracy and Credibility

My goal as a researcher was to ensure credibility, trustworthiness, and validation during the data analysis process. Credibility was achieved through the accurate use of rich descriptions to facilitate determination of transferability (see Creswell, 2007) and my findings were derived from the critical voices of the participants, not from my own beliefs. Trustworthiness was established when findings reflected the meanings described by the participants (see Lietz et al., 2006). Validation was achieved when multiple methods of data collection, data analysis, and coding were employed to document the accuracy of the study (see Creswell, 2007).

According to Lincoln and Guba (1985), credibility is established when researchers ensure that the participants were identified and described accurately. The use of rich descriptions allowed the readers to draw analogies from what they read or heard to another context, whereas an audit trail helped to determine whether the findings, interpretations, and conclusions were supported by the data (see Creswell, 2007).

Trustworthiness supports that the findings are “worth paying attention to” (Lincoln & Guba, 1985). During the data analysis process, reflexivity and an audit trail were used to increase the trustworthiness of the study (see Lietz et al., 2006). An audit trail refers to a transparent description of the researcher’s in-depth approach taken from the start of the research study, during the development stages, and the final reporting of the study’s findings (Merriam & Tisdell, 2015).

Validation is the congruency between the process of the research and the results (Sousa, 2014). A researcher’s validation of a study connotes dependability of method and trustworthiness of evidence (Sousa, 2014).

Limitations

A researcher must specify the limitations of their study (see Creswell & Poth, 2018). Therefore, there are limitations associated with this basic qualitative study. In this study, I sought to gain an understanding of teachers' experiences with new discourse practices and their specialized knowledge and skills for ELs' language development to identify the types of PD that would best support teachers in implementing these new practices with ELs. The study included semistructured interviews with 12 third through fifth grade teachers at schools with at least 10% ELs. During the recruitment period, a worldwide pandemic prompted school districts to shift their entire teaching staff to providing online instruction. This affected the recruitment of potential participants for this study. Due to a limited amount of potential participants responding, this narrowed the selection pool of participants. Likewise, 12 participants, who included four teachers at each grade level, third through fifth grades is not enough to generalize the findings. Also, time was another limitation. This study's recruitment and interviews took place during the spring of 2020. If this study were conducted over a longer period of time with a larger number of participants, this could alter the study's findings. Finally, the study included four teachers at each grade level, third through fifth grades who taught mathematics with ELs in their classrooms, as opposed to all content teachers, such as EL specialists.

Although one of the primary limitations of this study was that it was not generalizable across populations, regions, or cultures, it is possible for another researcher to use the methods of this research to capture a different population of participants to provide further insight on why ELs' test scores have not improved on mathematics statewide assessments. Additionally, because there was only a small number of participants, saturation of data informed the researcher when themes began to repeat across the dialogs with participants. Findings were subject to the depth of critical dialog by each participant and while respectful of participants' time, the interview questions were carefully crafted for consistency and depth of critical thinking. Lastly, interviewer bias could be a limitation to this study as well. Therefore, I was conscious of any potential biases by keeping a field journal when conducting my interviews.

Conclusions

To gain an understanding of teachers' experiences with new discourse practices and their specialized knowledge and skills for ELs' language development, three RQs were addressed. The RQs helped to identify the types of PD that would best support teachers in implementing these new pedagogical, student-centered discourse practices with ELs in the third through fifth grade mathematics classrooms.

> RQ1: How do teachers describe their experiences with teaching ELs in mainstreamed, differentiated third through fifth grade mathematical classrooms?

Theme 1 indicated teachers used a variety of learning structures during mathematics instruction. The learning structures included whole group, small groups, partners, one-on-one, as well as scaffolding supports.

> RQ2: What specific challenges arise for teachers who work with ELs when implementing student-centered discourse practices in the mathematics third through fifth grade classrooms?

Theme 2 indicated teachers' attempts to use a variety of math talk strategies, multi-representational tools, and technology tools to help increase accessibility and access points for ELs.

RQ3: What are teachers' PD needs for improving their academic language instruction with ELs in the mathematics third through fifth grade classrooms?

Theme 3 indicated teachers wanted further support and learning on (a) academic language and language development, (b) new math curriculum, (c) math talk strategies, and (d) to increase collaborative learning with third through fifth grade mathematics teachers and EL specialists as well as a partnership between district and local universities for extended learning opportunities.

Based on these findings, teachers may need additional support and learning in implementing these new pedagogical, student-centered discourse practices with ELs in the third through fifth grade mathematics classroom. I have proposed that PD be developed to further teachers' student-centered discourse practices with ELs. In Section 3, I present a project based on these research findings that comprises PD for teachers working with ELs in the third through fifth grade mathematics classroom.

Section 3: The Project

The 3-day PD eLearning sessions are created to address the themes that emerged in my study's findings. The identified themes, (a) learning structures, (b) discourse and equitable practices, and (c) professional development recommendations, relate to the new pedagogical, student-centered discourse practices with ELs in the third through fifth grade mathematics classrooms. These themes are derived from the data findings that reflected third through fifth grade teachers would like to receive additional PD in the areas of (a) academic language and language development, (b) new curriculum support, (c) math talk, and (d) collaborative supports with third through fifth grade mathematics teachers and EL specialists. The 3-day PD eLearning sessions include the following:

- Day 1 – Scaffolds of supports with academic language and language development
- Day 2 – Equitable discourse practices with academic language and language development
- Day 3 – Collaborative PD with third through fifth grade mathematics teachers and EL specialists

The purpose of this study was to gain an understanding of teachers' experiences with new discourse practices and their specialized knowledge and skills for ELs' language development to identify the types of PD that would best support teachers in implementing these new pedagogical, student-centered discourse practices with ELs in the third through fifth grade mathematics classroom. My data collection process captured the participants' identified areas of potential PD that would best support teachers in implementing these new pedagogical, student-centered discourse practices with ELs in the third through fifth grade mathematics classroom. This included participants' desire and need for collaboration between third through fifth grade mathematics teachers and EL specialists as well as their frustration with the new mathematics curriculum and instructional discourse practices.

In this section, I describe this study's project, 3-day PD eLearning sessions, to address participants' identified areas to further their learning with ELs' academic language/language acquisition in mathematics and equitable discourse practices with ELs in the third through fifth grade mathematics classroom. I provide a description and rationale of the project along with the project's learning objectives and activities. Moreover, potential barriers are presented as well as all resources and supports to be used with participants during the 3-day PD. A literature review about PD informs the genre of this study's project. Lastly, this section provides an evaluation plan for the project as well as a summary of potential implications for social change.

Rationale

The problem that prompted this study was teachers experiencing a change in practice, from teacher-centered to student-centered, which affected their work with ELs in third through fifth grade mathematics classrooms. The implementation of student-centered discourse practices is essential to orchestrating productive mathematical discussions. However, the common practice was teacher-centered instruction where teacher talk is prevalent. Although the school district in this study provided PD to address student-centered practices, PD for teaching ELs to interact with peers in English as well as to capitalize on home language and cultural assets remained to be addressed. The findings revealed that teachers wanted further learning on (a) language development and academic language, (b) new math curriculum, (c) math talk strategies, and (d) increased collaborative learning with third through fifth grade mathematics teachers and EL specialists as well as a partnership between district and local universities for extended learning opportunities.

My conceptual framework, Knowles's (1984) adult learning theory of andragogy, took into consideration the characteristics of the adult learner when applied in the development of PD. When thinking about how adult learners approached their own learning and professional growth, Knowles made five assumptions about the design of adult learning. These included "(a) self-concept, (b) experience, (c) readiness to learn, (d) orientation to learning, and (e) motivation to learn" (Knowles, 1984, p. 12). Also, Knowles's six principles contributed to structuring the PD activities. These principles, "(a) adult learners need to know, (b) self-concept of the learner, (c) prior experience of the learner, (d) readiness to learn, (e) orientation to learning, and (f) motivation to learn," recognize the needs of the individual learner and the importance of developing PD based upon these ideologies (Knowles et al., 2015, p. 4). Both Knowles's andragogical assumptions and principles provided guidance and application for this study's project. Additionally, the PD experience offers opportunities for teachers to reflect on their new learnings and potential implementation in their classrooms. The PD also invites colleagues to engage in collegial, collaborative conversations to share their multiple perspectives (see Martin et al., 2018).

Thus, this project was created to address the participants' expressed needs with the new pedagogical, student-centered discourse practices and language demands with ELs in the third through fifth grade mathematics classrooms. PD participants will receive pedagogical discourse approaches and scaffolds of support to address the needs of ELs' academic language and language development in mathematics, which was revealed in the data collection findings. According to Knowles et al. (2015), it was pertinent that adult learners know "the how, what, and the why of learning" before their learning began (p. 60). Therefore, learners will be given agendas that articulate the goal and purpose for each activity, opportunities to reflect on what they have learned and how it may help them, as well as surveys to assess their learning needs.

The PD is designed and developed using my study's conceptual framework, Knowles's adult learning theory of andragogy, and the research-based information from the literature review about (a) best practices for developing and presenting PD, (b) valuable PD eLearning, (c) teacher agency in PD, and (d) the reflective practitioner in PD. The study participants expressed that the school district's PDs had not really addressed the language needs in mathematics for ELs. The third through fifth grade teachers wanted more PD that included language development, new curriculum support, math talk, and collaborative supports. Participants also wanted to be able to see an immediate use for learning. According to Knowles et al. (2015), further consideration of individual learner's needs was just as important as the PD's purpose and outcome goals. Embedded in the 3-day PD eLearning sessions are learning equitable discourse practices and types of scaffolding to support the academic vocabulary and language development in mathematics. The PD also provides a collaborative model for third through fifth grade mathematics teachers to collaborate with EL specialists to further promote planning and lesson preparation of the new curriculum.

The 3-day PD eLearning sessions were developed using Knowles' six principles of adult learning (Knowles et al., 2015), which provided a structure for the sessions that encouraged motivation and engagement, especially in an eLearning environment. For example, adult learners will be informed why it is necessary to learn what is being presented. The PD will reflect the needs of the learners as noted by their experience and background knowledge in the presurvey. Choices will be offered because this increases the learners' autonomy. Additionally, the instructional materials and discussions will provide opportunities to reflect upon practical uses in the classroom. Lastly, the instructor will take the stance as a facilitator and allow the learners to motivate themselves.

The 3-day PD eLearning sessions are based on the findings from the study's one-on-one interviews with participants teaching in third through fifth grade mathematics classrooms. The findings highlighted broader themes and categories about the teachers' experiences with new discourse practices and their specialized knowledge and skills for ELs' language development. Each of the 3-day PD eLearning sessions describes strategies and supports mathematics teachers and EL specialists can use to help with the implementation of the new pedagogical, student-centered discourse practices with ELs in third through fifth grade mathematics classroom. The PD provides instructional resources and pedagogical practices used to teach academic language and to support language development that may improve the instructional delivery for ELs in the third through fifth grade mathematics classroom.

A PowerPoint presentation outlines the goals and outcomes for the 3-day PD eLearning sessions. Each day's PowerPoint includes an opening activity, such as an ice breaker, opportunities for teacher reflection and discussion, group activities, and new learnings. The presentation was developed to support teachers and EL specialists with the implementation of new pedagogical, student-centered discourse practices to increase ELs' mathematical learning and achievement. Each participant will receive electronic copies of the PowerPoint presentations for all 3 days, ELP standards, related research, instruction strategies and types of scaffolds to support the learning of academic vocabulary, and strategies on language development as well as equitable discourse practice in the mathematics classroom. Furthermore, the participants will be given daily formative assessments to capture their learning during the 3-day PD eLearning sessions.

Review of the Literature

The study's results revealed that participants desired further PD to enhance their skills and knowledge to meet the language and academic needs of ELs in mathematics. Most importantly, the participants wanted EL specialists to be included in the PD. When thinking about how an adult learner learns best, Lindvall (2017) and Wei (2020) described adult learning as being active, not passive. PD should include opportunities for teachers to have meaningful interactions with their colleagues—to learn from one another as well as to grow as reflective practitioners (Anderson et al., 2018; Cirocki & Widodo, 2019; Garcés & Granada, 2016; Teo, 2018; Wei, 2020; Yu, 2018). Additionally, teachers should be empowered to negotiate their roles and responsibilities within the PD and be given time to take what they have learned and rebuild it into something they feel more suitable for their classroom (Durley & Ge, 2019; Wei, 2020; Yu, 2018). Most importantly, PD should feature processes that include participants' voice and feedback as well as collaborative conversations between the participants and facilitators (Cirocki & Widodo, 2019; Durley & Ge, 2019; Teo, 2018; Wei, 2020). These processes of learning resemble the foundational beliefs of student-centered pedagogical practices that teachers are experiencing in their own practice and align with this study's conceptual framework, Knowles's adult learning theory of andragogy.

The literature review for this project covers these four specific areas: (a) best practices for developing and presenting PD, (b) valuable PD eLearning, (c) teacher agency in PD, and (d) the reflective practitioner in PD. Recent, relevant research from peer-reviewed journals, educational and statistical publications, and professional texts were included in this literature review. The articles and reports were accessed from Walden University Library's multiple databases (e.g., ERIC system, What Works Clearinghouse), and the web-browser, Google. Key terms used to conduct my search inquiry included *adult learning, andragogy in education, best practices in PD for teachers, collaborative PD, growth mindset in PD, math PD for adult learners, PD in math, PD in math with ELs, teacher agency, online learning for adult learners,* and *reflective practitioners.*

The literature review provided pertinent information on how to develop and present effective eLearning PD to address this study's three themes: (a) learning structures, (b) discourse and equitable practices, and (c) professional development recommendations, which emerged from the 12 participants' interviews.

Best Practices for Developing and Presenting PD

Darling-Hammond et al. (2017) identified seven key elements for developing and presenting effective PD for educators. Of the 35 studies reviewed by Darling-Hammond et al., at least 30 of the 35 studies included most, if not all, of the elements in their PD recommendations. The key element "(a) is content focused, (b) incorporates active learning utilizing adult learning theory, (c) supports collaboration, typically in job-embedded contexts, (d) uses models and modeling of effective practice, (e) provides coaching and expert support, (f) offers opportunities for feedback and reflection, and (g) is of sustained duration" (Darling-Hammond et al., 2017, p. 1). The elements support teachers' learning and refining of pedagogical practices to assist them in their implementation of student-centered discourse practices, which are essential for orchestrating productive mathematical discussions (see Anderson et al., 2018; Darling-Hammond et al., 2017; Liao et al., 2017; Lindvall, 2017; Maass et al., 2017).

Content Focused

Content focused PDs place an emphasis on pedagogical practices related to subject-specific content, such as mathematics (Alamri et al., 2018; Anderson et al., 2018; Darling-Hammond et al., 2017; Lindvall, 2017; Pokhrel & Behera, 2016). For example, PD activities may involve examining instructional strategies related to equitable discourse practices to help enhance ELs' understanding of the mathematical content being taught (Kalinec-Craig, 2017). Other PD activities may involve a lesson analysis (e.g., resembling a lesson study) where teachers coconstruct a lesson that will be taught and analyzed with colleagues and then conclude with a reflection and evaluation about their experience (Alamri et al., 2018; Darling-Hammond et al., 2017). Other constructivist-related approaches may be used as well, such as inquiry, problem-solving, and learning cycles (Alamri et al., 2018; Maass et al., 2017). In Alamri et al.'s (2018) review of PD programs, researchers found that most PDs focused on the concentrated areas of teaching content knowledge, which consisted of subject matter, instructional practices, and pedagogical content knowledge. *Pedagogical content knowledge* refers to the concept and skills needed to teach the course content (Alamri et al., 2018).

Active Learning

Active learning provides opportunities for teachers to engage in hands-on activities that allow for sense making, a deep analysis of beliefs and proposed practices, as well as designing and practicing new pedagogical practices (Anderson et al., 2018; Darling-Hammond et al., 2017; Liao et al., 2017). This type of PD model encourages teachers to examine the lessons within the curriculum and to identify potential challenges/misconceptions for learners (Darling-Hammond et al., 2017). For instance, teachers may view lesson videos that build conceptual understanding of the skills and knowledge being taught (Darling-Hammond et al., 2017). Additionally, teachers may engage in the mathematical story problem prior to teaching the lesson to their students in order to experience the story problem themselves (Darling-Hammond et al., 2017).

Collaboration

In high-quality PD, collaboration is embedded by developing spaces for teachers to exchange ideas on the development of curriculum materials as well as to work in partnership with their colleagues on new instructional strategies being implemented in their classroom instruction (Allen, 2018; Darling-Hammond et al., 2017; Garcés & Granada, 2016; Lindvall, 2017). Collaboration may consist of one-on-one or small groups with other professionals in their building and/or beyond the school (Allen, 2018; Darling-Hammond et al., 2017). According to Pokhrel and Behera (2016), PD may also be structured in a variety of formats, which include (a) conference plans, (b) peer coaching, (c) preconference, (d) action research, (e) collaborative study groups, (f) individualized development plans, and (g) dialog journals. Other options are training, workshops, discussion blogs, conferences, and seminars (Pokhrel & Behera, 2016). Furthermore, PD may be structured in varying forms to support classroom teachers with ELs in their mathematics classrooms. One type of format may resemble pairing EL specialists with general education teachers to maximize teachers' professional learning and students' growth (Wei, 2020). Providing opportunities for teachers to exchange ideas and practices with other colleagues during the PD allows the teachers to engage in conversations that foster not only critical thinking but generate mathematical activities to implement in their classrooms (Piazza et al., 2020; Pokhrel & Behera, 2016).

Use of Models and Modeling

The use of models and modeling of best practices provide teachers an opportunity to observe how to effectively implement their new instructional strategies (Darling-Hammond et al., 2017). For instance, teachers may view examples of lesson plans, unit plans, and delivery of instruction on instructional videos (Darling-Hammond et al., 2017;

Piazza et al., 2020). Another model may include the sheltered instruction observation protocol (SIOP). Piazza et al. (2020) examined the use of the SIOP model for teacher PD. The researchers found that when this model was applied to PD, participants increased their areas of “lesson preparation, building background, strategies, interaction, practice/application, lesson delivery, and review/assessment” (Piazza et al., 2020, p. 382).

Coaching and Expert Support

Coaching and expert support offers teachers specialized knowledge by sharing their expertise about content and practice (Darling-Hammond et al., 2017; Piazza et al., 2020). Experts, such as master teachers or coaches may provide PD in one-on-one settings, in group workshops, or remotely using technology to provide eLearning with educators (Darling-Hammond et al., 2017). For example, remote coaching could resemble educators viewing a shared video with the coach providing detailed information about the video clips (Darling-Hammond et al., 2017).

Feedback and Reflection

Another key element of PD is feedback and reflection (Ankeny et al., 2019; Cirocki & Widodo, 2019; Darling-Hammond et al., 2017; Maass et al., 2017; Mathew et al., 2017; Yu, 2018). One way to embed feedback and reflection is to provide opportunities for critical self-reflection in coaching sessions or PD by creating time for teachers to think about their practice and solicit feedback (Darling-Hammond et al., 2017; Pokhrel & Behera, 2016). Frequently, teachers are not conscious of their instructional moves within their instruction, such as their delivery of directions, questions they pose to their students, responses to students’ queries, and other discussions within the lesson

(Teo, 2018). Activities, such as analyzing lesson plans, demonstrating a lesson, or viewing videos of teacher instruction, allow for feedback and reflection on what might be refined as well as reinforced in the lesson (Darling-Hammond et al., 2017).

Other possibilities included strategies for building stamina while practicing and honing feedback and reflection skills. A feedback strategy may include peer observations of lessons with the intention of collecting data on how students respond to new instructional strategies (Mathew et al., 2017). Some reflection strategies may include keeping a reflective journal, engaging in collaborative learning with a trusted colleague, and recording lessons to later view so as to develop a greater awareness of one's practice (Cirocki & Widodo, 2019; Mathew et al., 2017). As a result, PD allows teachers to reflect on and re-vitalized their thinking about their own teaching practices.

Sustained Duration

Sustained duration in strong PD initiatives encourages teacher learning over a period of time, such as weeks, months, or an academic year (Darling-Hammond et al., 2017; Lindvall, 2017). This allows for adequate time for teachers to not only learn new instructional strategies, but to practice, implement, and reflect upon these new strategies, which may assist in facilitating changes in their practice (Darling-Hammond et al., 2017). This element may also allow the facilitator to help teachers realize their own full potential by deepening their own understanding and awareness as self-learners (Pokhrel & Behera, 2016).

Valuable PD eLearning

Technology continues to play a significant role in education (Liao et al., 2017). Given the propensity of educators seeking eLearning experiences, it is important to find effective research-based models that will match or augment face-to-face PD (Otten et al., 2019). Currently, technology plays a greater role in teacher PD due to its accessibility (Gonçalves & Osório, 2018). PD is held primarily on virtual platforms, which allows for a wider range of participants (Otten et al., 2019). Herro and Quigley (2017) found that technology-mediated PD improved teachers' content and pedagogical practices, such as eLearning that offered teachers opportunities to collaborate with other teachers and experts across their community, throughout the country, and around the world Videoconferencing, online chats, and social media sites provided educators with unique ways of connecting and collaborating by forming online professional learning communities, which made adult learning more relevant and authentic (Cirocki & Widodo, 2019; Farrell, 2019; Widodo & Ferdiansyah, 2018).

Otten et al. (2019) developed a model for implementing online PD, which would build teacher capacity and improve their instructional practice in mathematics. The model consisted of three key components to increase the effectiveness of PD in synchronous and asynchronous eLearning settings. The components were (a) orchestrating mathematical discussions, (b) teaching labs, and (c) online video coaching (Otten et al., 2019).

Orchestrating Mathematical Discussions

The orchestrating mathematical discussions component aimed at leveraging the teachers' productive discussions online (Otten et al., 2019). A learning management system was used to allow synchronous whole group and small group discussions as well as asynchronous discussion threads (Otten et al., 2019). Virtual breakout rooms were used for participants to engage in synchronous work using a shared Word document, PowerPoint Slide, or virtual white boards. While in the breakout rooms, participants communicated with one another using their audio device or chat window. Meanwhile the presenter was able to move from one breakout session to another to provide support and address any questions as needed. Afterwards, the presenter was able to close the breakout sessions and the participants were automatically brought back together for a whole group session to debrief and reflect. The eLearning sessions may also be recorded so that participants may stream the video during an asynchronous learning time.

Virtual Teaching Labs

Teaching labs was another component that Otten et al. (2019) reported in their study. One of the challenges of online PD was to provide participants opportunities to learn complex instructional practices in an eLearning setting (Otten et al., 2019). Stigler and Hiebert's (1999) lesson study led to demonstration lessons crafted by a team of teachers called a teaching lab that later was built upon by the Teachers Development Group's (2010) studio classroom model (Lindvall, 2017; Otten et al., 2019). The teaching lab model consisted of a group of teachers developing a mathematical lesson in which one of the participants would teach online to a group of students and be recorded for later viewing by the team. The team of teachers (a) viewed the video online, (b) discussed the mathematical task of the lesson, (c) examined the learning goals related to CCSS-M practice and content standards, (d) focused on the teacher's productive discourse practices, (e) gathered evidence of student thinking and learning, and (f) collectively reflected on their personal experience of the process (Otten et al., 2019). This entire process may also be repeated continually.

Online Video Coaching

Based upon the models of West and Staub's (2003) content-focused coaching, the last innovative component was an online video coaching model (Otten et al., 2019). Online video coaching cycles focused on helping teachers identify and unpack their mathematics lessons (Otten et al., 2019). The online coaching experience involved synchronous and asynchronous sessions by conducting video conferencing conversations via Zoom or Microsoft Teams. For example, during a synchronous session, the coach and participant may collaborate on crafting a lesson plan, whereas an asynchronous session would give the participant an opportunity for post-lesson collaborative reflection by responding on a shared document or Microsoft Form survey. Additionally, teachers may video-record themselves using Swivl (Otten et al., 2019; Teo, 2018). Swivl allows the teacher to place their camera (e.g., iPhone or other electronic device) on a robot, which would track them around the classroom while videotaping. The video was automatically uploaded into a password-protected-site, which was accessible to view and annotate promptly. Swivl also allowed the coach and teacher to view and annotate the video separately, and the person viewing may pause the video at any time to type in a comment or question. This was beneficial to the coach and teacher because during the online coaching session, the coach may refer to the comment while viewing the video.

Furthermore, the annotations provided more substantive feedback for the teacher regarding their practice.

Teacher Agency in PD

There has been growing attention to teachers' roles in their professional development (Imants & Van der Wal, 2020). Teachers wanted to have a voice in what is being offered for them in their PD (Pokhrel & Behera, 2016; Wei, 2020). Often best practices and research-based programs were promoted and mandated from others outside the classroom setting (Wei, 2020). According to Wei (2020), teachers should be agents of their own PD. By encouraging teachers to be agents of their own learning, teachers may begin to negotiate their roles and responsibilities in the PD (Wei, 2020).

To foster teacher agency, Allen (2018) emphasized that teacher agency required a growth mindset. Teachers with a growth mindset, believe that learning contributed to their overall success (Allen, 2018) and challenges, obstacles, and setbacks were seen as opportunities for growth (Allen, 2018). Additionally, teachers with a growth mindset would freely admit and share their vulnerabilities with other colleagues regardless of the number of years they have taught (Allen, 2018).

Imants and Van der Wal (2020) described a model for analyzing the integration of PD and school reform from a teacher's agency viewpoint based on the review of research articles, of which 32 of 36 research articles portrayed teachers playing active, agentic roles in their PD. The model consisted of five basic characteristics, "(a) active role of individuals; (b) the dynamic character of the relationships; (c) the complexity of multiple levels in the work context; (d) the outcomes of PD and school reform as events in a continuing cycle; and (e) the inclusion of the content of PD and school reform" (Imants & Van der Wal, 2020, p. 11).

Reflective Practitioner in PD

A *reflective practitioner* is someone who systematical engages in reflection (Cirocki & Widodo, 2019; Maksimovíc & Osmanovic, 2018) and is dedicated to being a lifelong learner (Cirocki & Farrell, 2017). A *lifelong learner* is someone who engages in "a continuously supportive process which stimulated and empowered [teachers] to acquire all the knowledge, values, skills and understanding they would require throughout their lifetimes and to apply them with confidence, creativity and enjoyment, in all roles, circumstances, and environments" (Watson, 2003, p. 3). The practitioner tended to engage in ongoing reflection about their instructional practices (Cirocki & Farrell, 2017; Maksimovíc & Osmanovic, 2018) and it appeared that reflection may be a common practice with teachers who worked with ELs (Cirocki & Widodo, 2019; Farrell, 2019). However, it was only within this last decade that Teaching of English to Speakers of Other Languages recognized reflective practitioners as a well-established theoretical concept (Farrell, 2019).

During PD, teachers should be given multiple opportunities to examine their own instructional practices and make improvements in their lessons (Ankeny et al., 2019; Garcés & Granada, 2016). Knowles (1984) stated that PD was designed to provide the adult learner a cyclical experience. Papa and Jassica (2011) explained that adult learning would lead to reflection, action, and concrete reflection. Although studies revealed that critical self-reflection was an effective practice before, during and after the PD, teachers rarely took the time to reflect on their own pedagogical practices (Teo, 2018). One reason may be due to scheduling time that would allow for some reflection (Teo, 2018). Nevertheless, teachers' hectic teaching schedules and/or the lack of structured time for methodical reflection limited any form of sustainability (Teo, 2018). Sustaining a reflective practice may be challenging because it requires the teacher to "(a) acknowledge the theory and value of lifelong learning, (b) demonstrate strong motivation to learn, coupled with a sense of responsibility, (c) show clear self-perception, in addition to continual self-reflection and self-assessment, (d) display self-direction, self-adjustment and control of their learning process, (e) be effective in using diverse learning methods, strategies, approaches and resources to assist their own learning, and (f) assess the effects of their own learning and use their learning in solving problems, facilitating future learning" (Qinhua et al., 2016, p. 6-7). So, finding a more systematic structure within the PD may be a way to increase sustainability.

According to Cirocki and Widodo (2019), there were five formats of reflective practice for PD. These formats included "(a) writing reflective journals/diaries, (b) peer observation of teaching, (c) lesson study, (d) action research, and (e) reflecting with digital technologies" (p. 21). *Reflective journals* allow a teacher to digitally or hand reflect upon their classroom practices, noting their effective and noneffective practices, strengths, and weaknesses, as well as satisfactions, frustrations and to raise questions (Cirocki & Farrell, 2017; Cirocki & Widodo, 2019). A *peer observation* involves two or more practitioners engaged in observing each other's teaching within the classroom (Cirocki & Widodo, 2019). This format affords teachers opportunities to develop collegiality, construct feedback and reflect on one another's teaching practices as well as enhance their skills in receiving and giving feedback (Cirocki & Widodo, 2019). A *lesson study* format is a teacher-driven practice that involves teachers studying curriculum, lesson design, teaching, and student learning (Akiba et al., 2019). *Action research* format is a structured and interactive process that engages teachers in asking questions about their practice in order for them to learn from their experiences and develop a plan of action (Cirocki & Widodo, 2019). Lastly, *reflecting with digital technologies* format uses digital photography, video recording, personal blogs, or even Facebook to analyze and observe the classroom dynamics in action as well as replay for further analysis (Cirocki & Widodo, 2019; Farrell, 2019; Widodo & Ferdiansyah, 2018). These tools afford teachers an opportunity to verbalize their reflections and respond to each other's feedback (Tajeddin & Aghababazadeh, 2018). All of these formats empower teachers to engage in critical conversations and reflections.

Project Description

The project I developed consists of 3-day PD eLearning sessions for third through fifth grade teachers working with ELs in the mathematics classroom. According to my study's findings, teachers indicated that they would like further support and learning on (a) language development and academic vocabulary, (b) new math curriculum, (c) math talk strategies, and (d) to increase collaborative learning with third through fifth grade mathematics teachers and EL specialists as well as a partnership between the district and local universities for extended learning opportunities. The project is created from the three themes in the findings of the study (1) learning structures, (2) discourse and equitable practices, and (3) professional development recommendations. This project's primary goal is to provide instructional guidance for teachers' student-centered discourse practices with ELs. This includes learning how to scaffold ELs' language development and academic language in mathematics. The secondary goal is to provide a collaborative learning partnership between third through fifth grade mathematics teachers and EL specialists to enhance their instruction with ELs in mathematics. As a result of the 3-day PD eLearning sessions, third through fifth grade mathematics teachers and EL specialists will receive research-based instructional strategies and tools to assist them in their implementation of equitable opportunities for ELs to access the cognitive demands and the academic vocabulary in the mathematics curriculum.

The PD for Day 1 includes an overview of the sessions for each of the 3 days as well as agendas outlining the eLearning sessions' overall goals and outcomes. Day 1 will focus on using scaffolded instructional tools, which includes (a) understanding how academic language affects ELs in mathematics, (b) identifying effective scaffolds of support for ELs, and (3) identifying and selecting scaffolds that will support the academic language in mathematics curriculum for ELs. At the end of Day 1, participants will receive a formative assessment with reflective questions related to the PD.

Day 2 will focus on using equitable discourse practices. This includes (a) understanding language challenges that are inherent to mathematics, (b) providing equitable discourse opportunities for ELs to engage in mathematics, and (c) learning scaffolded supports to promote student-centered discourse that is equitable and accessible for all learners. At the end of Day 2, participants will receive a formative assessment with reflective questions related to the PD.

Day 3 will focus on promoting language in the mathematics classroom. This includes (a) learning about the four design principles that promote language in mathematics, (b) learning how the eight mathematics language routines encourage and promote language in mathematics, and (c) collaborating with colleagues for lesson planning and lesson development using the four design principles and eight mathematics language routines as a lens. At the end of Day 3, participants will receive a brief exit evaluation related to all 3-day PDs.

Throughout the 3-day PD eLearning sessions, participants will be given opportunities to examine their relatively new mathematics curriculum to construct and discuss one of the grade-level units. Participants will be grouped into breakout sessions to work with specific grade-level materials. These small groups include grade-level mathematics teachers, third through fifth grade and EL specialists. At the end of the 3-day PD eLearning session, participants will be given a brief formative assessment that asks about what portion(s) of the PD were potentially most beneficial.

Potential Barriers and Potential Solutions to Barriers

There are potential barriers with these proposed 3-day PD eLearning sessions. The PD is completely optional. Therefore, participants, third through fifth grade teachers and EL specialists, may elect to attend. Participants may also decide to not attend all 3 days and/or they may only attend partial sessions. Participants may not be able to receive compensation for their attendance. Hence, this could create some limitations for the facilitator when setting up collaborative group work in a virtual setting because there may be a varied number of teachers at each of the three grade levels as well as a limited number of EL specialists. Lastly, there may be other PDs being offered by the district at the same time as these sessions.

Proposal for Implementation and Timetable

The proposed plan will be presented to the EL director and curriculum and instruction director in the Fall of 2021. I will schedule a time to discuss my study's project, 3-day PD eLearning sessions, and to review my PowerPoints. The individuals will be debriefed on the goals and proposed outcomes as well as topics being addressed for each of the 3 days. Ideally, the sessions would be offered as virtual PD sometime during the school year, 2021 to 2022. However, the final decision to offer this PD as well as the timing of the PD, the number of participants, and interested parties involved will be determined by the district administrators who oversee the PD for certified staff.

My Role and Responsibility

My role and responsibility will be to present my project study to district administrators. I am willing to (a) organize the meetings with district administrators, (b) facilitate communication between all administrators, (c) assist in coordinating the professional development sessions, as well as (d) ensure that all resources, equipment, and location outlined are available and secured.

For this project, I am including 3-day PD eLearning sessions that may be implemented by the district to further support teachers' student-centered discourse practices with ELs. Moreover, I would welcome the opportunity to be involved in this partnership and/or provide the instruction for these 3-day PD eLearning sessions that focus on collaboration with third through fifth grade mathematics teachers and EL specialists.

Project Evaluation Plan

This project uses formative assessments to elicit from participants portions of the PD that they found most beneficial. Reflective practice is an important tool, and it plays an essential role in teachers' PD (Mathew et al., 2017). Teaching is complex and deliberate reflection is essential (Mathew et al., 2017). Therefore, by providing participants opportunities to question what they are learning and determine how it is applicable to their practice empowers teachers to take ownership of their own learning.

Evaluation Goals

The goal of the formative assessments (e.g., daily reflections) is to afford the participants an opportunity to reflect on what they have learned during their participation in the PD eLearning sessions. Importantly, the formative assessments will help determine the project's effectiveness. Each day the participants will be asked to complete an exit evaluation, which includes reflective questions related to the day's presentation. For example, the exit evaluations for Day 1 and 2 will include questions about a new strategy they have learned, a strategy they will try implementing, as well as questions they would like to have addressed at the next session(s). On the third day, participants will be asked to provide feedback regarding the portions they found beneficial (e.g., What did you find most beneficial about these PD eLearning sessions?) as well as the portions that were less effective for their practice (e.g., What would you change? What would you like to see instead?). Lastly, these evaluation results may offer ideas for future PDs.

Key Stakeholders

The key stakeholders for this project include third through fifth grade teachers who work with ELs in mathematics classrooms as well as EL specialists who provide EL support in these grade levels. Participants will benefit in engaging in rich discussions and learning alongside one another during these collaborative eLearning sessions. The 3-day PD eLearning sessions will provide new pedagogical, student-centered discourse practices to increase ELs' mathematical learning, scaffolds of support for academic language and language development in mathematics, and opportunities for teachers to work with EL specialists in the mathematics content area.

Project Implications

The project is created to facilitate positive social change for mathematics teachers, EL specialists, and district administrators. This project is based on the participants' perspectives, third through fifth grade mathematics teachers, who are at schools with highly ethnically and racially diverse populations of ELs. The 3-day PD eLearning project is a model that may be implemented as is or modified to align to the targeted needs in this study's individual district as well as other school districts.

Teachers are experiencing a change in practice, from teacher-centered to student-centered, which affects their work with ELs in third through fifth grade mathematics classrooms. The implementation of student-centered discourse practices is essential to orchestrating productive mathematical discussions. The information provided in this project includes research-based instructional strategies on how to meet ELs' language demands in mathematics as well as how to increase accessibility for ELs using student discourse with the intention of improving student learning. Importantly, these research-based strategies may be used with all learners, not just ELs.

Importance of Project in a Larger Context

This project has the potential to reach a much larger context of educators throughout the United States because it is not exclusive to one area. The PD is a model that presents the best practices of effective PD and therefore, may be replicated in other content areas as well. Additionally, the information provided in this project study is adaptable and may be adjusted to meet the individual needs of other districts. The 3-day PD eLearning sessions are a model for other districts to replicate and further expand based on their own needs assessment and district values and beliefs. Other districts may use the PD in this project to support educators within their districts to meet the academic language and language development needs (e.g., linguistic demands) of ELs in mathematics instruction. Academic language and language development can sometimes be misidentified as opportunity gaps in mathematics learning because of cultural differences or proficiency language levels related to math terminology. The scaffolds of support embedded in this PD provide recommendations for addressing the language demands in mathematics as well as the ELs' current English language proficiency levels.

Mathematics instruction for ELs requires scaffolds of support for academic language and language development in mathematics. According to Sprenger (2017), academic language cannot be ignored. Providing effective communication in the mathematics classroom involves multiple modes of discourse practices that expand beyond just basic conversation (Moschkovich, 2012). In the 21st century, teachers need to be provided with multiple opportunities to make significant changes regarding their pedagogical practices for all learners. Teachers also need PD that encourages real communication through discussions and affords opportunities to engage in conversations in their home language. Moreover, it is critical to the success of ELs to engage in complex, rigorous tasks, especially because academic language plays an important role in students' success on standardized tests (Beck et al., 2013; Marzano, 2004).

Section 4: Reflections and Conclusions

Project Strengths and Limitations

The project's strengths relate to the design and development of PD for educators working with ELs in the mathematics classroom. This study included third through fifth grade teachers who have an average of four spoken languages in their classrooms. The design and development of the 3-day PD eLearning sessions are based on Knowles's (1984) adult learning theory of andragogy, which takes into consideration the foundational principals and assumptions about adult learners. Andragogy emphasizes the importance of PD providing opportunities for the adult learners to be self-directed and take responsibility for their own learning (Knowles, 1984). This project takes into consideration the needs of the adult learners for PD that is focused on the areas recommended by the participants in this study. Other strengths of this project that are crucial to the success of ELs in the mathematics classroom are (a) a focus on the development of ELs' academic vocabulary in mathematics, (b) an understanding of ELs' language development that includes the use of ELP standards, (c) ways to provide scaffolded instruction for ELs, (d) a list of evidence-based student-centered discourse practices that are equitable for all learners, and (e) time to collaborate and plan with third through fifth grade teachers and EL specialists.

The first strength of the project is that the PDs are based on an understanding of the principles of adult learning informed by the work of Knowles (1984). Study participants expressed a desire to receive collaborative training with third through fifth grade mathematics teachers and EL specialists. Thus, opportunities for collaboration are embedded throughout the 3-day PD eLearning sessions.

The second strength of this project is that it includes PD that embeds evidence-based, student-centered discourse practices with scaffolded instruction for the participants. Therefore, the PD focuses on providing varying types of instructional scaffolds that effectively support ELs in equitable opportunities to engage in student discourse.

Another strength of the project is that it includes ample time for third through fifth grade teachers to collaborate with EL specialists in planning a math unit for the coming year. The participants in this study commented on the need for this collaborative effort as well as their desire for the school district to collaborate with a local university. Although the PDs are intended for the school district's third through fifth grade teachers and EL specialists, this model is transferable and may be replicated to include collaboration with a local university.

There are also several limitations to this project. The first limitation is that although I am willing to take on the task of facilitating this 3-day PD, I would be the only facilitator, and, therefore, the participants would not learn and hear the experiences of other professionals who are experts in mathematics and English language acquisition. Lastly, the project provides only 3-days of PD eLearning sessions. Further ongoing PD in these areas would be recommended to continue throughout the school year to facilitate implementation at each of the schools for sustainability purposes.

Recommendations for Alternative Approaches

Education has greatly changed due the worldwide pandemic in 2020 through at least 2021. Teachers are grappling with how to increase student engagement with online tools that promote student discourse. Teachers are also struggling with meeting the needs of ELs in the remote online learning environment. Given the increased use of technology with remote learning, another project I might have developed based upon my study would have included PD for mathematics teachers, third through fifth grade, to explore and examine ways to use some of the new technology tools, such as Flipgrid (2021) and Nearpod (n.d.) to increase student discourse, especially with ELs. Additionally, PD has shifted to online learning for educators, and, therefore, educators are quickly learning how to engage in collaborative conversations through Zoom and TEAMS. Thus, another project for this study could have included additional technology tools, such as Padlet (n.d.) and shared Google Docs (Google, n.d.) for engagement and collaboration of adult learners in PD.

Alternate definitions and solutions to the problem addressed by this study could have focused on teachers' struggle to determine whether an EL's academic problems with student discourse stem from a language acquisition need or some other factor(s). For example, RQs for this study could have inquired about the schools' processes for identifying ELs with language acquisition needs. Questions might have addressed multitiered systems of support for early intervention strategies for ELs, whether ELs were being under- or over-identified for special education services, or -how the multitiered systems of support determined the best academic supports for ELs.

Additionally, this study could be conducted on a larger scale and include other grades at the elementary level because this study's findings with 12 participants has limited transferability. Also, the study could have included other teachers besides general education teachers, such as special education teachers and EL specialists.

Finally, research should also include not only high poverty schools with at least 10% EL populations but also more affluent schools with ELs to gain a more in-depth perspective. A future study might also include schools with dual language programs in mathematics.

Scholarship, Project Development and Evaluation, and Leadership and Change

I learned several things about myself as a result of this study and its project. As a scholar, I focused solely on being a researcher. This required me setting aside my roles as an instructional coach, a K to 3 collaborative teacher, a guest lecturer at a local university, as well as my former role as an assistant principal. Instead, I learned how to conduct a qualitative study that involved interviewing participants. During these interviews, I had to refrain from imposing my own viewpoints, personal prejudices, and assumptions to solely hear what the participants' experiences were in relation to my study's problem. According to Merriam and Tisdell (2015), researchers are to depict the essence of the experience as well as to explore their own personal prejudices, viewpoints, and assumptions related to the phenomenon. Moreover, during the analysis of data, I learned how to identify trends and develop possible solutions. This careful analysis facilitated my development of the study's project.

The data analysis strengthened my ability to collaborate with leadership to use data in support of setting achievable building goals and district initiatives. I could more readily access, generate, collect, and organize my data from multiple sources and use the information to reflect upon as well as communicate to my building principal the impact my coaching had with teachers and students. Moreover, I was able to support classroom teachers by engaging them in ongoing cycles of instructional planning using the multiple data points I had gathered to assist in analyzing their students' academic growth in order to establish new growth goals.

As a project developer, I learned how to apply my skills as a researcher when designing this project. For example, the use of Darling-Hammond et al.'s (2017) seven key elements assisted in designing effective PDs for each of the 3 days. These included elements related to mathematics, adult learning theory, structures that promoted collaboration, models of effective practice, coaching/expert support, feedback/reflection, and sustainability. These elements were important to include because they supported teachers' learning and refinement of pedagogical practices.

In my role as an instructional coach, I felt more confident in my abilities to model high yield strategies as well as support teachers by modeling how they may include these strategies into their instruction. I was also able to assist teachers in making informed decisions about their practice and address next steps for student learning after reviewing the collected student data. Additionally, I met with teachers to help examine their data to identify inequities within the classroom.

Lastly, as a practitioner, the research and examination of multiple peer-reviewed sources to inform this project provided me with depth of knowledge for the development of effective PD. This depth of knowledge was invaluable because of the numerous PDs I develop and create for K to 5 teachers at my school. I learned how to effectively engage staff in virtual PDs as well as to craft and develop reflective questions. Importantly, my PD sessions encouraged collegial inquiry and dialogue with the use of protocols and other structures for high levels of engagement.

Being a practitioner, I am more devoted in finding solutions when presented with a problem of practice. I am constantly working with teachers to help them use data to inform their instruction as well as develop PDs that provide student-centered practices for engaging students, such as ELs in the virtual and classroom settings.

Reflection on Importance of the Work

Although this study had a limited number of participants, the data collected and the findings of this study will be beneficial for the school district, the participants, other outside agencies, and local universities. The project was based solely on the participants' responses during the interviews and their desire to have a collaborative PD with EL specialists that included (a) language development, (b) new curriculum support, (c) math talk, and (d) collaborative supports. I enjoyed listening to the participants' responses and their reflections on areas for future PD related to their current practices and challenges they encounter while teaching ELs mathematics. Finally, it was helpful for me to affirm that teachers really know what they want and recognize areas that would further develop their skills as they juggle the cognitive demands of the mathematics curriculum while supporting ELs with their literacy skills, academic language, and English language structures.

Implications, Applications, and Directions for Future Research

In this study, I analyzed teachers' personal experiences and their perceptions of their instructional practices with ELs in the mathematics classrooms. I found that there were positive implications for social change, not only for the third through fifth grade teachers but also for the EL specialists who will help facilitate ELs' academic and language proficiencies as well as their academic growth.

The implication for positive social change is that this 3-day PD eLearning project may be implemented as presented or modified to align to the targeted needs of the school district as well as other school districts. The research-based instructional strategies are for developing ELs' language demands in mathematics. However, these strategies may be used with all learners. This study also has the potential to be replicated by other educational organizations, such as the school of education department at private and state universities.

Mathematics teachers, EL specialists, district administrators, and other outside agencies all have the opportunity to be affected by this social change. If teachers could acquire more knowledge and skills for providing scaffolded instruction for academic and language development in mathematics, teachers could potentially feel more confident in meeting ELs' language demands in mathematics as well as how to increase accessibility for ELs using student discourse with the intention of improving student learning.

Recommendations for Future Research

It would be beneficial to conduct a qualitative study that includes EL specialists as well as special education teachers. ELs have also been identified with learning disabilities and the collaboration with special education and EL education would be critical to promoting ELs' academic and linguistic development in mathematics. However, many special education teachers and EL specialists continue to work in isolation—focusing only on their own specialized areas (Kangas, 2017). Thus, special needs ELs are receiving fragmented instruction in mathematics. Kangas (2017) provided specific strategies for cocreating individualized education programs to help special education teachers and EL specialists build collaborative relationships that benefit ELs' learning. Therefore, future researchers may want to study the challenges that special education teachers and EL specialists have in addition to the general education classroom teachers who provide mathematics instruction to ELs. Additionally, PDs may be designed that provide ample time for the general education teachers, special education teachers, and EL specialists to plan differentiated lessons in mathematics.

Conclusion

The shift of practice from teacher-centered to student-centered has redefined the roles of teachers and ELs in the third through fifth grade mathematics classrooms. Academic and language demands have increased in the classroom due to the standards of mathematical practice and the CCSS-M. Therefore, teachers are expected to engage ELs in productive discourse activities. However, there seems to be a lack of explicit instruction for how to do this. To support teachers in addressing increased language demands that are necessary when engaging ELs in student-centered discourse, research that describes teachers' perceptions and gives teachers a voice regarding their instructional challenges is needed.

It is essential to offer PD that supports teachers' need to be able to explicitly teach ELs the language of mathematics as well as the academic language of mathematics by providing scaffolds of support. If teachers could acquire more knowledge and skills for providing scaffolded instruction for academic and language development in mathematics, they could potentially feel more confident in meeting ELs' language demands in mathematics as well as how to increase accessibility for ELs using student discourse with the intention of improving student learning.

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Appendix A: The Project

Three-Day Professional Development Sessions for Third Through Fifth Grade Mathematics Teachers and English Learner Specialists

This study's project was shaped by the findings derived from semistructured interviews with 12 teachers who taught mathematics (third through fifth grade) at high poverty schools with at least 10% ELs. The teacher participants had at least three or more years of mathematics teaching experience that included more than one grade level. Based on the collected data, teachers expressed that they wanted further support and learning on the following topics (a) language development and academic language, (b) new math curriculum, (c) math talk strategies, and (d) to increase collaborative learning with third through fifth grade mathematics teachers and EL specialists as well as a partnership between the district and local universities for extended learning opportunities.

This project includes a recommendation for 3-day professional development (PD) eLearning sessions for teachers working with English learners (ELs) in the third through fifth grade mathematics classroom. I am proposing that the district consider including these potential topics in future collaborative PD efforts for mathematic teachers third through fifth grade along with the ELs specialists who provide services for this age group. This PD could potentially be offered during the school year, 2021 to 2022.

Additionally, the district's mathematics and EL departments could collaborate and present these 3-day PD eLearning sessions together. The social change implication allows for this project, which is a model, to replicated with other age groups as well as with other content areas. Furthermore, the instructional strategies being taught in the PDs are best practices for all learners. The mathematics department in 2018 created an instructional framework that contains the overall structure that envisions what best practices in mathematics teaching and learning should emulate in this district's PreK to 12 classrooms. My project aligns with this framework, which also includes the CCSS-M, Eight Best Practices in Mathematics, Equity, and Mathematical Mindset. Therefore, my project provides a foundation for all PD for educators.

A cohesive partnership between the named departments would greatly enhance the learning for all teachers needing additional support for implementation of these new pedagogical, student-centered discourse practices with ELs' in the third through fifth grade mathematics classroom. Therefore, this project's 3-day PD eLearning sessions could encourage an alliance to further support teachers' student-centered discourse practices with ELs. Moreover, I would welcome the opportunity to be involved in this endeavor.

Audience

The 3-day PD eLearning sessions are proposed for the district's future PDs next school year, 2021 to 2022. I am recommending that these eLearning sessions include third through fifth grade mathematics teachers as well as EL specialists who are interested in learning instructional strategies that support ELs' language development as well as their academic language in mathematics.

Formative Assessments

Day One: Reflections

1. What excited/interested me about this topic?
2. What new skills, information or understanding have I taken away from this session?
3. What is something I am still wondering about?

Day Two: Reflections

1. What excited/interested me about this topic?
2. What new skills, information or understanding have I taken away from this session?
3. What is something I am still wondering about?

Day Three: Reflections

1. What are three strategies you will commit to using during the school year?
2. What did you find most beneficial about these PD eLearning sessions? What would you change? What would you like to see instead?
3. What question(s) do you still have at this time?

Timeline

Agendas for 3-Day Professional Development Institute

Day One

Improving ELs' Academic Language in Mathematics: Using Scaffolded Instructional Tools

Agenda

8:30 a.m.	Welcome, Norms, Overview of Sessions, Today's Learning Goals
8:45 a.m.	Define Academic Language & Three Language Components - Language Component: Vocabulary
9:30 a.m.	Breakout Session: Vocabulary (includes 5 min. break)
10:00 a.m.	Continue w/ Three Language Components - Representing Information - Student Discourse
10:30 a.m.	Breakout Session: Representing Information & Student Discourse (includes 5 min. break)
11:45 a.m.	Return to Whole Group for Debrief
12:00 p.m.	Lunch
1:00 p.m.	Macro vs. Micro Scaffolding - Read Article: WIDA Focus On Scaffolding learning for multilingual students in math. - Breakout Session for Discussion
1:45 p.m.	Four Types of Instructional Scaffolds
2:15 p.m.	Breakout Session: Collaborate with Grade-level Teams & EL Specialists - Lesson Planning w/ Instructional Scaffolds
3:15 p.m.	Return to Whole Group for Recap and Reflections of Learning
3:30 p.m.	Final Words & Formative Assessment

Day Two

Improving ELs' Academic Language in Mathematics: Using Equitable Discourse

Agenda

8:30 a.m.	Welcome, Norms, Today's Learning Goals
8:45 a.m.	Language Challenges for ELs
9:15 a.m.	Equitable Discourse
9:30 a.m.	Breakout Session: Equitable Discourse (includes 5 min. break) - Read Article: Six strategies to close math gaps for ELs: For Latino English language learners in elementary and middle schools (Hudson, 2015). - Breakout Session for Discussion
10:00 a.m.	Return to Whole Group to Share
10:15 a.m.	Discourse Practices - Benefits of Discussions for ELs - Ways to Structure Discourse - Teacher & Student Discourse Moves
11:30 a.m.	Breakout Session: Teacher & Student Discourse Moves
12:00 p.m.	Lunch
1:00 p.m.	Discourse Scaffolds
1:45 p.m.	Breakout Session: Collaborate with Grade-level Teams & EL Specialists - Lesson Planning w/ Instructional Scaffolds for Discourse
3:15 p.m.	Return to Whole Group for Recap and Reflections of Learning
3:30 p.m.	Final Words & Formative Assessment

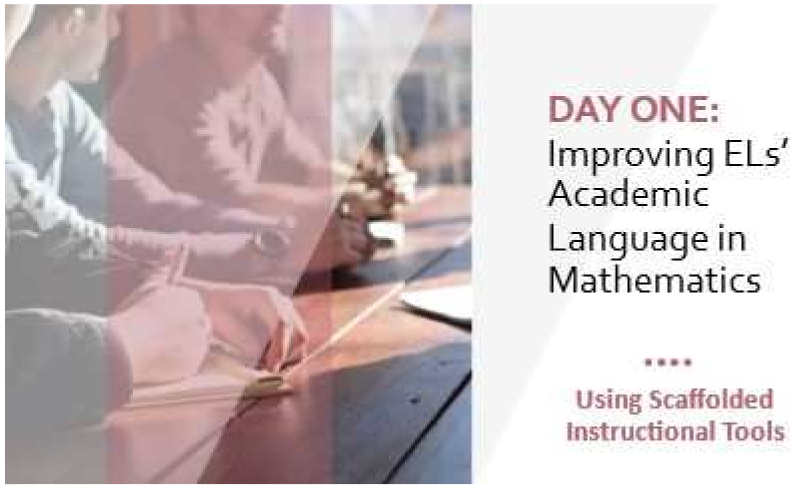
Day Three

Improving ELs' Academic Language in Mathematics: Using Equitable Discourse

Agenda

8:30 a.m.	Welcome, Norms, Today's Learning Goals
8:45 a.m.	Promoting Language in Math for ELs - 4 Design Principles - 8 Math Language Routines (MLRs)
9:45 a.m.	Breakout Session: Math Language Routines (includes 5 min. break) - Refer to Article: Principles for the design of mathematics curricula: Promoting language and content development (Zwiers et al., 2017). - Breakout Session to Complete Shared Document of 1 of 8 MLRs
10:15 a.m.	Return to Whole Group to Share
10:45 a.m.	Breakout Session: Collaborate with Grade-level Teams & EL Specialists - Lesson Planning using MLRs
11:45 a.m.	Return to Whole Group for Reflections of Learning
12:00 p.m.	Lunch
1:00 p.m.	Collaborative Work
1:15 p.m.	Breakout Session: Collaborate with Grade-level Teams & EL Specialists - Lesson Planning w/ Instructional Scaffolds for Discourse, etc.
3:15 p.m.	Return to Whole Group for Recap and Reflections of Learning
3:30 p.m.	Final Words & Formative Assessment

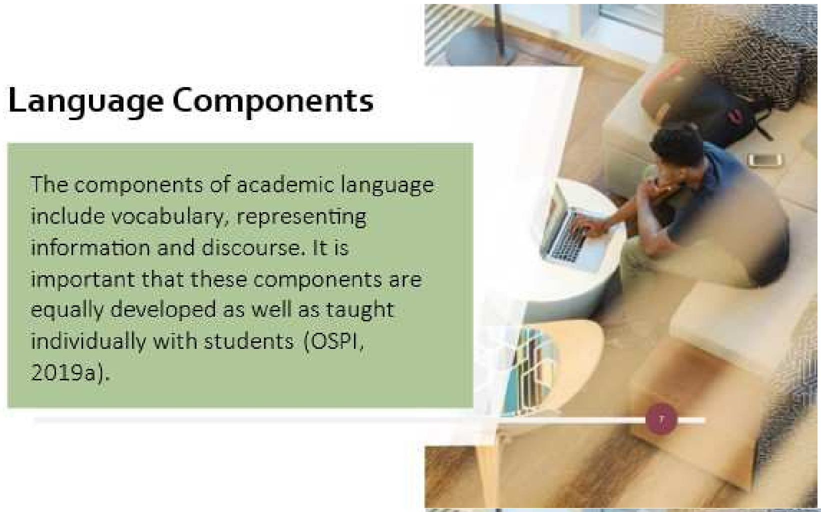
Power Point Presentations



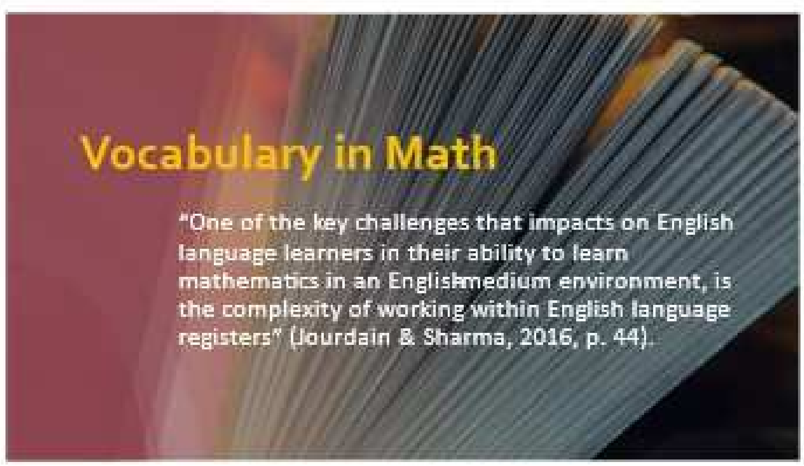

Academic Language can be defined as
1) language used in the classroom
2) language of text
3) language of assessments
4) language of academic success
5) language of power.
Crosson et al., (2020)


Informal Language vs. Academic Language
Informal language is the social language we use everyday to communicate with one another. For example, when students are talking with their friends on the playground, interacting with their families, or having a conversation with theirteachers (Colorín Colorado, 2019).
Academic Language is the language that is essential to a students' success in school. This language relates to what is being taught in the various content areas, such as math, science, social studies, and English language arts (Colorín Colorado, 2019).


Why is academic language important?
Academic language is essential for a student's academic success. Students use this language in varying in content areas. It is how a student communicates their understandings of complex concepts in mathematics (OSPI, 2019a).


Language Components
The components of academic language include vocabulary, representing information and discourse. It is important that these components are equally developed as well as taught individually with students (OSPI, 2019a).


Language Components
• Vocabulary
• Representing Information
• Student Discourse
(OSPI, 2019a)


Vocabulary in Math
"One of the key challenges that impacts on English language learners in their ability to learn mathematics in an English-medium environment, is the complexity of working within English language registers" (Jourdain & Sharma, 2016, p. 44).

Mathematical Registers: What does this mean?

Halliday's (1978) seminal work provided a definition of a register: "A register is a set of meanings that is appropriate to a particular function of language, together with the words and structures which express these meanings" (p. 195).

Mathematical Registers: Pose Challenges

The mastery of the mathematical registers requires strong linguistic and metalinguistic skills (Jourdain & Sharma, 2016).

For a student from an English-speaking background, mathematical registers can pose a significant challenge, as a new form of language must be learned and mastered (Jourdain & Sharma, 2016).

Three Significant Challenges for ELs

1. ELs are expected to learn English while also working within the English mathematical registers.
2. ELs may require more processing time to solve the mathematical problems.
3. ELs can easily miss out on the mathematical learning because ELs are focused on trying to understand the math questions as well as navigating the mathematical registers (Jourdain & Sharma, 2016).

Vocabulary in Math

Vocabularyis another very crucial component of elementary mathematics. Without explicit vocabulary instruction, students are more likely to become confused, frustrated, and possibly even angry. Additionally, students lacking basic math vocabulary are likely to not comprehend the information and, as a result, fall behind(Jourdain & Sharma, 2016).

Vocabulary in Math

- Tier I – Words with varying meanings that are subjectbased.
  (e.g., table, ruler, even, times, square, etc.)
- Tier II – Academic vocabulary used in other disciplines.
  (e.g., compare, analyze, evaluate, describe, etc.)
- Tier III – Subject specific words/symbols used only in math.
  (e.g., numerator, denominator, divisor, ÷. ≥, ≤, x, etc.

Stanford Center for Assessment, Learning, and Equity(2018)

Symbols in Math

Symbols help our students to interpret and demonstrate their mathematical thinking and it is helpful to provide students multiple opportunities to practice how the symbols represent quantities (OSPI, 2019a).

Examples of Symbols in Math

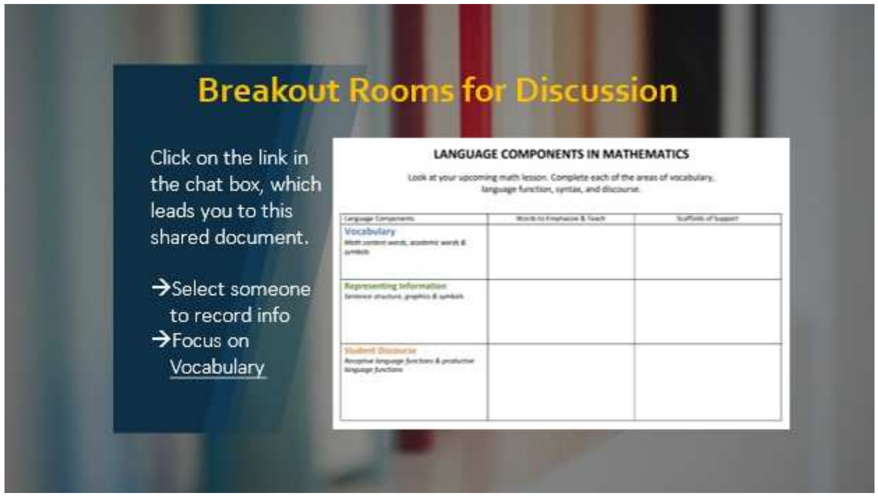
Symbol	= (equal sign)	Symbol	+ (plus sign)
Meaning	same, equal to	Meaning	add, plus, put together
Example	3 + 2 = 5	Example	4 + 3 = 7
Symbol	- (minus sign)	Symbol	X (multiplication sign)
Meaning	subtract, take away	Meaning	times, repeated addition
Example	5 – 4 = 1	Example	2 x 5 = 10

Adapted from Weebly (n.d.)

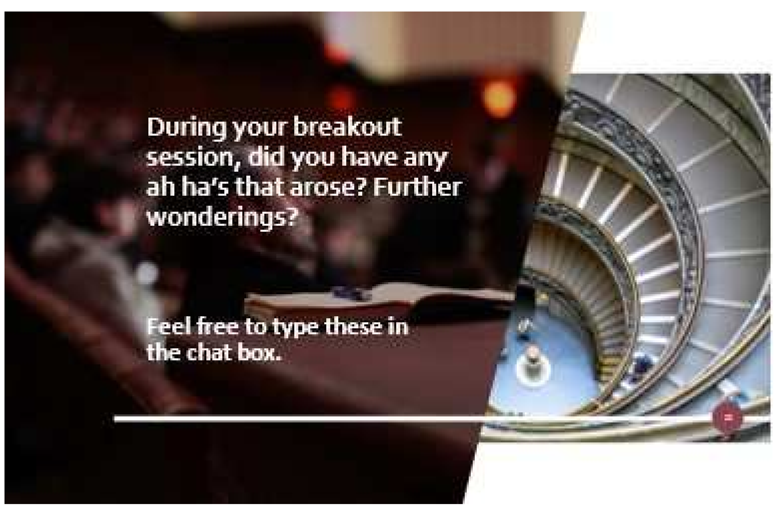
Vocabulary in Math: Tier III

Tier III Words	**Content specific, low frequency use**
Addition	Adding 2 or more number that equals a larger amount.
Subtraction	Difference between 2 or more values.
Multiplication	Repeated addition (2 + 2 + 2 = 6 or 3 x 2 = 6)
Division	Parts of the whole
Sum	Total amount of 2 or more numbers

Adapted from Weebly (n.d.)


Breakout Rooms for Discussion
Click on the link in the chat box, which leads you to this shared document.
→Select someone to record info
→Focus on Vocabulary
LANGUAGE COMPONENTS IN MATHEMATICS
Look at your upcoming math lesson. Complete each of the areas of vocabulary, language function, syntax, and discourse.
Vocabulary
Representing Information
Student Discourse


You'll have 30 minutes to work on the vocabulary component.
This includes a 5-minute break


During your breakout session, did you have any ah ha's that arose? Further wonderings?
Feel free to type these in the chat box.

Why Teach Sentence Structure?

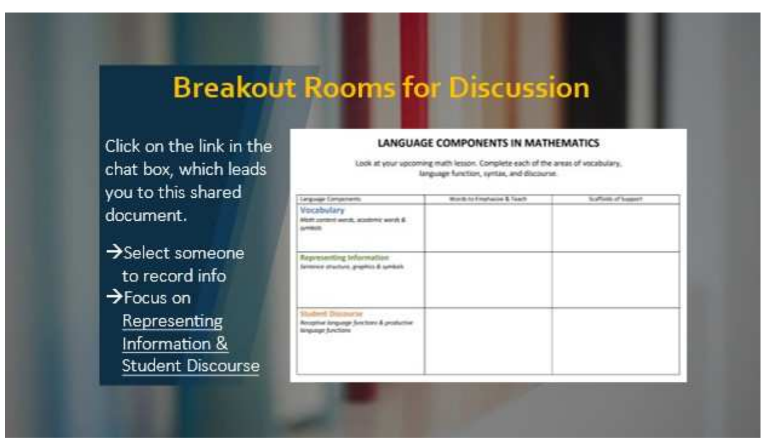
Students are expected to interpret and represent information in mathematics (OSPI, 2019a). Therefore, these skills need to be explicitly taught because it requires students to not only read and write, but to interpret and explain their mathematical thinking using symbols and graphic representations (OSPI, 2019a).

Discourse Elements

Student discourse involves receptive language includes listening and reading, whereas productive language includes speaking and writing skills (OSPI, 2019a).

What is Language Function?

Language function are the outcomes of what we expect students to be able to do within a math lesson. For example, we may want them to explain their strategies, compare the lengths of two objects, or describe the attributes of a triangle (Galante, 2015).

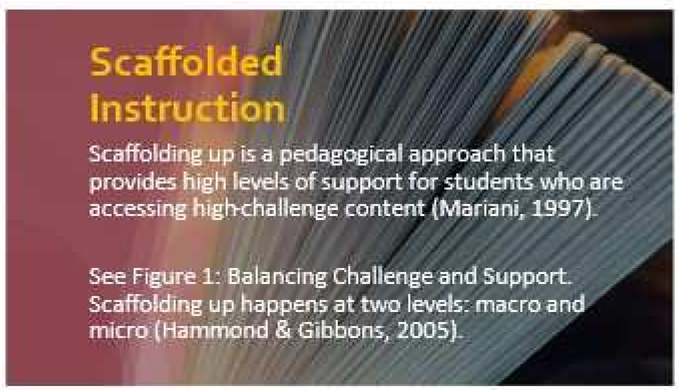


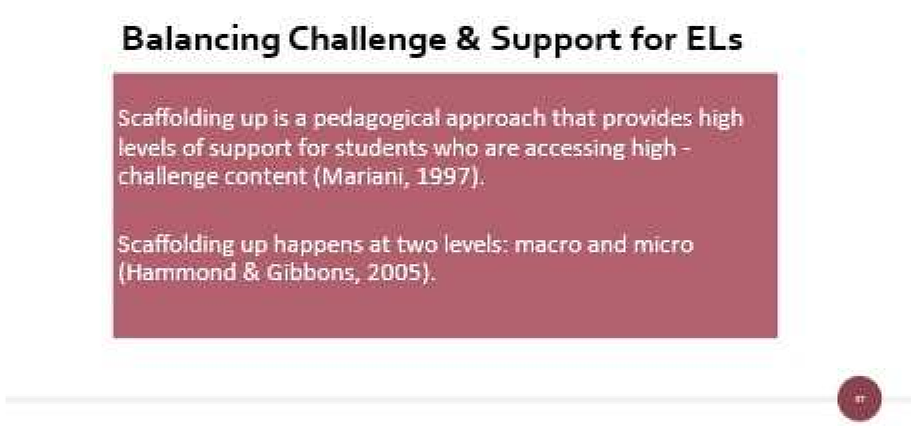

You'll have 90 minutes to work on the remaining components.
This includes a 5-minute break


During your breakout session, did you have any ah ha's that arose? Further wonderings?
Feel free to type these in the chat box.


LUNCH BREAK
You will have an hour to break for lunch
Return online at 1:00 p.m.


Welcome back!
Take a moment to reflect upon this morning's work and share one takeaway in the chat box.


Scaffolded Instruction
Scaffolding up is a pedagogical approach that provides high levels of support for students who are accessing high-challenge content (Mariani, 1997).
See Figure 1: Balancing Challenge and Support. Scaffolding up happens at two levels: macro and micro (Hammond & Gibbons, 2005).


Balancing Challenge & Support for ELs
Scaffolding up is a pedagogical approach that provides high levels of support for students who are accessing high - challenge content (Mariani, 1997).
Scaffolding up happens at two levels: macro and micro (Hammond & Gibbons, 2005).

Macro-scaffolding practices

Macro-scaffolding practices happen before a lesson.

"Teachers develop a long-term vision with clear learning goals for their students and sequence lessons that build students' cumulative and coherent body of knowledge" (World Class Instructional Design Assessment [WIDA], 2018, p. 2.)

Micro-scaffolding practices

"Micro-scaffolding practices happen during a lesson in the interactions between teacher and students" (WIDA, 2018, p. 2).

QUESTIONS FOR ARTICLE

After reading the article, take turns sharing questions 1, 2, and 3. Make sure everyone gets a chance to share. Select one person in your group to be your spokesperson to provide a brief highlight of what was discussed.

1. What did you agree with? Disagree with?
2. What pressed your thinking?
3. What are you still wondering about?

Visual Scaffolding

- Conveys meaning of words, phrases, and sentences by using visual imagines, such as drawings or photographs (Lei et al., 2018).
- Enhances ELs' academic language in the mathematics classroom by using visual supports, such as manipulatives, representational tools, real-life objects, and multimedia materials (Gottlieb & Castro, 2017; Lei et al., 2020).

Linguistic Scaffolding

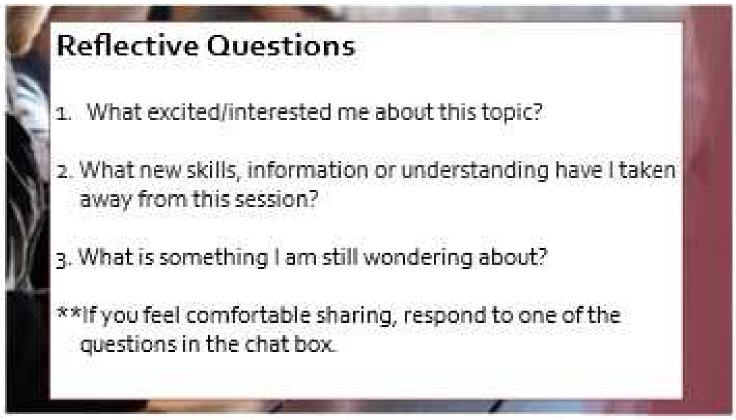
- Provides supports for ELs' oral language (Lei et al., 2018).
- Requires teachers to use language that is understandable, especially when introducing new knowledge. Often, teachers may speak at a slower rate, simplify their vocabulary, or use words repetitiously to reinforce the new learning (Gottlieb & Castro, 2017).

Interactive Scaffolding

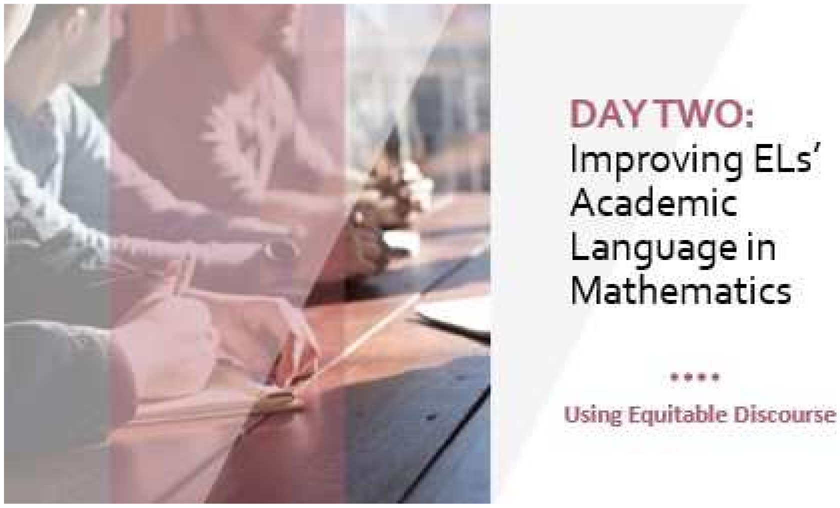
- Interactive scaffolding takes place when the teacher and students engage in facilitated conversations about the content and language use in mathematics (Lei et al., 2020).
- Gibbons (2015) provided examples of this interaction when teachers and students engaged in one-on-one and small group work.

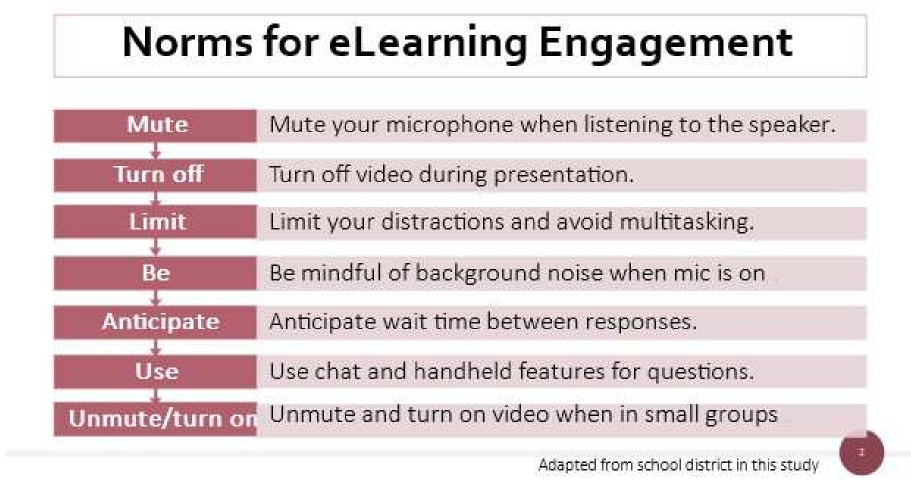
Kinesthetic Scaffolding

- Kinesthetic scaffolding was first introduced as Total Physical Response (Asher, 1969).
- Allows ELs to produce content knowledge nonverbally with some form of physical movement (e.g., GLAD strategies) and provides physical interaction (e.g., sign language or gestures) with language to solidify and demonstrate ELs' comprehension without limiting their participation in the mathematics classroom (Lei et al., 2020).

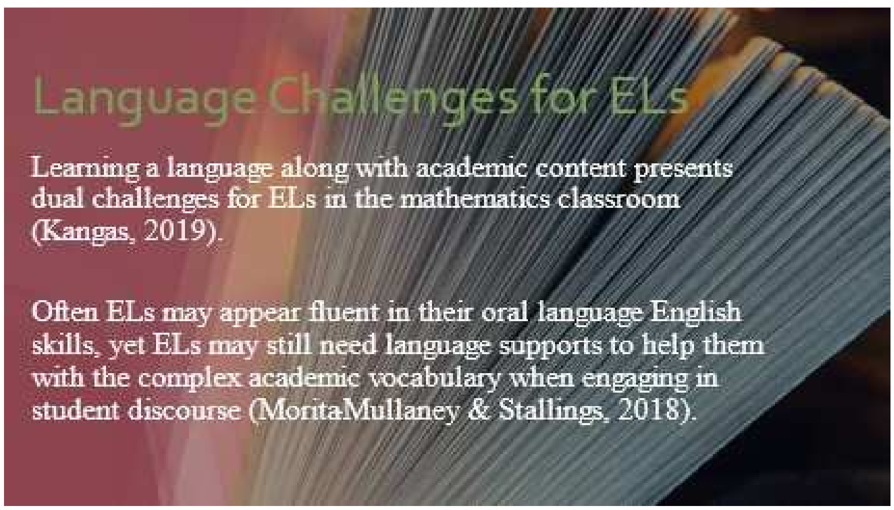

Reflective Questions
1. What excited/interested me about this topic?
2. What new skills, information or understanding have I taken away from this session?
3. What is something I am still wondering about?
**If you feel comfortable sharing, respond to one of the questions in the chat box.


DAY TWO's session will focus on
Equitable Discourse
See you tomorrow at 8:30 a.m.

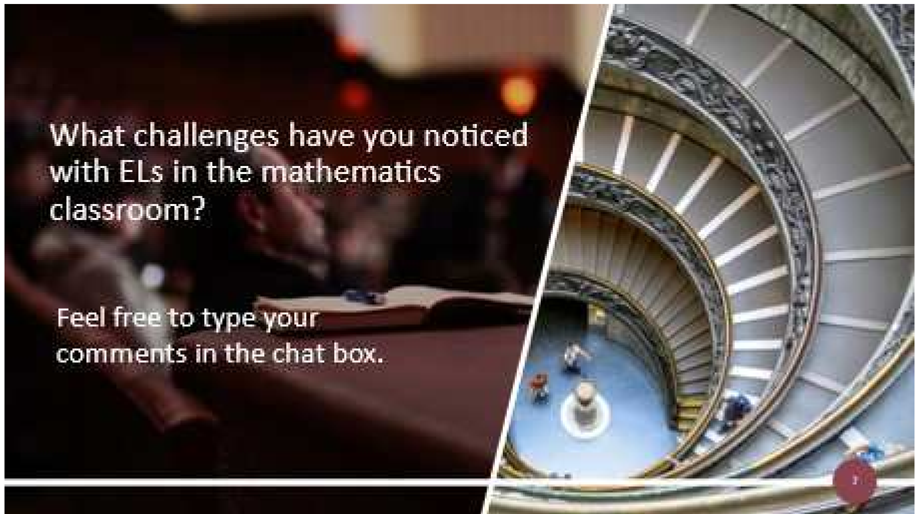

DAY TWO:
Improving ELs' Academic Language in Mathematics
Using Equitable Discourse

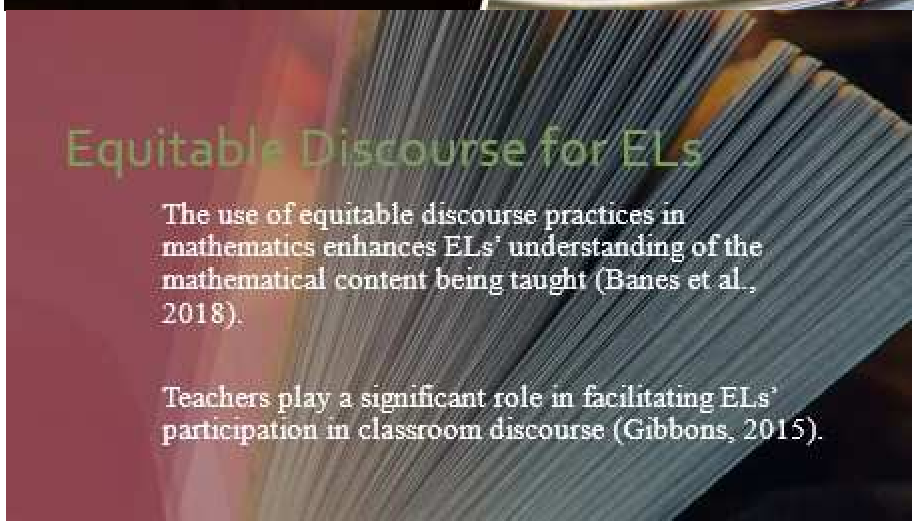

Norms for eLearning Engagement
Mute
Mute your microphone when listening to the speaker.
Turn off
Turn off video during presentation.
Limit
Limit your distractions and avoid multitasking.
Be
Be mindful of background noise when mic is on
Anticipate
Anticipate wait time between responses.
Use
Use chat and handheld features for questions.
Unmute/turn on
Unmute and turn on video when in small groups
Adapted from school district in this study


Learning Goals – Day Two
To understand language challenges that are inherent to mathematics
To provide equitable discourse opportunities for ELs to engage in mathematics
To learn scaffolded supports to promote student-centered discourse that is equitable.



Moschkovich (2015) emphasizes that language components, such as syntax, structure, and vocabulary are a part of mathematics, and they need to be explicitly taught to ELs.





Balancing Structure of Activities & Rigor

Teachers need to consider how to balance the structure of the activities to reduce the language barrier that may impede ELs' participation as well as maintain a high level of rigor in the mathematics content—conceptual and procedural knowledge (Banes et al., 2018).

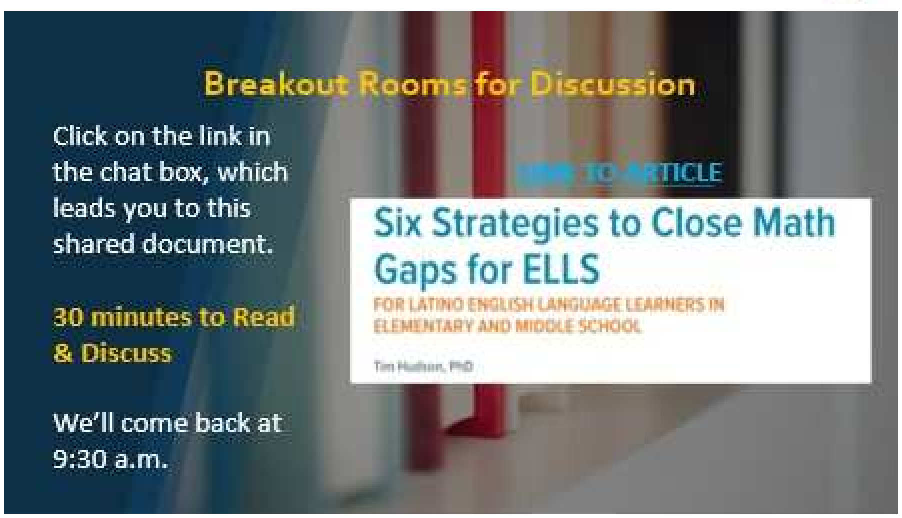
Equitable Practices

When thinking about equitable practices in the mathematics classroom, there are four dimensions that need be addressed—access, identity, power, and achievement (Gutiérrez, 2012).

Achievement is one of the four dimensions that still needs to be addressed because of the growing demands of the mathematical communication within the CCSSM and its impact on EL's performance on mathematics assessments (Banes et al., 2018).

Equity in Mathematics

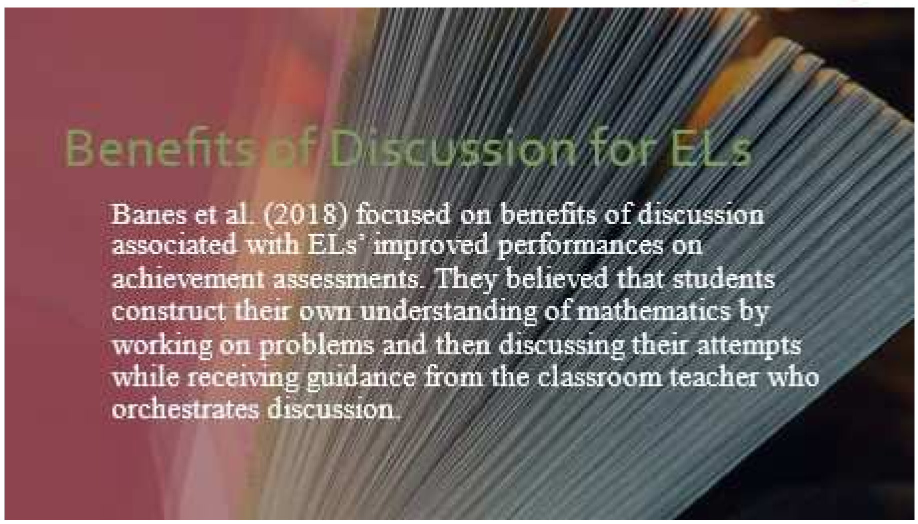
NCTM (2014) rightly advocates for equity in our schools and curricula and points out that "Excellence in mathematics education requires equity—high expectations and strong support for all students."



QUESTIONS FOR ARTICLE

After reading the article, take turns sharing questions 1, 2, and 3.
Make sure everyone gets a chance to share. Select one person to be your spokesperson to provide a brief highlight of what was discussed.

1. What did you agree with? Disagree with?
2. What pressed your thinking?
3. What are you still wondering about?



What are mathematical discussions?

Mathematical discussions were defined as an academic activity in which students engage in listening, speaking, and thinking about mathematical ideas (Banes et al., 2018). In their study, they identified five key features for effective math discussion "(1) variety of approaches, (2) opportunities to speak, (3) equitable participation, (4) explanations, and (5) connections between ideas" (p. 417418).

1: Variety of Approaches

There are a variety of approaches for how to solve a story problem. Engaging ELs in meaningful conversations about how they arrived at their answers as well as the multiple strategies used to solve the problem offers ELs access to ideas from their peers because they may not have considered solving the problem using that strategy (Banes et al., 2018; Truxaw, 2020). Also, it is beneficial to provide ELs with multiple concrete and visual tools (e.g., manipulatives) for solving the story problems because it increases their comprehensibility and conceptual understanding, especially when ELs struggle to understand verbally (Banes et al., 2018; Echevarria et al., 2007).

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2. Opportunities to Speak

ELs have potential benefits when given opportunities to speak. Ideally, you want ELs engaged in student discourse daily (Banes et al., 2018). Therefore, in their study, the frequency of student voices was tracked to see how many times students were given opportunities to speak in whole and small group instruction as well as with partners.

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3. Equitable Participation

Equitable participation includes verbal and non-verbal forms of communication (e.g., hand signals to agree/disagree). Also, ELs tend to have an easier time understanding their peers' explanations because their peers' language structure and vocabulary is closer to their own level of language proficiency (Banes et al., 2018; Ellis, 1999; Fink, 2019). Finally, ELs benefit in hearing the same idea presented by several speakers as the repetition enhances their comprehension (Banes et al., 2018; Chapin et al., 2009).

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4. Explanations

When ELs are given opportunities to explain their ideas to themselves, they will learn more. However, when ELs are given an opportunity to explain their ideas to a peer, they learn even more (Banes et al., 2018; Rittle-Johnson et al., 2008). Thus, explanations provided by the students rather than the teacher are for more advantageous because it allows ELs to capture their thinking and to provide explanations of their conceptual understanding (Banes et al., 2018).

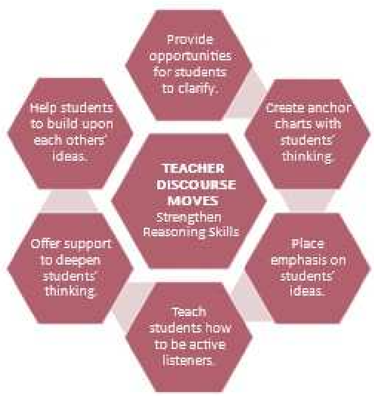
5. Connections Between Ideas

Banes et al. (2018) interpretation of connections between ideas is the prioritizing of the "building on and connecting of ideas" that takes place during studentcentered discourse rather than teacher-centered discourse (p. 419). Making connections among strategies and with varied problem types, enables students to transfer their knowledge to other unknown problems, such as those that appear on assessments (Banes et al., 2018; Truxaw, 2020).

Ways to Structure Discourse for ELs

- Pose a concrete discussion task on the board and clarify your expectations for task completion.
- If the question or mathematical task is open-ended, allow your students time to write down their ideas before beginning.
- Provide a sentence starter that includes your lesson's targeted vocabulary.
- Model a response using the sentence starter.
- Provide students with adequate time to complete their response.
- Have students share their responses with a partner. Be sure to encourage active listening and ask them to paraphrase their partner's idea.
- Monitor students' writing and "nominate" one or two students to share their written response.

Teacher Discourse Moves



WIDA (2018)

Provide opportunities for students to clarify	Create anchor charts with students' thinking.
• Be sure to provide wait time by pausing 20-30 seconds to allow for processing time. • Use question stems, such as "Can you show us what you mean?" or "Can you tell us more about your thinking?"	• Have students share their thinking on chart paper. • Revoice by paraphrasing what students' thinking using more precise academic language. • Inquire by asking, "Did I say your idea correctly?"

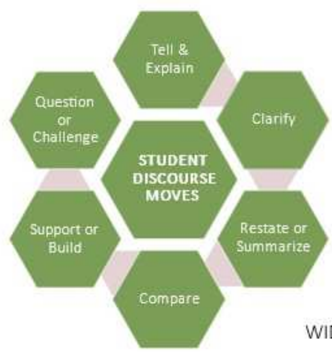
Place emphasis on students' ideas.	Teach students how to be active listeners.
• Ask other students to revoice or paraphrase what another student just shared so everyone can hear it again. • Inquire by asking, "Would someone like to retell that idea again?" • Have students repeat what they said by asking, "Can you say that again for us?"	• Who would like to repeat what we just heard? • Partner A share what partner B just explained. • Do you agree or disagree? Why? • Whose idea is like yours? • Whose idea differs from yours?

WIDA (2018)

Offer support to deepen students' thinking.	Help students to build upon each others' ideas.
• Tell us more about your thinking? Why do you think that works? • Would that always be true? • Can you prove that this is always true? • How could we revise our thinking/model so that it is true? • What new questions do you have now?	• Partner A, repeat what partner B just said. • Partner B, did partner A say it correctly? • Partner A, do you agree with what partner B explained? Why or why not? • Partner A, you look uncertain. Could you ask Partner B to say it again? • How does partner A's thinking build upon partner B's thinking? Does it connect?

WIDA (2018)

Student Discourse Moves



WIDA (2018)

Tell and Explain	Clarify
• "I think..." • "I know it will work because..." • "I believe the best strategy is... because..."	• "Please repeat." or "Could you say it again?" • "What did you mean when you said..." • "Are you saying that..."

Restate or summarize	Compare ideas
• "[Student's name] said..." • "So, in other words..." • "A suggestion was made by [student's name] that..."	• "[Student's name] has the same idea because..." • "I think my idea is better because..." • "[Student's name] strategy is more efficient (works well) because..."

WIDA (2018)

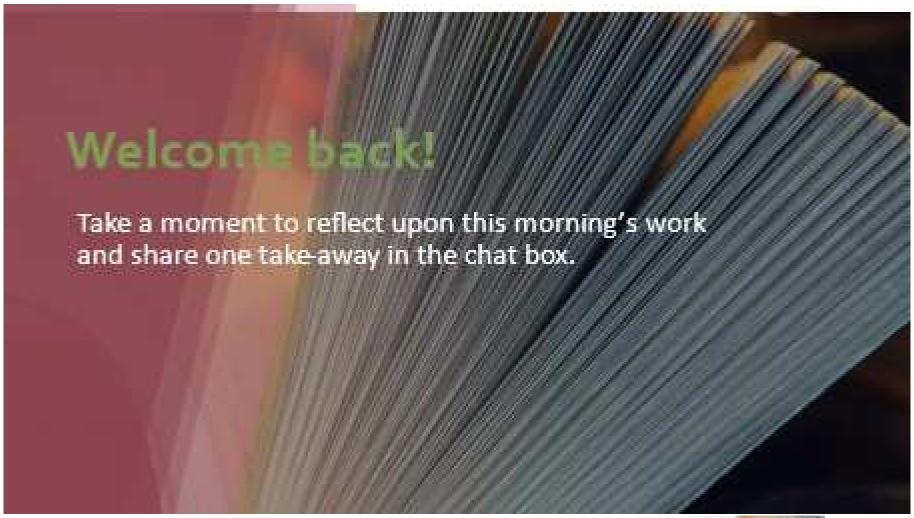
Support or Build	Question or Challenge
• "That's a good idea because…" • "Let's try that…" • "Let's change our strategy to that…" • "That strategy would help us figure this out why…"	• "Why? I don't understand." • "Why? That doesn't make sense to me." • "Can you solve it another way?" • "But that doesn't explain…"

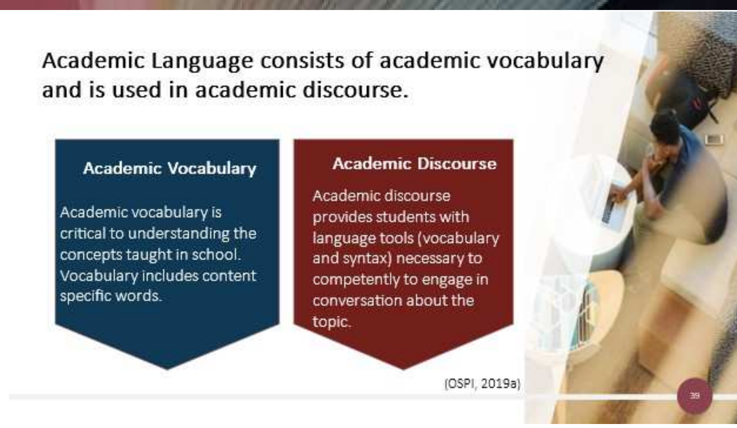
WIDA (2018)


You'll have 25 minutes to work on discourse moves.
Return at 11:55 a.m.


During your breakout session, did you have any ah ha's that arose? Further wonderings?
Feel free to type these in the chat box.


LUNCH BREAK
You will have an hour to break for lunch.
Return online at 1:00 p.m.

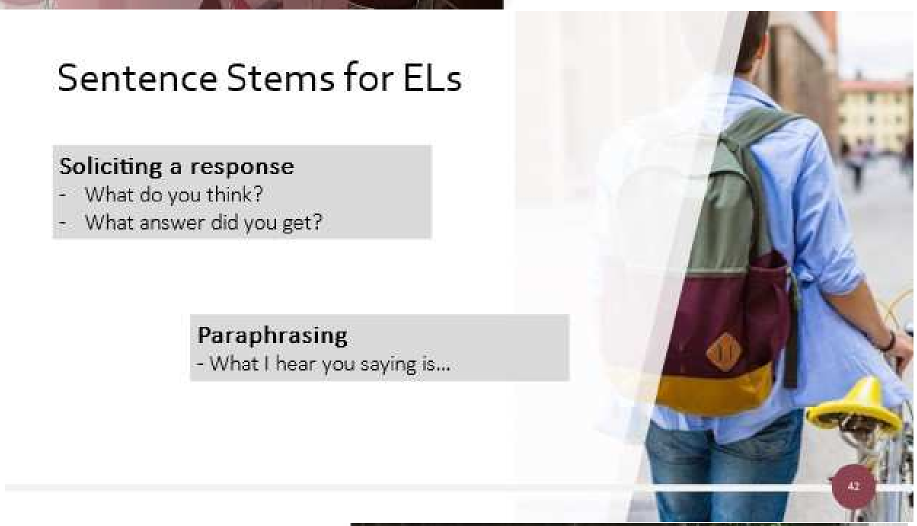


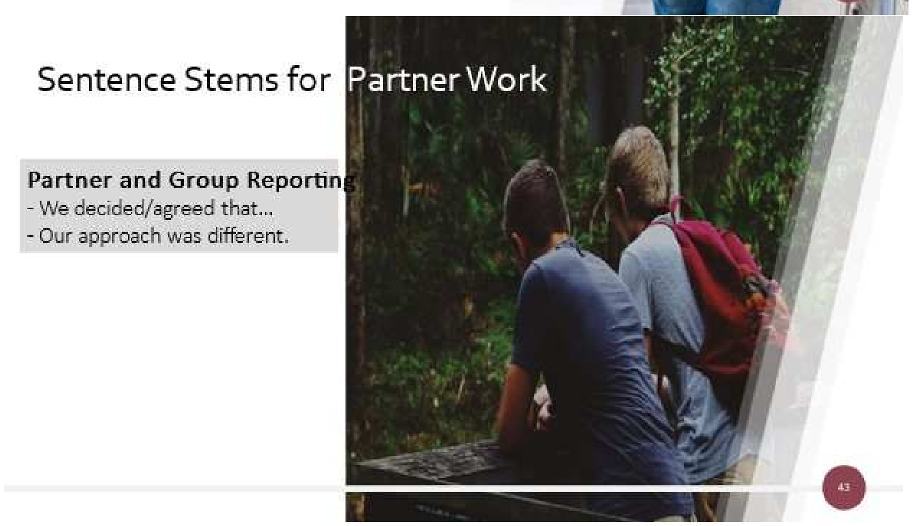


Scaffolds of Support for ELs

There are a variety of scaffolds for supporting discourse with ELs in the virtual classroom as well as in the classroom with faceto-face instruction. Sentence frames/stems are one way of encouraging ELs'participation. However, teacher modeling, word walls, graphic organizers, manipulatives, and structured peer interactions are beneficial too (OSPI, 2019a).


Sentence Stems for ELs
When Expressingn
Opinion
I think/believe that...
In my opinion...


Sentence Stems for ELs
Soliciting a response
- What do you think?
- What answer did you get?
Paraphrasing
- What I hear you saying is...
42


Sentence Stems for Partner Work
Partner and Group Reporting
- We decided/agreed that...
- Our approach was different.
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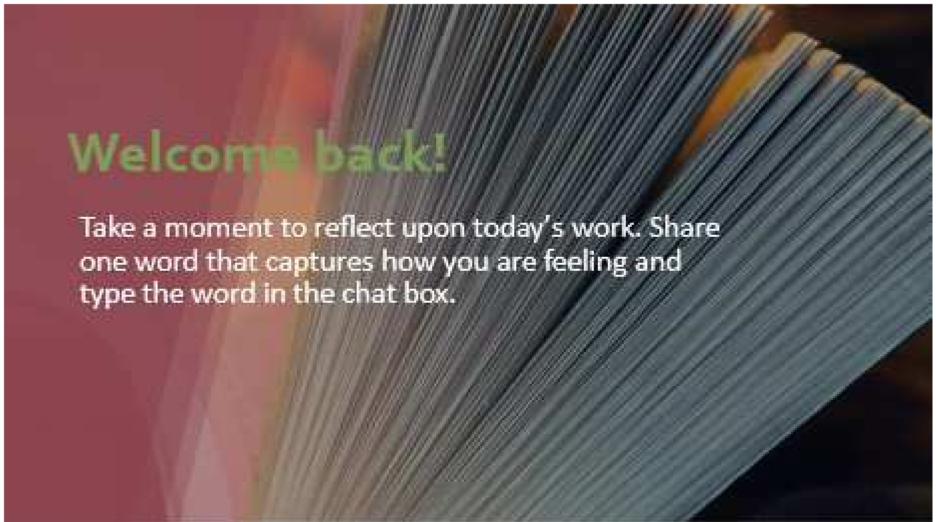
What academic vocabulary and academic discourse did I observe?

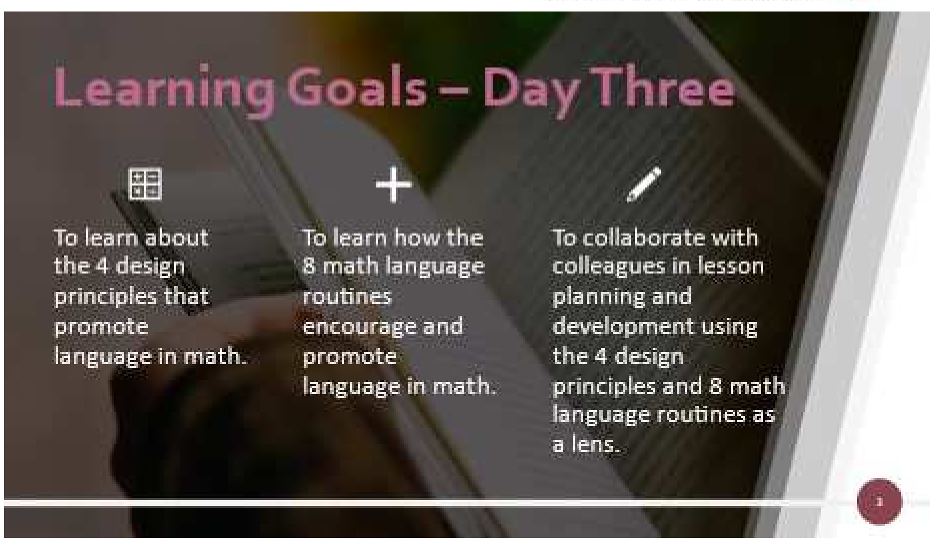
Academic Vocabulary	Academic Discourse
Student used the following ❑ Clear and explicit use of words ❑ Provided clarification of unfamiliar words ❑ Use word walls, imagines/pictures/photos, and/or another student's work to include academic vocabulary	❑ Models (uses of word form) ❑ Uses sentence frames ❑ Dialogue is based on graphic organizers ❑ Uses appropriate language register ❑ Engages in partner discussions ❑ Gives an oral presentation ❑ Engages in structured talk ❑ Engages in open-ended discussions

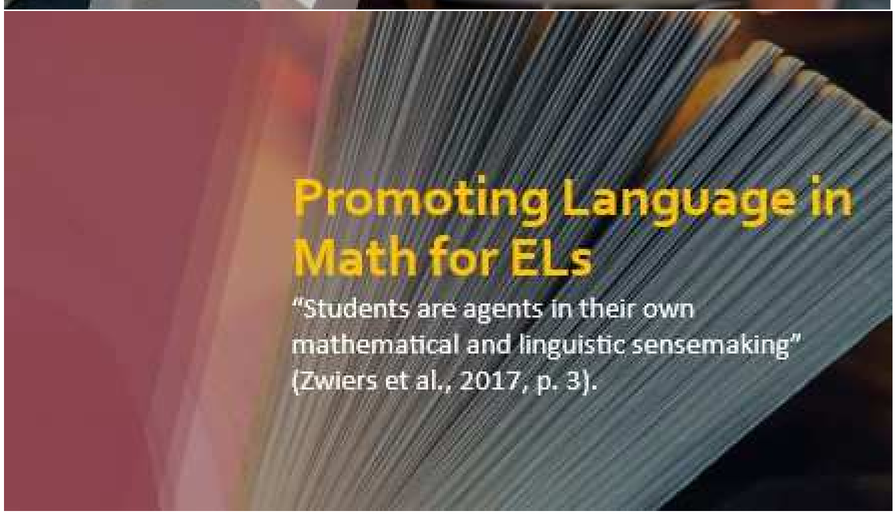

Welcome back!
Take a moment to reflect upon today's work. Share one word that captures how you are feeling and type the word in the chat box.


DAY THREE's session will focus on
Promoting Language
See you tomorrow at 8:30 a.m.


DAY THREE:
Improving ELs' Academic Language in Mathematics
Promoting Language


Norms for eLearning Engagement
Mute
Mute your microphone when listening to the speaker.
Turn off
Turn off video during presentation.
Limit
Limit your distractions and avoid multitasking.
Be
Be mindful of background noise when mic is on
Anticipate
Anticipate wait time between responses.
Use
Use chat and handheld features for questions.
Unmute/turn on
Unmute and turn on video when in small groups
Adapted from school district in this study


Learning Goals – Day Three
To learn about the 4 design principles that promote language in math.
To learn how the 8 math language routines encourage and promote language in math.
To collaborate with colleagues in lesson planning and development using the 4 design principles and 8 math language routines as a lens.



"Teachers can select from the 'heavier' or 'lighter' supports provided in the curriculum as appropriate. When selecting from these supports, teachers should take into account the language demands of the task in relation to their students' English language proficiency" (Zwiers et al., 2017, p. 5).

Four Design Principles for Promoting Mathematical Language

1: Support sense-making
2: Optimize output
3: Cultivate conversation
4: Maximize linguistic and cognitive metaawareness

(Zwiers et al., 2017)

1: Support Sense-making

- Scaffold tasks and amplify language so students can make their own meaning.
- Students do not need to understand a language completely before they can start making sense of academic content and negotiate meaning in that language.
- Language learners of all levels can and should engage with grade -level content that is appropriately scaffolded.
- Students need multiple opportunities to talk about their mathematical thinking, negotiate meaning with others, and collaboratively solve problems with targeted guidance from the teacher (Cazden, 2001; Moschkovich, 2013).

1: Support Sense-making

Teachers can foster students' sensemaking by **amplifying** rather than simplifying, or watering down, their own use of disciplinary language.

Teachers should make language more "considerate" to students by **amplifying** (Walqui & van Lier, 2010) rather than simplifying speech or text. Simplifying includes avoiding the use of challenging texts or speech.

1: Support Sense-making

Amplifying means anticipating where students might need support in understanding concepts or mathematical terms and providing multiple ways to access those concepts and terms.

- Visuals or manipulatives
- Modeling problem-solving
- Engaging in think-alouds
- Creating analogies or context
- Layering meaning

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2: Optimize output

Strengthen the opportunities and supports for helping students to describe clearly their mathematical thinking to others, orally, visually, and in writing.

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2: Optimize output

Linguistic **output** is the language that students use to communicate their ideas to others. Output can come in various forms, such as oral, written, visual, etc. and refers to all forms of student linguistic expressions except those that include significant back-and forth negotiation of ideas.

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2: Optimize output

Students need …

1. Repeated, strategic, iterative and supported opportunities to articulate complex mathematical ideas into words, sentences, and paragraphs (Mondada & Doehler, 2004).

2. Spiraled practice in (a) making their ideas stronger with more robust reasoning and examples, and (b) making their ideas clearer with more precise language and visuals.

3: Cultivate conversation

- Conversations are back-and-forth interactions with multiple turns that build up ideas about math.

- Conversations act as scaffolds for students developing mathematical language because they provide opportunities to simultaneously make meaning and communicate that meaning (Mercer & Howe, 2012).

3: Cultivate conversation

Conversations allow students to hear how other students express their understandings.

When students have a reason or purpose to talk and listen to each other, interactive communication is more authentic.

4: Maximize linguistic and cognitive meta-awareness

Language is a tool that not only allows students to communicate their math understanding to others, but also to organize their own experience, ideas, and learning for themselves.

4: Maximize linguistic and cognitive meta-awareness

Meta-awareness is consciously thinking about one's own thought processes or language use. Metaawareness develops when students and teachers engage in classroom activities or discussions that bring explicit attention to what students need to do to improve communication and/or reasoning about mathematical concepts

4: Maximize linguistic and cognitive meta-awareness

Meta-awareness in students is strengthened when teachers ask students to explain to each other the strategies to solve a challenging multi-step problem.

- "How does yesterday's method connect with the method we are learning today?"
- "What ideas are still confusing to you?"

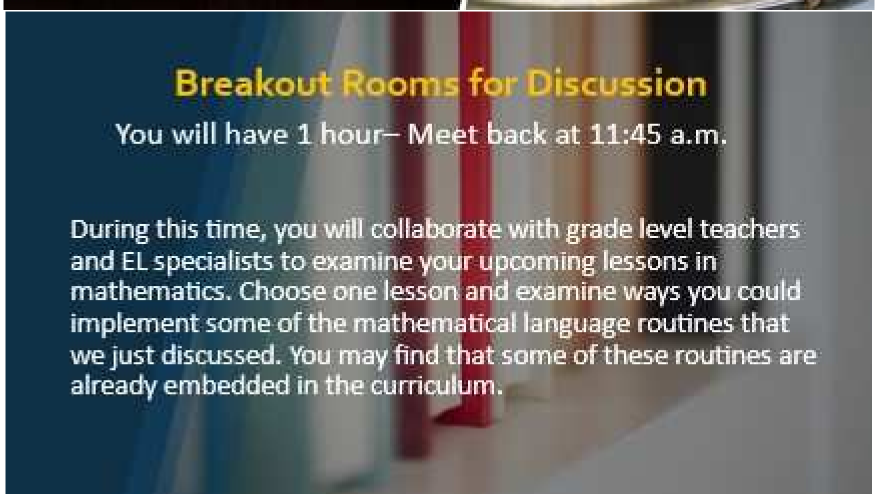
These questions are metacognitive because they help students to reflect on their own and others' learning of the content.

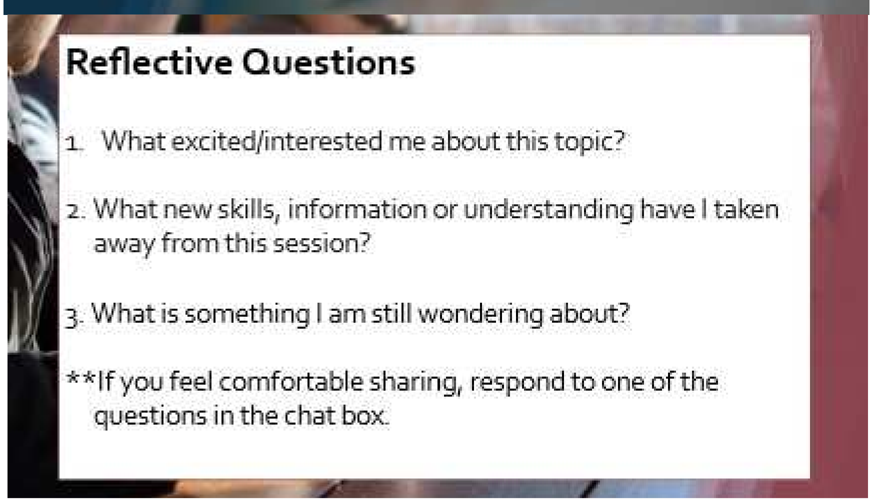

Breakout Rooms for Discussion
We will be using the work from Zwiers et al., 2017, mathematical language routines, to increase our knowledge and understanding of how to promote language and content development with ELs in mathematics.
CLICK HERE TO ACCESS THE ARTICLE
UNDERSTANDING LANGUAGE/
STANFORD CENTER FOR ASSESSMENT,
LEARNING, AND EQUITY
Stanford University
Graduate School of Education
Principles for the Design of Mathematics Curricula:
Promoting Language and Content Development


Breakout Rooms for Discussion
In your grade level teams, you will be assigned to review and discuss 1 of 8 Mathematical Language Routines.
Select someone to record on the shared document and someone to share when we come back together as a whole group.

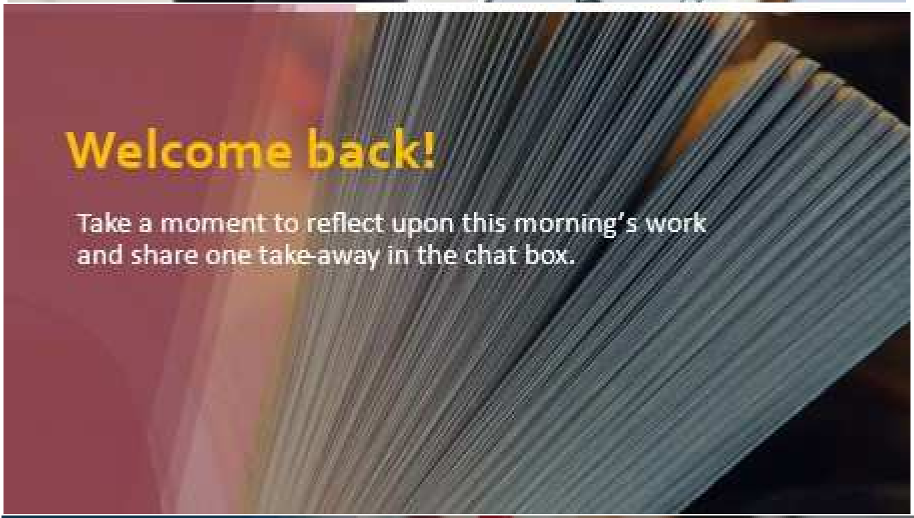

You'll have 30 minutes to work on this shared document.
This includes a 5-minute break

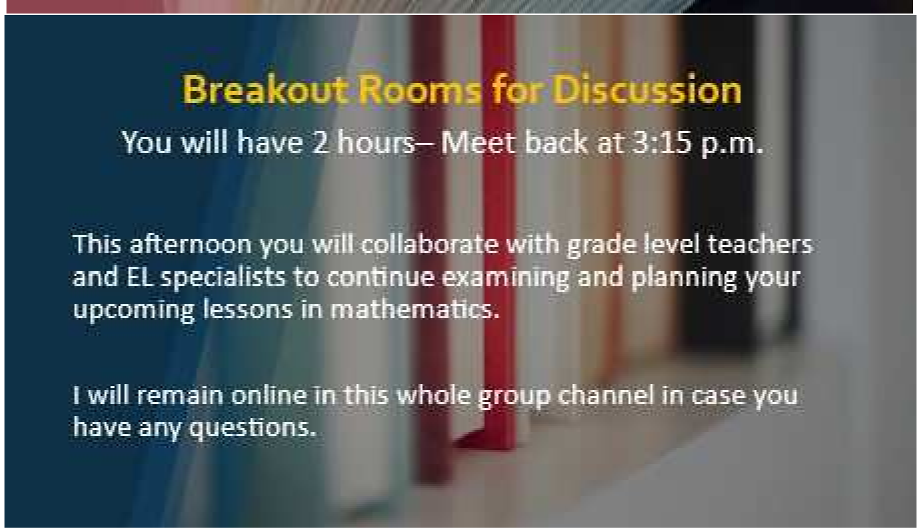

Each team should have a spokesperson ready to share your team's mathematical language routine
Please turn on your camera and mic when it's your turn to share. Thank you.


Breakout Rooms for Discussion
You will have 1 hour– Meet back at 11:45 a.m.
During this time, you will collaborate with grade level teachers and EL specialists to examine your upcoming lessons in mathematics. Choose one lesson and examine ways you could implement some of the mathematical language routines that we just discussed. You may find that some of these routines are already embedded in the curriculum.

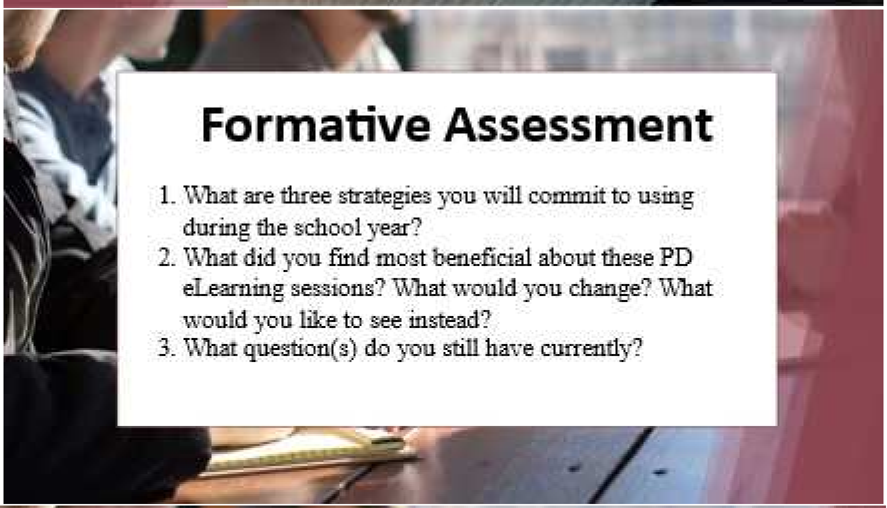

Reflective Questions
1. What excited/interested me about this topic?
2. What new skills, information or understanding have I taken away from this session?
3. What is something I am still wondering about?
**If you feel comfortable sharing, respond to one of the questions in the chat box.

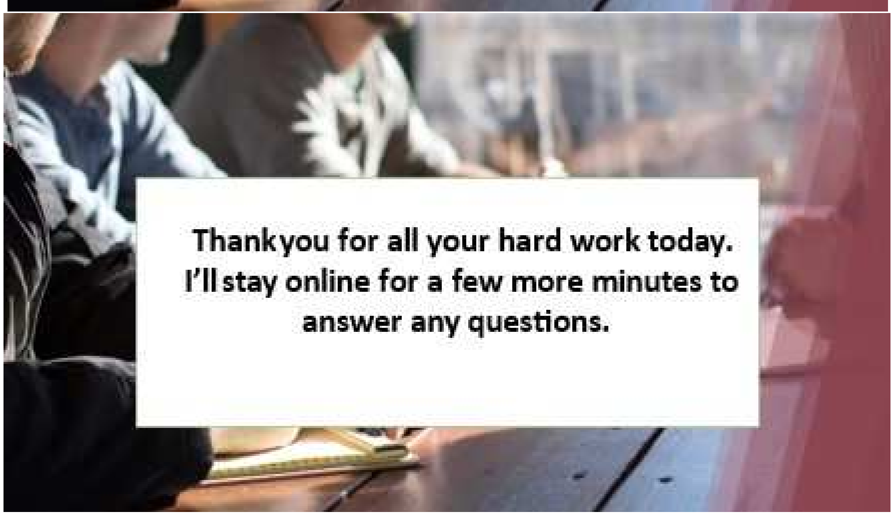

LUNCH BREAK
You will have an hour to break for lunch.
Return online at 1:00 p.m.


Welcome back!
Take a moment to reflect upon this morning's work
and share one take-away in the chat box.


Breakout Rooms for Discussion
You will have 2 hours– Meet back at 3:15 p.m.
This afternoon you will collaborate with grade level teachers and EL specialists to continue examining and planning your upcoming lessons in mathematics.
I will remain online in this whole group channel in case you have any questions.


Welcome back!
Take a moment to reflect upon today's work. Share one word that captures how you are feeling and type the word in the chat box.


Formative Assessment
1. What are three strategies you will commit to using during the school year?
2. What did you find most beneficial about these PD eLearning sessions? What would you change? What would you like to see instead?
3. What question(s) do you still have currently?


Thankyou for all your hard work today. I'll stay online for a few more minutes to answer any questions.

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Appendix B: Demographic Questionnaire

Name: ____

Personal email: _______________________ Home/cell number: ______________

1. Choose your level of education.

   - ☐ Bachelor's degree
   - ☐ Master's degree
   - ☐ Doctorate's degree

2. Select your certification level.

   - ☐ Continuing
   - ☐ Residency
   - ☐ Professional
   - ☐ Substitute
   - ☐ Limited Certificate
   - ☐ Standard/Continuing (issued prior to 9/1/87)
   - ☐ Provisional (issued in the 1960s, 1970s, and 1980s)

3. How long have you been teaching third through fifth grade in mathematics?

   - ☐ 3-5 years
   - ☐ 6-10 years
   - ☐ 11-19 years
   - ☐ 20-25 years
   - ☐ 26 or more

4. What grade levels in mathematics have you taught? _____________________

5. How long have you been teaching ELs?

   - ☐ 3-5 years
   - ☐ 6-10 years
   - ☐ 11-19 years
   - ☐ 20-25 years
   - ☐ 26 or more

6. Do you hold an EL endorsement?

   - ☐ Yes
   - ☐ No

Appendix C: Interview Protocol

This qualitative study used an interview protocol refinement (IPR) comprised of four-phases (Castillo-Montoya, 2016).

Phase 1: Ensuring interview questions align with RQs

Research Questions	Interview Questions
How do teachers describe their experiences with teaching ELs in mainstreamed, differentiated third through fifth grade mathematical classrooms?	How many students do you have in your class? How many students are ELs? How many spoken languages? How would you describe the needs of your ELs? How do you meet the needs of linguistically diverse students in math? Describe what differentiation looks like when teaching math.
What specific challenges arise for teachers who work with ELs when implementing student-centered discourse practices in the mathematics third through fifth grade classrooms?	What kinds of math talk activities do you engage your students in? How is this going? Describe how you support ELs in math to encourage math talk? Tell me more about some of the strategies you use for eliciting math discourse with your ELs.
What are teachers' PD needs for improving their academic language instruction with ELs in the mathematics third through fifth grade classrooms?	Describe your experiences with PD you have received regarding student talk in math. What is the best tip you have received? What tips have you received that were less successful? Is there anything else you would like to share? What suggestions do you have for future PD to support your work with ELs and their academic language development?

Phase 2: Constructing an inquiry-based conversation

Types of Questions	Explanations of Type of Questions	Examples of Type of Questions
Introductory Questions	Questions are neutral and elicit general and non-intrusive information	How many students do you have in your class? How many students are ELs? How many spoken languages?

		How would you describe the needs of your ELs?
Transition Questions	Questions that link the introductory questions to the key questions asked	How do you meet the needs of linguistically diverse students in math?
Key Questions	Questions that are most related to the RQ and purpose of study	Describe what differentiation looks like when teaching math. Describe how you support ELs in math to encourage math talk? Tell me more about some of the strategies you use for eliciting math talk with your ELs. What kinds of math talk activities do you engage your students in? How is this going? What suggestions do you have for future PD to support your work with ELs and their academic language development?
Closing Questions	Questions that are easy to answer and provide an opportunity for closure	Describe your experiences with PD you have received regarding student talk in math. What is the best tip you have received? What tips have you received that were less successful? Is there anything else you would like to share?

Phase 3: Receiving feedback on interview protocols

A retired colleague provided feedback for clarity of interview questions.

Clarity of Interview Questions	Yes	No	Feedback for Improvement
Beginning questions are factual			
Majority of questions are key questions and are placed in between beginning and ending questions			
Questions at the end of the interview are reflective			

Questions provide participant an opportunity to share closing comments			
Overall interview is organized to promote conversational flow			
Only one question is asked at a time			
Most questions ask participants to describe their experiences			
Questions are open-ended			
Questions are written in a nonjudgmental manner			
All questions are needed			
Questions/statements are concise			
Questions/statements are devoid of academic language			
Questions/statements are easy to understand			

Phase 4: Phase Piloting the interview protocol

I practiced my interview protocol with a retired colleague to check each question for clarity, simplicity, and answerability.