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A Qualitative Study of Instructional Practices for English Learners in Elementary Mathematics

Katie Corinne Baum
Walden University

Walden University

College of Education

This is to certify that the doctoral study by

Katie Baum

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the review committee have been made.

Review Committee
Dr. Samson Lyman, Committee Chairperson, Education Faculty
Dr. Crissie Jameson, Committee Member, Education Faculty
Dr. Salina Shrofel, University Reviewer, Education Faculty

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Abstract

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MA, Walden University, 2010

BS, University of North Carolina Wilmington, 2007

Proposal Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

It is important for elementary teachers to provide quality mathematics instruction for English Learner (EL) students to close achievement gaps. Elementary mathematics teachers in the Keystone School District were struggling to implement instructional practices for EL students in mathematics as evidenced by communications with teachers, administrators, and documents from the state-required action plan. The purpose of this study was to explore the instructional practices and the challenges encountered by teachers related to providing mathematics instruction for ELs. The Sheltered Instruction Observation Protocol Model served as the conceptual framework. The research questions focused on the instructional practices that teachers were implementing related to building background knowledge, student interactions, application, and teacher challenges. This study used a qualitative case study design with data being collected through interviews and observations of 8 teachers in 1st through 5th grades. Data analysis was conducted by coding and thematic analysis. The results showed a gap in practice related to supporting ELs during mathematics interactions and measures of accountability. Teachers reported challenges related to the lack of accurate assessments and appropriate instructional resources for ELs in mathematics. Based on the findings of this project study, a professional development program was developed to provide teachers with the knowledge, skills, and resources to support EL students in mathematics. This study has implications for positive social change by preparing teachers to provide effective mathematics instruction for EL students through the professional development program as well as informing future district decisions related to EL students in mathematics.

A Qualitative Case Study of the Instructional Practices for Elementary English Learner Students in Mathematics

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Katie Baum

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Dedication

In loving memory of my grandmother, Elsie Finkey.

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Section 1: The Problem

With the recent approval of the Every Student Succeeds Act (ESSA) of 2015, closing achievement gaps and teacher accountability continue to be a focus of education in the United States. At the same time, the number of linguistically diverse students has become the fastest growing student subgroup, and U.S. schools are educating more than 5 million English Learner (EL) students making up 10% of the total student population in kindergarten through Grade 12 (Spees, Potochnick, & Perreira, 2016). Current research suggests that some teachers are struggling to use effective instructional practices for EL students (Doabler, Nelson, & Clarke, 2016). In some cases, EL students are not receiving the quality mathematics instruction that helps them develop a comprehensive understanding of mathematics rather than simply learning to count and compute numbers (Warren & Miller, 2015). Research also suggests that the use of effective instructional practices is crucial to improving student mathematics achievement (Bottia, Moller, Michelson, & Stearns, 2014; Firmender, Gavin, & McCoach, 2014; Scott, Hirn, & Alter, 2014). Teachers' difficulty to implement effective instruction may be contributing to a deficiency in mathematics performance among EL students and a documented achievement gap between ELs and their peers. National test scores from the 2013-2014 National Assessment for Educational Progress (NAEP) showed that when comparing the percentage of students who scored proficient or above, 26% fewer EL students scored at those levels than the overall population on the 4th-grade mathematics assessment (Department of Education, n.d.). Pennsylvania students demonstrated a similar gap on this assessment, with 29% fewer EL students performing proficient or above than the overall student population of 4th-grade students (Department of Education, n.d.).

Some of the effective instructional practices for ELs recommended by the literature include building background knowledge (Doabler et al., 2016), meaningful student interactions (Warren & Miller, 2015), and opportunities to apply learning (Chval, Pinnow, & Thomas, 2015). Teachers can help EL students build background knowledge by making connections to life experiences, prior learning, and vocabulary (Doabler et al., 2016). Students build academic and language understanding by interacting and engaging content-rich discussions with their teachers and peers (Warren & Miller, 2015). It is also important for EL students to have opportunities to practice and apply both their language knowledge and content knowledge in a variety of activities (Chval et al., 2015). Despite the growing need for professional development, opportunities for teachers to acquire knowledge and skills for teaching ELs are not readily available (Ross, 2014). For EL students to receive quality instruction in mathematics, teachers must have the knowledge and skills to implement effective instructional practices to meet the diverse learning needs of these students.

Proficiency in foundational mathematics skills affects a person's ability to function in everyday life as an adult (Akpan & Beard, 2014). Basic life skills such as telling time, counting money, and measuring accurately are taught in elementary mathematics classrooms (Akpan & Beard, 2014; Common Core State Standards Initiative, 2015). Doabler et al. (2016) noted that EL students are specifically at-risk for failure in mathematics.

With the enactment of ESSA, the United States accepted the charge to "provide all children significant opportunity to receive a fair, equitable, and high-quality education, and to close educational achievement gaps" (ESSA, 2015, p. 13). If educators across the nation endeavor to meet these expectations, local school districts must ensure that teachers are prepared and consistently using effective instructional practices for all students, including ELs in mathematics.

The Local Problem

The problem that I explored in this study was that despite the professional development implemented through the state-required Action Sequence, elementary mathematics teachers in the Keystone School District appear to have experienced difficulty in implementing effective instructional practices to meet the learning needs of EL students, specifically in the areas of building background knowledge, interactions, and application. Local performance data and personal communications with teachers and administrators suggested that some elementary mathematics teachers in the Keystone School District have struggled to implement effective instructional practices for EL students. Specifically, a need exists to improve instructional practices related to building background knowledge, interactions, and application.

EL student performance data demonstrated a sizeable gap in achievement between ELs and the overall student population in Grades 3, 4, and 5 on the Pennsylvania System for School Assessment (PSSA) in mathematics. The 2016 PSSA data showed that the percentage of EL students in Grade 3 through Grade 5 who scored proficient or advanced in mathematics was at least 36% lower than the overall population in all three grades (K-12 mathematics supervisor, personal communication, September 26, 2016). Building background knowledge, student interactions, and application of learning have been identified as areas of mathematics instruction for EL students who need improvement (K-12 mathematics supervisor, personal communication, June 14, 2017). In addition, multiple elementary teachers have reported using a limited amount of commonly accepted best instructional practices for EL students in mathematics classrooms (teacher, personal communication, July 20, 2016; teacher, personal communication, June 28, 2016; teacher, personal communication, June 30, 2016; teacher, personal communication, October 18, 2016). A review of the current research has shown that effective instructional practices are imperative to improving student achievement in mathematics (Bottia et al., 2014; Firmender et al., 2014; Scott et al., 2014).

The English as a Second Language (ESL) head teacher for the district has noted that more EL students have continued ESL services into middle and high school because they were unable meet the academic performance requirements needed to exit ESL services. Many EL students have failed to exit ESL services specifically due to not meeting the required level of mathematics proficiency on state tests (ESL head teacher, personal communication, October 23, 2014). Local records also showed that 90% of the ESL students in 10th through 12th grade who dropped out during the 2016-2017 school year were receiving a “D” or an “F” in one or more mathematics classes (ESL head teacher, personal communication, May 1, 2017). As a result of the poor performance of ELs on the PSSA in mathematics in previous years along with failing to exit students from ESL services, the state has mandated that the Keystone School District develop an

Action Sequence, or improvement plan, specifically targeting the performance of EL students in mathematics. The Action Sequence was developed (see Appendix E); however, the components have been minimally implemented at this time. Elementary mathematics teachers have received a 25-minute professional development session outlining effective instructional practices for EL students. Because the study district is under State sanction, its administrators want to learn how mathematics teachers have implemented effective instructional practices for EL students so that they can determine what further resources and supports the teachers need to meet the learning needs of EL students enrolled in their classrooms

Many factors have been found to influence the achievement of EL students in mathematics; however, research showed that implementation of effective instructional practices (Bottia et al., 2014; Firmender et al., 2014; Scott et al., 2014) and the amount of exposure to mathematics instruction (Ottmar, Decker, Cameron, Curby, & Rimm-Kaufman, 2014) are important factors in improving student achievement. However, local evidence suggested that some elementary teachers have struggled to use effective instructional practices for ELs in mathematics in the Keystone School District (teacher, personal communication, July 20, 2016; teacher, personal communication, June 28, 2016; teacher, personal communication, June 30, 2016; teacher, personal communication, October 18, 2016). Specifically, instructional practices related to building background knowledge, interactions, and application were in need of improvement (K-12 mathematics supervisor, personal communication, June 14, 2017).

Rationale

Evidence at the Local Level

Through a review of local evidence, it appears that elementary mathematics teachers have struggled to implement effective instructional practices for EL students, specifically those related to building background knowledge, student interactions, and application of learning. This problem has influenced the 623 EL students across the Keystone School District, 316 of whom were at the elementary level (ESL head teacher, personal communication, October 1, 2016). There were 164 elementary EL students identified as having a 1 to 3 English Language Proficiency (ELP) level whereas 136 EL students have scored between a 3.1 and 6 (More & Barnes, 2015). These ELP levels were based on the student's performance on the WIDA ACCESS, a placement test that identifies whether a student needed to receive English as a Second Language (ESL) services and what level of instruction was most appropriate (ESL head teacher, personal communication, October 1, 2016). According to WIDA Consortium (2012), the performance definitions that correspond to the ELP levels were Level 1 - Entering, Level 2 - Beginning, Level 3 - Developing, Level 4 - Expanding, Level 5 - Bridging, and Level 6 - Reaching. Although the EL population in the Keystone School District represented 26 different countries of birth, the data showed that 49% of EL students were born in the United States (More & Barnes, 2015). Fifteen percent of ELs were born in Puerto Rico and 13% were born in Guatemala (More & Barnes, 2015). The EL students in this district speak 21 different languages with 88% of students speaking Spanish and 5% speaking

Creole (More & Barnes, 2015). The students of concern for this study were all of the EL students receiving ESL services in first through fifth grades.

Some elementary teachers in the Keystone School District have reported using a limited number of commonly accepted best instructional practices for EL students in mathematics classrooms (teacher, personal communication, July 20, 2016; teacher, personal communication, June 28, 2016; teacher, personal communication, June 30, 2016; teacher, personal communication, October 18, 2016). The head teacher of ESL confirmed that teachers have struggled to implement effective instructional practices for ELs in mathematics and added that teachers across the district have not been provided adequate professional development in order to guide them in providing effective instruction for ELs in mathematics (ESL head teacher, personal communication, October 18, 2016).

The K-12 mathematics supervisor provided insight into specific areas of mathematics instruction for EL students that need improvement at the elementary level. According to the K-12 mathematics supervisor, making connections to experiences and prior learning have been inconsistently used across the elementary mathematics classrooms (K-12 mathematics supervisor, personal communication, June 14, 2017). She added that teachers have struggled to master new grade-level expectations as well as understand the standards from the previous grade level, which made it difficult for teachers to make connections to EL students' prior learning (K-12 mathematics supervisor, personal communication, June 14, 2017). Vocabulary instruction has also been implemented inconsistently across classrooms (K-12 mathematics supervisor, personal communication, June 14, 2017). According to Echevarría, Vogt, and Short (2008) and the Sheltered Instruction Observation Protocol (SIOP), these three instructional practices are all associated with helping students build background knowledge. Building background knowledge by making connections to prior learning and incorporating vocabulary instruction have been identified as a district focus (K-12 mathematics supervisor, personal communication, June 14, 2017).

Teachers and administrators reported an increase of student interactions with peers and instructors through content discussions in elementary mathematics classrooms (teacher, personal communication, July 20, 2016; teacher, personal communication, June 28, 2016; teacher, personal communication, June 30, 2016; K-12 mathematics supervisor, personal communication, June 14, 2017; teacher, personal communication, October 18, 2016). Through local data collection, the mathematics coaches found that EL students were not actively engaging in content discussions (K-12 mathematics supervisor, personal communication, June 14, 2017). In many cases, this was due to inappropriate grouping of students, which did not effectively support the needs of EL students, for example sitting EL students with another student who speaks their native language (K-12 mathematics supervisor, personal communication, June 14, 2017). The mathematics coaches found that some teachers were making instructional decisions based on assumptions about students' language proficiency rather than using language proficiency data or consulting an ESL teacher (K-12 mathematics supervisor, personal communication, June 14, 2017). Using language proficiency data would have enabled teachers to provide appropriate language supports such as seating EL students with other students who speak their native language. Local data also showed that teachers were not providing sufficient wait time for student responses (K-12 mathematics supervisor, personal communication, June 14, 2017).

According to the SIOP developed by Echevarría, Vogt, and Short (2008), practicing and applying learning should incorporate the use of hands-on materials, activities that enable EL students to apply both content and language knowledge, and an integration of reading, writing, listening, and speaking. The K-12 mathematics supervisor has seen some improvements in these areas; however, inconsistencies still exist across grade levels and the district in these areas (K-12 mathematics supervisor, personal communication, June 14, 2017). Having acknowledged an issue with the use of hands-on materials and manipulatives, the district planned on providing professional opportunities for teachers to collaborate on their use of hands-on materials and manipulatives in hopes that this will encourage more consistent use across schools (K-12 mathematics supervisor, personal communication, June 14, 2017). Teachers were observed providing opportunities for EL students to apply both language and content knowledge during mathematics lessons; however, this was also not consistently being implemented across the district (K-12 mathematics supervisor, personal communication, June 14, 2017). A recent focus on classroom routines and response rubrics has improved the integration of reading, listening, and speaking; however, a need still exists to improve the integration of writing in mathematics classes (K-12 mathematics supervisor, personal communication, June 14, 2017).

The difficulties that teachers have encountered related to consistently providing effective instructional practices for EL students in elementary mathematics classrooms may have contributed to the current gap in achievement between EL students and the overall student population both on state and classroom assessments. All students in third, fourth, and fifth grades participate in the PSSA in reading and mathematics. The mathematics data for Grades 3 through 5 are shown in Table 1, Table 2, and Table 3 (K-12 mathematics supervisor, personal communication, September 26, 2016). Each table compares the performance levels for ELs and the overall student population (K-12 mathematics supervisor, personal communication, September 26, 2016). These tables highlight the percentage of students performing at the below basic, basic, proficient, and advanced levels. The state considers proficient and advanced to be acceptable performance levels. Table 1 shows that 8.7% of third-grade EL students performed proficient, whereas 2.2 % scored advanced, compared with 31.2% of the overall population scoring proficient with an additional 18.2% scoring advanced. Table 2 shows that no fourth grade EL students scored proficient or advanced and 89.7% scored at the lowest level, below basic. The data in Table 2 also show that 28.3% of the overall population in fourth grade scored proficient and 10.7% scored advanced. In Table 3, the data show that 3.1% of fifth grade ELs scored proficient, whereas no students scored advanced in mathematics. However, Table 3 also shows that 24.6% of the overall population in fifth grade scored proficient and 15.1% scored advanced. This data demonstrated a considerable achievement gap between ELs and the overall student population on the state assessments in Grades 3 through 5.

Table 1

2016 PSSA Mathematics Performance Levels for Grade 3: ELs Versus Overall Population

		% in each performance level			
Students	*n*	Below basic	Basic	Proficient	Advanced
EL	46	47.8	41.3	8.7	2.2
Overall	708	24.4	26.1	31.2	18.2

Table 2

2016 PSSA Mathematics Performance Levels for Grade 4: ELs Versus Overall Population

		% in each performance level			
Students	*n*	Below basic	Basic	Proficient	Advanced
EL	39	89.7	10.3	0.0	0.0
Overall	709	30.5	30.5	28.3	10.7

Table 3

2016 PSSA Mathematics Performance Levels for Grade 5: ELs Versus Overall Population

		% in each performance level			
Students	*n*	Below basic	Basic	Proficient	Advanced
EL	32	84.4	12.5	3.1	0.0
Overall	667	31.6	28.6	24.6	15.1

Along with the state assessment data, a gap in performance was evident on various levels of assessments within the district including unit tests and Measures of Academic Progress (MAP) assessments, according to the ESL head teacher for the district (ESL head teacher, personal communication, October 23, 2014). Teachers have also noted that EL students have struggled with classroom-level assessments and other mathematics activities (teacher, personal communication, July 20, 2016; teacher, personal communication, June 28, 2016; teacher, personal communication, October 18, 2016). One teacher expressed concern that her EL students often exhibit signs of frustration in mathematics and are confused when trying to navigate their way through a word problem (teacher, personal communication, October, 18, 2016). Other teachers have noticed EL students have struggled with content discussions, explanations of mathematical thinking, (teacher, personal communication, October 30, 2016) and creating mathematics models (teacher, personal communication, June 28, 2016). Teachers' struggle to implement effective instructional practices for ELs in elementary mathematics may have contributed to this gap in achievement between ELs and the overall student population on multiple levels.

EL students in the Keystone School District have continued ESL services into middle and high school because they were unable to meet exit requirements, specifically the required level of mathematics proficiency on the state test (ESL head teacher, personal communication, October 23, 2014). Callahan and Shifrer (2016) noted that most high school EL students are not recent immigrants, not new to the United States, and are not new to English. The district-wide deficit in performance among ELs in mathematics along with failing to exit ELs from ESL services has prompted the state to require an Action Sequence (see Appendix E) be developed to address the issue. According to the Action Sequence, EL student performance on state tests was an area of concern caused by a lack of mathematics support in the ESL curriculum, a lack of mathematics interventions, and an increase in expectations by the state in mathematics. To improve EL students' performance on state tests, the district set three strategies to address these issues. First, mathematics teachers were to incorporate content vocabulary instruction. Some EL students used a computer-based intervention program to supplement classroom instruction. Also, mathematics teachers were to increase participation and rigor of instruction for ELs by using best instructional practices. The first and third strategies identified by the district in the Action Sequence specifically highlighted a need to improve the quality and rigor of the mathematics instruction for EL students to effectively meet their learning needs.

Also of concern, local data showed that nearly all of the EL students who dropped out of high school were struggling in mathematics. According to local records, 22 students receiving ESL services in 10th through 12th grades dropped out in the 2016-2017 school year (ESL head teacher, personal communication, May 1, 2017). Of these students, 20 had received a “D” or an “F” in one or more mathematics classes at the high school level (ESL head teacher, personal communication, May 1, 2017). Of additional concern is the fact that 10 students received a “D” or “F” in multiple mathematics classes and 5 students failed the same class more than once (ESL head teacher, personal communication, May 1, 2017). Not only will a lack of mathematics skills affect these students but they will likely encounter additional challenges due to not completing high school. This is an example of the long-term affect that poor mathematics performance can have on EL students.

The head teacher of ESL for the Keystone School District noted that teachers across the district have not been provided adequate professional guidance to prepare them to meet the diverse learning needs of EL students in mathematics (ESL head teacher, personal communication, October 18, 2016). Since the Action Sequence has been developed, teachers at each school have received a brief professional development session on effective instructional strategies for ELs in mathematics, including explicit vocabulary instruction, providing opportunities for interaction with peers, and using hands-on materials for practice (Session Agenda, January 10, 2017). Improving the mathematics instruction for ELs became a district focus due to the district-wide issue of

EL student mathematics performance (K-12 mathematics supervisor, personal communication, October 20, 2016).

Elementary classroom teachers reported several barriers that were being encountered in relation to providing effective instruction for ELs in mathematics. First, teachers have commented that prior to the development of the Action Sequence, they had received no professional development through the school district on how to identify and meet the needs of EL students in mathematics (teacher, personal communication, December, 3, 2016; teacher, personal communication, December 3, 2016). Teachers have also reported that there was inadequate time available for collaboration with ESL teachers on how to better meet the needs of EL students in mathematics (teacher, personal communication, December 3, 2016; teacher, personal communication, December 3, 2016). Finally, teachers struggled to find extra time to prepare and implement additional supports and instruction for EL students during mathematics classes (teacher, personal communication, December 3, 2016; teacher, personal communication, December 3, 2016). These barriers added to a multifaceted local problem, recursive in nature, which lead to a need for more effective instructional practices for ELs in elementary mathematics classrooms.

The Keystone School District communicated the mission statement "Safe, nurturing, and engaging environment where students will receive a rigorous and responsive education that will empower them to compete globally." With this mission statement, the district demonstrated a commitment to providing a responsive education for all students in order to prepare them be actively involved in the global economy. If

EL students are to receive the educational opportunities to help them be successful, teachers must use instructional practices that meet the academic and language needs of these students in mathematics. Similarly, the ESSA of 2015 stated that schools must provide opportunities for all students to receive a quality education and close achievement gaps (ESSA, 2015). To close the achievement gap and meet the expectations set in the district's mission statement and ESSA, teachers' difficulties in employing effective instructional practices for ELs in mathematics were examined, specifically in the areas of building background knowledge, student interactions, and applications of learning.

Evidence in the Literature

Although many factors have been found to influence the achievement of EL students in mathematics, research has shown that the use of effective instructional practices is important to improving student achievement (Bottia et al., 2014; Firmender et al., 2014; Hoskins, 2016; Scott et al., 2014).

Although many factors have influenced this issue, the inconsistencies of effective instructional practices being implemented likely contributed to the mathematics achievement gap between ELs and their peers that has been documented across all levels of assessment. In addition to the local data, national test scores from the 2013-2014 National Assessment for Educational Progress (NAEP) showed that 26% fewer EL students scored proficient or above than the overall population on the 4th grade mathematics assessment (Department of Education, n.d.). A similar gap was evident among Pennsylvania students, with 29% fewer EL students performing proficient or above than the overall student population of 4th-grade students (Department of Education, n.d.). Recent research suggests that the use of effective instructional practices affected student performance (Bottia et al., 2014; Firmender et al., 2014; Scott et al., 2014). Therefore, it was likely that teachers' difficulties associated with implementing effective instructional practices for EL students contributed to the achievement gap.

Current research studies provided insight into a variety of instructional practices that benefit all students, specifically ELs. Making connections to prior learning and real world experiences enables EL students to build background knowledge (Chval et al., 2015; Doabler et al., 2016), which can have a considerable effect on learning new content (Doabler et al., 2016). Vocabulary instruction is also helpful in building background knowledge and should also be connected to prior learning as well as other languages (Doabler et al., 2016). It is essential for EL students to have opportunities to interact and discuss with their English proficient peers, fostering the development of academic vocabulary and conceptual understanding of mathematics (Pereira & de Oliveira, 2015). This is most often accomplished by setting up simple classroom routines and expectations for student discussions (Bondie, Gaughran, & Zusho, 2014). Warren and Miller (2015) found that instructional practices that incorporate opportunities for EL students to engage in meaningful discourse are most effective. It is also important for teachers to include opportunities for EL students to practice and apply both their language knowledge and mathematics knowledge (Chval et al., 2015). Teachers should also be using language proficiency data and additional individualized student data to modify instruction appropriately for each child (Pereira & de Oliveira, 2015).

The local problem, identified by some teachers, administrators, and the state-required Action Sequence, was despite being provided with professional development through implementation of the Action Sequence elementary mathematics teachers in the Keystone School District were struggling to implement effective instructional practices for EL students. Student performance data demonstrated an achievement gap between ELs and their peers on state assessments. The literature showed that using effective instructional practices for EL students in mathematics had an effect on their learning and achievement (Bottia et al., 2014; Firmender et al., 2014; Scott et al., 2014). Building background knowledge (Chval et al., 2015; Doabler et al., 2016; Nargund-Joshi & Bautista, 2016) incorporating meaningful student interactions (Moschkovich, 2015; Nargund-Joshi & Bautista, 2016; Warren & Miller, 2015), and opportunities for application of language and content knowledge (Chval et al., 2015; Doabler et al., 2016; Moschkovich, 2015) are instructional practices that have been highlighted in the SIOP as effective for EL students (Echevarría, Vogt, & Short, 2008). Guided by the local evidence and the literature, my purpose in this study was to explore teachers' implementation of effective instructional practices for EL students and the challenges they encounter when implementing such practices in the classroom to provide information to the district that could inform further resources and supports that would help teachers better meet the needs of EL students. Specifically, I explored the instructional practices related to building background knowledge, student interactions, and application of learning.

Definition of Terms

Academic literacy in mathematics: Academic literacy in mathematics involves a combination of mathematics skills proficiency, use of mathematics practices, and effective mathematics discourse (Moschkovich, 2015). This highlighted the interconnected relationship between language and mathematics, because it includes both cognitive and social skills (Moschkovich, 2015).

Application: This term refers to instructional practices which enable students to have an opportunity for hands-on practice with new learning or applying previous learning in new ways, while integrating all language skills, including reading, writing, listening, and speaking (Echevarría, Vogt, & Short, 2008). Practice/application is one of the components of the SIOP (Echevarría, Vogt, & Short, 2008).

Building background knowledge: According to Echevarría Vogt, and Short (2008), building background knowledge refers to instructional practices, which enable students to make connections to life experiences and prior learning, while developing content and common vocabulary. Building background knowledge is one of the components of the SIOP (Echevarría, Vogt, & Short, 2008).

English as a second language (*ESL*): According to the Pennsylvania Department of Education (2015a), ESL students are identified through a Home Language Survey and are placed through an annual state language proficiency test called WIDA ACCESS. Those students, who are identified as ESL, receive supplemental services to help them learn English and successfully reach the content achievement expectations set by the state (Pennsylvania Department of Education, 2015a).

English learner (*EL*): Generally stated, English Learners are students who have a native language other than English and are still learning English in school (Pereira & Gentry, 2013). *English Language Learners* (*ELL*s), *Limited English Proficient* (*LEP*) students, and *English as a Second Language* (*ESL*) students are all terms used to describe these students (Pereira & Gentry, 2013).

Limited English Proficient: According to the Pennsylvania Department of Education (2015b), a Limited English Proficient student is someone who "was not born in the United States or whose native language is other than English and comes from an environment where a language other than English is dominant" (p. 2) or is a " Native American or Alaska Native who is a native resident of the outlying areas and comes from an environment where a language other than English has had a significant impact on (the student's) level of English language proficiency" (p. 2) or is "migratory and whose native language is other than English and comes from an environment where a language other than English is dominant" (p. 2). In addition, an LEP student has "sufficient difficulty speaking, reading, writing or understanding the English language; and … has difficulties that may deny (the student) the opportunity to learn successfully in classrooms where the language of instruction is English or to participate fully in our society" (Pennsylvania Department of Education, 2015b, p. 2).

Mathematics proficiency: Reaching a level of mathematics proficiency requires conceptual understanding, an ability to explain procedures and solutions to problems, justifying your thinking, and representing ideas using multiple representations

(Moschkovich, 2015). *Mathematics proficiency* also refers to what is considered an acceptable performance level on the PSSA.

Student interactions: Echevarría, Vogt, and Short (2008) emphasized that for students to develop language knowledge and skills, they must have frequent opportunities to interact with teachers and their peers. Instructional practices such as preferential seating, providing sufficient wait time, and allowing students to receive clarification in their native language are some ways that can support frequent student interactions in the classroom (Echevarría, Vogt, & Short, 2008). Interactions as described here is one of the components of the SIOP (Echevarría, Vogt, & Short, 2008).

Significance of the Study

Various local sources, including personal communications with teachers and administrators, the documented achievement gap, and the Action Sequence, indicated that teachers were struggling to implement effective instructional practices for ELs in elementary mathematics classrooms. Specifically, instructional practices related to building background knowledge, student interactions, and applications have been identified as issues. Many of the mathematics skills taught at the elementary level are foundational for secondary mathematics concepts (Common Core State Standards Initiative, 2015). Local secondary teachers in the district of study noticed EL students' inability to make real-world connections due to a lack in foundational mathematics skills (ESL head teacher, personal communication, October 23, 2014). Additionally, local EL students have failed to exit English as a Second Language (ESL) services due to poor mathematics scores (ESL head teacher, personal communication, October 23, 2014). Also of concern was the fact that nearly all of the EL students who dropped out in tenth through twelfth grades in the 2016-2017 school year were receiving a “D” or “F” in one or more mathematics courses (ESL head teacher, personal communication, May 1, 2017).

Therefore, an examination of effective instructional practices for EL students implemented by elementary mathematics teachers was needed. The purpose of this study was to explore how mathematics teachers in first through fifth grade were using effective instructional practices, related to building background, student interactions, and application, to meet the needs of EL students as well as the possible challenges experienced by teachers when implementing these practices. Collectively, these results may provide foundational information to guide the district in addressing the local issue. Administrators might benefit from this information as it might enable them to make informed decisions about what support is needed for mathematics teachers working with EL students. Teachers will benefit from having informed administrators who are aware of the practices currently in place in mathematics classrooms, which will hopefully inform future professional development opportunities and added supports to enable teachers to successfully implement effective instructional practices for ELs in mathematics. The results of this study provided evidence that professional development is needed to build on teachers’ current knowledge and practices. EL students will benefit from having teachers who are more prepared to meet their academic and language needs in mathematics. In the future, these students may benefit from acquiring foundational mathematical literacy as well as increased opportunities to access careers in Science, Technology, Engineering, and Mathematics (STEM) fields.

Research Questions

Teachers and administrators in the Keystone School District identified a problem with teacher implementation of effective instructional practices for EL students in elementary mathematics classrooms. The existence of the problem was evidenced by an achievement gap between ELs and their peers on state mathematics assessments as well as district and classroom level assessments, personal communications with teachers and administrators, and the state-required Action Sequence. The local problem was explored by focusing on effective instructional practices related to building background knowledge, providing opportunities for varied student interactions in the classroom, and providing opportunities for practice and application of both content and language knowledge. This qualitative case study was guided by the following questions:

1. How do first through fifth grade mathematics teachers implement instructional practices related to building background knowledge for EL students?
2. How do first through fifth grade mathematics teachers implement instructional practices related to student interactions for EL students?
3. How do first through fifth grade mathematics teachers implement instructional practices related to practice and application for EL students?
4. What challenges do first through fifth grade teachers experience related to implementing effective instructional practices for EL students in mathematics?

Review of the Literature

The local problem was that despite the provided professional development through implementation of the state-mandated Action Sequence, teachers appeared to be struggling to implement effective instructional practices for EL students in elementary mathematics. Local evidence and current literature supported the need to explore the current instructional practices of teachers, specifically how effective practices related to building background, student interactions, and opportunities for application are being implemented in the mathematics instruction for first through fifth grade EL students as well as the challenges being experienced by teachers in relation to implementing these practices. The purpose, research questions, and methodology for this study were developed in alignment with the following conceptual framework.

Conceptual Framework

The SIOP Model (Echevarría, Vogt, & Short, 2008) was the conceptual framework for this study. The SIOP Model was created to improve the use of Sheltered Instruction (SI), a teaching approach that integrates language development into instruction of academic content in order to make grade level concepts accessible to ELs (Echevarría, Short, & Powers, 2008; Kareva & Echevarría, 2013; Stephens & Johnson, 2015; Vogt & Echevarría, 2015).

SI was developed in the 1980s and 1990s during the educational reform movement in an effort to improve content-based instruction for EL students (Daniel & Conlin, 2015; Echevarría, Vogt, & Short, 2008; Polat & Cepik, 2016). Kareva and Echevarría (2013) stated “The goal of sheltered instruction is to provide access to the core curriculum by teaching in a way that is meaningful and understandable for second language learners and through these modified lessons, students learn academic language" (p.239). SI lessons are not less rigorous. Rather this instructional approach enables EL students, who may not have grade-level language skills, to make sense of grade level content through added supports (Kareva & Echevarría, 2013; Macías et al., 2013). SI practices can be used in all academic subjects and across all grade levels (Kareva & Echevarría, 2013) and is now widely used across the country (Stephens & Johnson, 2015). This approach is most often utilized by classroom teachers, rather than by English as a Second Language (ESL) teachers, and incorporates best instructional practices for ELs and their peers in mainstream classrooms (Echevarría, Short, & Powers, 2008; Echevarría, Vogt, & Short, 2008).

Short, Fidelman, and Louguit (2012) found that implementation and techniques used for SI were inconsistent across classrooms. This inspired the development of a preliminary version of the SIOP in the early 1990s, which was created as a supervisory tool to improve and measure the implementation of SI (Echevarría, Vogt, & Short, 2008; Polat & Cepik, 2016; Short et al., 2012). The preliminary SIOP was field tested with SI teachers and revised according to feedback (Echevarría, Vogt, & Short, 2008). In 1996, a research study on SI was conducted for the National center for Research on Education, Diversity, & Excellence (CREDE) and funded by the U.S. Department of Education (Echevarría, Vogt, & Short, 2008). The focus of this research project was to construct a model for SI, develop a method to train teachers to effectively implement the SI model, and conduct research on the effects of SI on EL students' development of language skills and content knowledge (Echevarría, Vogt, & Short, 2008). Throughout the next several years, the SIOP continued to be refined and tested for reliability (Echevarría, Vogt, & Short, 2008). Eventually the SIOP developed into a framework for effectively planning and delivering SI with fidelity (Echevarría, Vogt, & Short, 2008; Kareva & Echevarría, 2013; Short et al., 2012). In 2000, the SIOP Model (see Appendix B) was created, consisting of 30 instructional features organized into the following eight components:

- Preparation
- Building Background
- Comprehensible Input
- Strategies
- Interaction
- Practice/Application
- Lesson Delivery
- Review/Assessment (Short et al., 2012, p.28-29).

Preparation is the first component and highlighted the importance of focusing each SIOP lesson on clearly defined language and content objectives (Echevarría, Vogt, & Short, 2008; Kareva & Echevarría, 2013). Building background knowledge is essential to SIOP lessons because this enables students to make connections to prior learning and experiences as well as become familiar with key vocabulary (Echevarría, Vogt, & Short, 2008; Kareva & Echevarría, 2013). It is necessary for teachers to use an appropriate level of speech matched to students’ language proficiencies, providing clear explanations, and incorporating a variety of supports such as visuals, manipulatives, and kinesthetic activities, which is described as Comprehensible Input (Echevarría, Vogt, & Short, 2008). It is important to provide students with multiple opportunities to practice strategies as well as scaffolding the learning process through think alouds and higher-order questioning (Echevarría, Vogt, & Short, 2008). Student interactions are a key component to the SIOP Model and the features highlighted the need for frequent opportunities for students to engage in meaningful discourse with teachers and peers, appropriate student groups, adequate wait time for students to form responses, and opportunities for clarification (Echevarría, Vogt, & Short, 2008). Practice/Application involves incorporating activities where students can practice both content and language skills through the use of hands-on materials or manipulatives as well as the language processes (reading, writing, listening, and speaking) (Echevarría, Vogt, & Short, 2008; Kareva & Echevarría, 2013). The delivery of the lesson must support the content and language objectives, be appropriately paced, and students must be actively engaged (Echevarría, Vogt, & Short, 2008). Finally, it is necessary to provide comprehensive reviews of vocabulary and concepts with consistent feedback as well as assess how students have met the lesson objectives (Echevarría, Vogt, & Short, 2008).

The research-based techniques and best practices included in the SIOP Model are designed to make academic content more accessible to EL students (Short, 2013; Short et al., 2012). The SIOP Model is not scripted and can be used with different teaching styles (Echevarría, Vogt, & Short, 2008; Short et al., 2012). The ultimate purpose of the SIOP Model is to provide a guide for teachers to help improve the content instruction for EL students by incorporating academic language development (Short, 2013; Short et al., 2012; Vogt & Echevarría, 2015).

The local problem was elementary mathematics teachers seemed to be experiencing difficulty in implementing effective instructional practices to meet the learning needs of EL students. Collectively the local data showed a need to improve mathematics instruction related to building background knowledge, interactions, and application. The guiding research questions for this study were developed from this local data and were also aligned to portions of the SIOP Model. The SIOP Model was an appropriate framework for this study because it was aligned with the local problem and the purpose of SIOP is to improve content instruction for EL students. For the current study, I explored how effective instructional practices related to building background, interactions, and practice/application were being implemented in the mathematics instruction for first through fifth grade EL students. The corresponding portions of the SIOP were used for data collection during classroom observations along with anecdotal field notes. The following paragraphs review research which demonstrates the effectiveness of the SIOP Model with learners who are similar to those at the study site.

In Boston, a study was conducted to examine effect that the SIOP Model had on elementary student achievement (Kareva & Echevarría, 2013). Teachers in the district were introduced to each SIOP component, individually, over the course of a school year with ongoing professional development, instructional coaching, and systematic feedback occurring for 3 years (Kareva & Echevarría, 2013). State test scores were examined from 502 students from a low-socioeconomic background, 90% speaking Spanish and nearly half not speaking fluent English (Kareva & Echevarría, 2013). The results showed that the reading scores on standardized tests increased from 20 points below the state average to 0.2 points above the state average and the mathematics scores increased from 28 points below the state average to 20 points above the state average (Kareva & Echevarría, 2013).

Echevarría, Short, and Powers (2008) compared the pre and post writing assessments of students who had comparable teachers by credentials and experience except that the intervention group teachers were also trained in the SIOP Model. The students who received SIOP lessons had lower average scores than the comparison group on the overall test and all sub-scores for the pretest but had higher scores than the comparison group on all post-tests (Echevarría, Short, & Powers, 2008). Students receiving SIOP lessons performed significantly higher than the comparison group on language production (Intervention group M=3.22, SD= 079; Comparison group M=3.09, SD=.73), organization (Intervention group M=3.31, SD=.78; Comparison group M=3.21, SD= 071), and mechanics (Intervention group M=3.28, SD= .87; Comparison group M=3.17, SD=.94) (Echevarría, Short, & Powers, 2008). SIOP students also scored higher than the comparison group in the categories of focus and elaboration; however these were not found to be statistically significant (Echevarría, Short, & Powers, 2008).

Murillo (2013) used the SIOP Model as a theoretical framework for a study which examined how teachers can adapt their lesson delivery to improve English instruction for sixth grade students in Columbia. Murillo used anecdotal field notes in addition to a checklist during classroom observations in order to capture a clear understanding of the practices and interactions taking place. Surveys and artifacts were also used to gather qualitative data (Murillo, 2013). Murillo found that students reported that lessons that were adapted to the SIOP Model were more comprehensible and they learned more vocabulary. Students also reported that they found the clear lesson objectives to be motivating and they enjoyed interacting with their peers (Murillo, 2013).

Although these are small-scale studies, the results show that the SIOP Model has yielded positive gains for students and is a promising approach to improving the instruction for EL students. Additionally, the continual development of the SIOP Model through research studies, conducted both by the authors and other educators, with the purpose of improving the academic success of EL students in content areas conveys the idea that this is an area of concern for many and there is a need for positive social change. The SIOP Model includes building background, interactions, and application as three of the major components. It is for these reasons that the SIOP Model was selected as the conceptual framework for this study. The purpose of this study was to explore the implementation of effective instructional practices for EL students by elementary mathematics teachers in the Keystone School District related to building background knowledge, student interactions, and application opportunities. Additionally, the purpose was to explore the possible barriers experienced by teachers related to implementing effective instructional practices for EL students in mathematics.

Search Strategy

The literature reviewed for this study was found using the following online databases: Education Source, ERIC, Academic Search Complete, and Teacher Reference

Center. The following search terms were used in preparation for this literature review: *English Language Learners, English Learners, linguistically diverse, mathematics, instruction, instructional practices, challenges, achievement, Sheltered Instruction, and Sheltered Instruction Observation Protocol*. Various combinations of the search terms, including abbreviations and synonyms, were used as well. After reading an article, I reviewed the listed sources for any that may have been applicable to my study. In order to reach saturation of the current literature, I also searched for related studies by the same authors. I searched for peer-reviewed articles and searched primarily for journal articles published in 2014 or later.

Review of the Broader Problem

Throughout the remainder of this literature review, I have provided an in-depth review of the current literature related to the local problem. The review will begin with a review of research about the broader problem, and then review research about effective instructional practices for EL students, specifically highlighting building background knowledge, interactions, and application. Next, a review of the research on academic literacy in mathematics is provided along with challenges experienced by EL students in mathematics classrooms. Finally, the research about preparing elementary teachers to implement effective instructional practices to meet the learning needs of EL students in mathematics is reviewed. The review concludes with a critical analysis of the collective body of literature. All of the pieces of this review were necessary to fully understand the dynamics of the local problem associated with the instructional practices for ELs in mathematics.

The rapid increase in enrollment of linguistically diverse students in public schools (Spees et al., 2016) has created new challenges for teachers and students across the country. The United States has the highest population of foreign-born people, more than 40 million (Moreno-Recio, Corrales, Orange, & Lastrapes, 2018). EL students often encounter challenges related to being a minority, coming from an impoverished home, and possibly having parents who are immigrants (Callahan & Shifrer, 2016). In addition to these challenges, EL students are charged with the task of learning English, navigating a new culture (Nelson & Guerra, 2014), and learning academic content (Orosco & Abdulrahim, 2018).

Unfortunately, there is a well-documented gap in mathematics achievement between EL students and their native English speaking grade-level peers (Department of Education, n.d.). This gap has likely been impacted by the fact that many EL students learn mathematics in a mainstream classroom with teachers who may not have the knowledge and resources to effectively teach them (Chval et al., 2015). Therefore, many EL students often do not receive the quality mathematics instruction needed for them to be successful (Doabler et al., 2016).

In addition to teachers being unprepared, there are several other factors that may be impacting the quality of instruction being provided to EL students in mathematics. In most schools, the instructional focus for all students, including ELs, is reading and writing rather than mathematics (Hopkins, Lowenhaupt, & Sweet, 2015). When implementing instructional practices in mathematics, most often schools focus on vocabulary when in fact there is much more to the academic language of mathematics than vocabulary (Hopkins et al., 2015; Moschkovich, 2015). Although there is limited research on linguistically diverse students (Doabler et al., 2016; Hopkins et al., 2015; Warren & Miller, 2015), several instructional practices have been highlighted in the literature as effective for EL students in mathematics including building background knowledge, providing meaningful interactions , practice and application opportunities (Nargund-Joshi & Bautista, 2016).

Research About Effective Instruction for English Learners

There is a growing need to improve the achievement of EL students in mathematics and close the gap between ELs and their native English speaking peers (Whitenack & Venkatsubramanyan, 2016). Although many factors have been found to influence the achievement of EL students in mathematics, current research suggests that the use of effective instructional practices is important for improving student achievement (Bottia et al., 2014; Firmender et al., 2014; Hoskins, 2016; Scott et al., 2014). However, providing linguistically differentiated instruction for multiple language proficiency levels while also maintaining the rigor of grade level content is an immense challenge for teachers (Moreno-Recio et al., 2018).

Providing effective mathematics instruction for EL students requires the incorporation of a variety of learning opportunities, representations, and methods of communication (Warren & Miller, 2015). Most mathematics curricula are not designed specifically for EL students and cannot be expected to meet the needs of all learners (Banse, Palacios, Merritt, & Rimm-Kaufman, 2017; Chval et al., 2015).

Sheltered Instruction (SI) is an instructional approach for EL students used by teachers across the U.S. (Stephens & Johnson, 2015). The SIOP Model, theoretical framework for this study, includes best instructional practices that are designed to make academic content more accessible to EL students and can benefit all students (Short, 2013; Short et al., 2012). The current literature has summarized three components of the SIOP Model that are the focus of this study: building background, interactions, and practice/application.

Building background. As mentioned previously, there are no curricular programs that work for all students which is why teachers are challenged with knowing how to modify their instruction to meet the needs of their learners (Chval et al., 2015). One way to make mathematics content accessible to all students, including ELs, is to build background knowledge as highlighted in the SIOP Model (Echevarría, Vogt, & Short, 2008; Kareva & Echevarría, 2013). This is most often accomplished by making connections between new content and past experiences and prior learning of students (Chval et al., 2015; Doabler et al., 2016). Explicit instruction on content vocabulary and specialized language structures instruction also provides students with foundational academic language knowledge that enables them to access rigorous mathematics content (Adoniou & Yi, 2014). The local evidence suggested that building background is an area of mathematics instruction that needs improvement within the district under study (K-12 mathematics supervisor, personal communication, June 14, 2017).

According to Doabler et al., (2016), prior knowledge and experiences have a significant impact on the extent to which students learn new academic content. This is a challenge for many teachers because many EL students lack the background knowledge and experiences to learn even prerequisite skills (Doabler et al., 2016). Therefore, teachers must draw on students' funds of knowledge that have been developed at home, in the community, and in previous classrooms (Chval et al., 2015; Doabler et al., 2016; Nargund-Joshi & Bautista, 2016). This is done by helping students make connections between life experiences and previously learned knowledge or skills (Chval et al., 2015; Doabler et al., 2016; Nargund-Joshi & Bautista, 2016). It is also helpful to make explicit connections to students' primary languages (Doabler et al., 2016).

Visual aids and math models must be thoroughly explained when used to scaffold instruction and build background (Adoniou & Yi, 2014). Along with connecting visuals and models to mathematics concepts, graphic organizers can also be used to help students organize and expound on what they have learned (Moschkovich, 2015). Incorporating reflection into learning opportunities encourages students to make connections between new knowledge, prior learning, and lingering questions they may have. Along with using visuals and models, teachers need to incorporate student interest and relevant contexts into mathematics stories. "Think alouds" can be used to guide students in creating and solving problems (Banse et al., 2017).

Content vocabulary is one piece of the academic language used in mathematics. Mathematics vocabulary differs from everyday language, although some words overlap or have multiple meanings (Adoniou & Yi, 2014; Warren & Miller, 2015). For example, the word *difference* means the result of subtraction in mathematics yet it refers to people or things that are not alike in everyday language. Therefore, content vocabulary, abbreviations, synonyms, and specialized language structures should be explicitly taught, as these are often new information and confusing to EL students (Adoniou & Yi, 2014). It is important for EL students to develop meaningful understandings of mathematics vocabulary so that it can be used to access specific skills and content (Warren & Miller, 2015). This means, simply memorizing disconnected definitions and lists of words is not sufficient to foster academic literacy in mathematics (Moschkovich, 2015). When EL students understand mathematics vocabulary, they are able to access new content and build conceptual understanding more efficiently (Doabler et al., 2016). In addition to words specific to mathematics, there is academic vocabulary that is used across content areas which also needs to be explicitly taught (Doabler et al., 2016).

To make vocabulary instruction manageable for EL students, teachers should identify key vocabulary words that are essential to conceptual understanding and limit the number presented at one time based on the lesson objectives and student needs (Doabler et al., 2016). It is helpful to connect these words to prior learning and other languages (Doabler et al., 2016). Teachers must also model appropriate use of sophisticated mathematics vocabulary and provide various opportunities for EL students to engage in the language of mathematics in meaningful ways (Chval et al., 2015; Doabler et al., 2016).). The practice guide developed by Institute of Education Sciences (IES), reported that there is strong evidence in current research studies to support the effectiveness of providing explicit vocabulary instruction to improve the learning of EL students in content areas such as mathematics (Baker et al., 2014). Specifically, the guide highlighted teaching a limited number of words at a time, using multiple modes of learning, and including both academic and general vocabulary that will support their understanding of the content (Baker et al., 2014). Although the details of the reviewed research studies are not provided, the panel of experts that create the guide use specific criteria to rate the level of evidence including: number of studies, designs of studies, internal validity, range of participants and settings, attributing the findings to the instructional practices being studied, and consistent positive findings (Baker et al., 2014).

Interactions. With the increasing expectations for mathematics performance (Short, 2013) there is a need for authentic learning opportunities and content-rich discussions which draw on students' language knowledge and prior experiences to be available to ELs in order to build understanding of new mathematics concepts (Hakuta et al., 2013). According to Warren and Miller (2015), instructional practices which incorporate meaningful contexts and opportunities for students to communicate about mathematics are most effective. Although local evidence suggested that student interactions and discussions are a commonly used instructional practice in the Keystone School District, local evidence suggested that improvements need to be made to ensure EL students are fully engaging in these interactions (K-12 mathematics supervisor, personal communication, June 14, 2017).

EL students need to have a variety of opportunities to interact with teachers and their peers (Nargund-Joshi & Bautista, 2016). As mentioned earlier, mathematics literacy requires a combination of mathematics proficiency, demonstration of mathematics practices, and appropriate use of the language of mathematics (Moschkovich, 2015). Incorporating opportunities for meaningful mathematics discourse enables EL students to engage in all of these while also applying content and language knowledge (Moschovich, 2015).

Effective interactions among EL students, their peers, and their teachers in a mathematics classroom are frequent, intentional, and allow students to share ideas, solutions, and reasoning, as well as evaluate the thinking of others (Banse et al., 2017; Doabler et al., 2016; Ernst-Slavit & Wenger, 2016; Moschkovich, 2015; Nargund-Joshi & Bautista, 2016). Doabler et al., (2016) emphasized the need to foster meaningful foundational interactions between EL students, their peers, and their instructors, when introducing new mathematics content. Interactions should also incorporate a variety of skill levels including computation and higher-order thinking (Moschkovich, 2015). EL students need opportunities to demonstrate their reasoning, justify their thinking, and expound on their ideas (Doabler et al., 2016). These types of purposeful interactions can be guided by teachers' questioning (Banse et al., 2017; Doabler et al., 2016). According to the practice guide developed by Institute of Education Sciences (IES), there is strong evidence in current research to support the need of frequent interactions and discourse for EL students in content areas such as mathematics (Baker et al., 2014).

It is important for teachers to support EL students during interactions, including mathematics discourse (Banse et al., 2017). Additionally, when EL students are engaging in mathematics discussions, it is important to encourage students to use a variety of modes of communication to share their thinking, which could include using symbols or other representations (Moschkovich, 2015). Sometimes it is necessary for teachers to repeat student responses and provide clarification. This reiterating of student responses is a powerful way to confirm student understanding while modeling appropriate mathematics language (Banse et al., 2017). Teachers can elaborate on student responses or prompt students to elaborate on their own thinking (Banse et al., 2017). Allowing students to respond in their native language when necessary can help them become more comfortable in the learning environment, thus enabling them to focus on the mathematics rather than the language (Doabler et al., 2016). Another way to support EL students during interactions is to provide additional “think time” (Doabler et al., 2016). This allows students time to formulate their ideas and identify the necessary language and communication skills needed to share. “Self-talk” provides EL students with additional opportunities to engage in new mathematics content by repeating and expounding on their thinking using appropriate language skills (Banse et al., 2017).

In order to facilitate effective discourse in the classroom, Bondie et al. (2014) suggested grouping students with differing strengths. This will allow students to share their learning and benefit from the strengths that each person brings to the group. Pereira and de Oliveira (2015) suggested providing opportunities for EL students to engage in mathematics discussions with fluent English speakers. It is important for teachers to set up consistent discussion routines which enable EL students to focus on the content and language in student discussions because they are comfortable and engaged in a familiar process (Bondie et al., 2014). Bondie et al. also suggested using time limits and random reporting to increase focus and hold students accountable.

Using data from the United States Department of Education Early Childhood Longitudinal Study, Bottia et al. (2014) examined the relationship between several instructional practices and student achievement. Bottia et al. used regression coefficients from hierarchical linear models to analyze the mathematics achievement of 15,840 black, white, Latino, and Asian kindergartners. The results showed that interactive group activities had a coefficient of .14 ($SE = .04$, $p < .001$) (Bottia et al., 2014). Similarly, mathematics drills had a coefficient of .20 ($SE = .03$, $p < .001$), showing that these instructional practices enhanced the mathematics performance of all students (Bottia et al., 2014). The use of manipulatives, music, and movement did not significantly impact the achievement of all students, including those who are linguistically diverse (Bottia et al, 2014).

Practice and applications. The literature has already revealed the importance of drawing on the prior knowledge and experiences of EL students (Doabler et al., 2016). Background knowledge should also be considered when designing practice and application opportunities for mathematics content. EL students benefit from explicit instruction and clear modeling of tasks (Doabler et al., 2016). Teachers must build on the foundational language and mathematics skills by thoughtfully designing instruction and practice activities that will foster success (Doabler et al., 2016).

Academic literacy in mathematics, which will be discussed in detail in the following section, should be the focus of practice and application opportunities (Moschkovich, 2015). It is important for teachers to provide EL students with opportunities to apply both their mathematics and language knowledge (Chval et al., 2015), as viewing language and mathematics as separate entities can be detrimental to EL students (Moschkovich, 2015). The Common Core Standards for Mathematical Practice highlighted target behaviors of successful mathematics learners (Common Core State Standards Initiative, 2015). These behaviors are developed through mathematics discourse and application of mathematics knowledge and skills (Moschkovich, 2015). In order to fully develop these behaviors, it is critical for teachers to incorporate all forms of communication throughout mathematics instruction including reading, writing, listening, and speaking (Doabler et al., 2016). Mathematics instruction for EL students becomes more effective when teachers integrate language and mathematics instruction and applications simultaneously (Chval et al., 2015). This is another area that has been identified as inconsistent across the Keystone School District and in need of improvement (K-12 mathematics supervisor, personal communication, June 14, 2017). Building background, interactions, and opportunities for application are instructional practices which enable all learners, especially EL students, to build academic literacy in mathematics. The following section will review the current literature on academic literacy in mathematics.

Academic Literacy in Mathematics

A common misconception is that mathematics is easy for EL students because numbers are universal and require little language (Hopkins et al., 2015). Becoming academically literate in mathematics requires far more language knowledge and skills than memorizing a list of mathematics vocabulary words (Moschkovich, 2015). Academic literacy in mathematics requires a combination of proficiency in mathematics content and skills, proficiency in mathematics practices, and proficiency in mathematics discourse (Moschkovich, 2015). Academic literacy in mathematics requires both cognitive and social aptitudes; therefore it is essential for educators to consider both language and mathematics skills when providing instruction for ELs (Moschkovich, 2015). Academic literacy in mathematics is a central component to the instructional practices building background, interactions, and applications as these practices will foster the development of academic literacy in mathematics. Therefore, academic literacy in mathematics is an essential part of this literature review and necessary to fully understand the local problem and the importance of effective instructional practices.

Just as social language is most effectively learned through life experiences, academic language is best learned through meaningful experiences within the context of the classroom (Chval et al., 2015). Providing the appropriate environment and supports to enable EL students to engage in meaningful mathematics discussions is a challenge for teachers (Banse et al., 2017; Chval, et al., 2015; Doabler et al., 2016). Mathematics instruction should provide EL students with equal access to higher-order activities that build conceptual understanding and reasoning (Moschkovich, 2015). This means that teachers should not be reducing the rigor of the mathematics content but instead providing a context and learning opportunities that make the content more accessible or relevant to the students (Chval, et al., 2015). One way to do this is to focus on one real-life context, (e.g. an ice cream shop) for an extended period of time and create mathematics problems that demonstrate the target skills within the context (Chval, et al., 2015).

The expectations outlined in the Common Core Standards for Mathematical Practice now require students at all grade levels to persevere in problem solving; make connections between context, quantities, and mathematics operations; defend their reasoning for mathematical decisions and critique the reasoning of others; use math models to solve every day problems; use appropriate tools; use explicit math vocabulary; identify and utilize patterns; and identify regularity in repeated reasoning (Common Core State Standards Initiative, 2015). A student's ability to develop many of these mathematical practices depends highly on the student's ability to effectively engage in mathematics discourse. What is important to consider is that these mathematical practices do not rely on specific words or vocabulary, rather a demonstration of understanding and critical thinking (Moschkovich, 2015). Mathematics discourse incorporates more than just oral language; students can draw on various resources such as symbols, manipulatives, models, artifacts, and content vocabulary to develop an understanding of mathematics concepts (Moschkovich, 2015). When facilitating a discussion of a new mathematics concept, Moschkovich (2015) suggests encouraging ELs to begin by using everyday vocabulary to actively engage, discuss, and build meaning. Then, guided by explicit instruction and learning experiences, encourage students to incorporate content specific vocabulary words into their discourse (Moschkovich, 2015). It is imperative that teachers understand that literacy in mathematics can be demonstrated by using everyday vocabulary to explain ideas, solutions, and justifications of mathematics problems. Formal vocabulary is not always required (Moschkovich, 2015).

Challenges ELs Face When Learning Mathematics

In order to fully understand the dynamics of the local problem related to teachers having difficulties employing effective instructional practices, it is necessary to acknowledge the many challenges faced by EL students in mathematics classrooms. EL students encounter challenges above and beyond what most native English speaking students experience in mathematics classrooms. In many cases, EL students experience struggles relating to being a minority, having a low socio-economic status, having parents who are immigrants, having parents with limited levels of education, and attending schools with high poverty rates (Callahan & Shifrer, 2016). Adding to this, 99% of minority students who are not ELs enter U.S. schools in kindergarten, while only 48% of ELs entered U.S. schools entered in kindergarten (Callahan & Shifrer, 2016). This means that nearly half of the EL population is not receiving the full continuum of education in U.S. schools, further adding to the factors hindering EL students' educational success.

According to Doabler et al. (2016), EL students have a high probability of failure in mathematics. This research mirrors the local data which showed that of the 22 EL students who dropped out in the 2016-2017 schoolyear, 20 were currently failing or had failed one or more mathematics courses. Callahan and Shifrer (2016) found that contrary to public opinion, most high school EL students are not new to the U.S. or new to the English language. EL students are more likely to enroll in lower level classes and earn lower grades than their peers and are the least likely subgroup of students to enroll in college (Callahan & Shifrer, 2016). In fact, high school graduation rates are used as a measure for academic success of EL students, rather than college or post high school education, further demonstrating low expectations for ELs (Callahan & Shifrer, 2016).

All students are faced with the task of learning academic language. EL students however, must do this while also learning conversational language (Pereira & deOliveira, 2015). In order for ELs to be successful in mathematics classrooms, these students must be able to interpret and communicate using a mix of everyday and content-specific language (Adoniou & Yi, 2014). Learning and applying both social language and academic language is a challenge for any student. However, an important point to consider is the heterogeneous nature of the group of students often referred to as “English Learners”, ‘English Language Learners”, or “Limited English Proficient.” Rodríguez, Abrego, and Rubin (2014) explained that EL students have varying levels of language proficiency both in English and their native language. Some EL students have had limited exposure to the English language and others have been around English speakers their entire lives but have not yet gained proficiency (Rodríguez et al., 2014). These EL students who have had limited exposure to the English language have a particularly challenging task when asked to communicate and learn academic content that is presented in a language of which they have limited proficiency (Rodríguez et al., 2014).

Some EL students experience the challenge of navigating a new culture within their educational environment (Nelson & Guerra, 2014). Adding to the challenge of adapting to a new culture is the fact that some EL students who are coming from out of the United States have never been to school (Rodríguez et al., 2014). These students must also figure out how to behave in a culturally acceptable way according to the school rules and routines.

To make matters worse, current research suggests that EL students are not receiving effective instruction in mathematics (Doabler et al., 2016). In many cases, being labeled as an EL, an English Language Learner (ELL), an English as a Second

Language (ESL) student, a Limited English Proficient (LEP) student, or any of the other titles given to linguistically diverse students, inadvertently conveys to teachers a need to limit the instructional rigor and lower academic expectations (Callahan & Shifrer, 2016). As a result of misconceptions like this one, EL students lack the rigorous mathematics instruction that provides them with a comprehensive understanding extending beyond simple arithmetic (Warren & Miller, 2015). When carried out over time, this misconception leads to a widening of the performance gap between EL students and their peers (Callahan & Shifrer, 2016).

Hopkins et al. (2015) found that even though the elementary teacher participants in their study were trained in Sheltered Instruction (SI), they viewed language needs as separate from content learning and therefore did not implement the instructional practices supported by SI. This view also impacts EL students who have effectively adapted to their learning environment. Despite the documented gap in performance between ELs and their peers on mathematics assessments (Department of Education, n.d.), the academic focus in most schools continues to be reading and writing instruction (Hopkins et al., 2015). Although academic interventions are readily available in reading and writing, most often academic support in mathematics is not available for EL students, leaving the mathematics teacher exclusively responsible for providing the support (Hopkins et al., 2015). Those students receiving ESL services receive additional support in reading and writing through the overlapping ESL curriculum (Hopkins, et al., 2015). Furthermore, there are less opportunities for professional development and other supports for mathematics teachers working with ELs than those who teach reading and writing (Hopkins, et al., 2015).

Another common misconception that may be impacting the mathematics instruction for ELs is the thought that mathematics is exempt from language that may be a barrier to learning the academic content for EL students (Hopkins et al., 2015). Many educators mistakenly think that if EL students can read the content vocabulary words, then they are being provided with equal access to the mathematics content (Hopkins et al., 2015). This is a narrow understanding of the relationship between language and mathematics.

As noted in this section, misconceptions of teachers and administrators can have a negative impact on the learning of EL students. The limited use of effective instructional practices for ELs in mathematics in the Keystone School District may be linked to misconceptions such as these. Therefore, it is essential for educators to have an understanding of the challenges faced by EL students as well as common misconceptions in order to identify effective practices and design instruction which will foster success among all learners, including EL students.

Preparing Teachers for Effective Instruction of ELs

The documented achievement gap between ELs and their peers (Department of Education, n.d.), and the limited use of effective instructional practices being implemented in mathematics instruction (Doabler et al., 2016; Hopkins et al., 2015; Warren & Miller, 2015) demonstrate a need for ELs to have access to highly-qualified mathematics teachers (Rodríguez et al., 2014). This is a problem which has been identified both in the current literature and the local district of study. Despite this need, many teachers across the country are receiving little to no professional development and support in teaching mathematics to EL students (Hopkins, et al., 2015). The accountability for effectively teaching mathematics to EL students should be a shared responsibility between teachers and administrators (Rodríguez et al., 2014). Ongoing professional learning opportunities about effective instructional practices for EL students must be made readily available to teachers as well as opportunities for teachers to collaborate with their peers (Hopkins, et al., 2015).

These professional learning opportunities need to prepare teachers to work with EL students with varying language proficiencies and cultural backgrounds (Pereira & de Oliveira, 2015). States are required to assess the language proficiency of all identified EL students from kindergarten through twelfth grade (Pereira & de Oliveira, 2015). Professional training may be needed to help teachers become familiar with English proficiency level descriptors and how to apply them when designing instruction (Pereira & de Oliveira, 2015). Teachers must also understand the difference between everyday English and the academic language used in mathematics classes as well as how to address student needs with both types of language (Pereira & de Oliveira, 2015). Along with being cognizant of language proficiency levels, teachers need to be aware of each student’s strengths and weaknesses as a learner (Park, 2014; Pereira & de Oliveira, 2015). Teachers should be using the language proficiency data along with other insights they have gained while working with their EL students to adapt instruction in a way that meets the learners needs yet maintains high expectations (Pereira & de Oliveira, 2015).

As the demographics continue to change across the nation, a change in teacher preparation programs and professional learning is needed to prepare teachers to provide effective instruction in mathematics, and all subjects, to EL students (Whitenack & Venkatsubramanyan, 2016). Studies have shown that teachers who have negative perceptions about linguistically diverse students often have low academic expectations for these students and place blame on individuals, their cultural background, and their family for the student's lack of academic proficiency (Barajas-Lopez, 2014; Nelson & Guerra, 2014). These negative perceptions reflect deficit thinking which can be detrimental to the learning of EL students (Barajas-Lopez, 2014; Nelson & Guerra, 2014). Findings from a narrative study conducted by Barajas-Lopez (2014) demonstrated positive perceptions of mathematics learning among students who reported experiencing success early in mathematics through accomplishing academic tasks, earning high grades, and receiving praise from his or her teacher. Students who felt that their teacher viewed them as competent mathematics learners also expressed positive perceptions of mathematics learning (Barajas-Lopez, 2014).

Bondie et al. (2014) urged teachers to develop a classroom environment in which all students feel safe contributing to discussions and learning experiences. Bondie et al. explained that the procedures and routines involved in developing this type of classroom atmosphere take time and continual practice. While setting up these expectations, teachers should be monitoring the language and academic growth of students to modify instructional practices accordingly (Bondie et al., 2014). Park (2014) added to this by sharing that emotional scaffolding can lead to positive experiences in the classroom and therefore more successful outcomes for students.

Limitations and Critical Analysis of the Literature

The current literature on effective instructional practices for EL students in mathematics is limited. There is a need for more research to examine effective instructional practices for EL students in mathematics (Doabler et al., 2016; Warren & Miller, 2015). Most of the available literature on EL students is focused on literacy (Hopkins et al., 2015). Although some instructional practices may be effective across content areas, there is still a need for current research on effective instruction for ELs specifically in mathematics. There is significantly limited research on the mathematics knowledge and skills of EL students (Newkirk-Turner & Johnson, 2018). Instructional practices that are effective for native English speakers may not be effective for EL students. Therefore, the differences in student variables must be considered when reviewing research on mathematics learning. The current studies involving EL students in mathematics may also be limited by the varying situations and experiences of the EL students. For example, those EL students who are surrounded by students who only speak English will have a very different experience than EL students who are surrounded by linguistically diverse peers (Banse et al., 2017). There is also a very limited amount of quantitative evidence to support the current research claims. Many of the studies examining teacher practice are qualitative. More quantitative evidence is needed to support the findings and effectiveness of the recommended instructional practices. Additionally, more research is needed to explore the challenges teachers are experiencing associated with teaching EL students. As the population of linguistically diverse students continues to rise in schools across the U.S. (Spees et al., 2016), research exploring effective instructional practices for EL students and understanding current challenges for teachers will be essential to providing equal access to mathematics instruction.

Curriculum Resources. Several issues can be identified within the body of literature reviewed for this study. First, most of the mathematics curriculum resources, often referred to as textbooks, available are not designed specifically for EL students (Banse et al., 2017; Chval et al., 2015). Some curriculum resources include tips or strategies to use with language learners in the teacher's manuals. However, these strategies are most often generic and will likely not be enough for most EL students to be successful. The fact is every student is different. Every EL student has different strengths and needs as a learner. EL students come into the education system on varying levels of academic experience and language knowledge (Rodríguez et al., 2014). A curriculum resource cannot possibly address all of the needs of every learner (Banse et al., 2017; Chval et al., 2015). This is why teachers must know their students and be prepared to provide effective instruction to meet the needs of each learner. What must be considered is that teachers are taking on this challenge with resources that do not necessarily align with their task.

Limited Instructional Time. Another issue which must be taken into account is instructional time. Teachers have a limited amount of instructional time with students, a portion of that time devoted to mathematics instruction. In most schools, reading and writing are the focus, which often leaves mathematics instruction lower on the priority list (Hopkins et al., 2015). Additionally, with the expansive scope of academic standards to be taught in a school year, the amount of time which can be spent on any given mathematics concept is limited. The current research has highlighted some effective instructional practices for EL students which will enable them to build foundational mathematics and language knowledge. These instructional practices can be implemented along with a curriculum resource; however they will require instructional time. In addition to the time it will take to actually implement these practices, time would also be needed to set up routines and expectations to ensure that the practices are utilized effectively (Bondie et al., 2014).

According to the ESSA of 2015, teachers are responsible for providing every child with a quality education and close current achievement gaps. When taking in to account the need for high-quality instruction, the limited amount of instructional time devoted to mathematics, the extensive scope of the mathematics standards, and the additional instructional practices and supports needed by many EL students in mathematics, the situation that many teachers are presented with is a contradiction. Adding to this, EL students have varying levels of academic and language knowledge, with some EL students performing multiple grade levels behind. In order for these students to be successful with grade-level mathematics content, foundational skills from previous grade levels must first be taught, requiring more instructional time.

It is clear that many factors are involved with the local and broader problem. The current literature highlighted building background knowledge (Adoniou & Yi, 2014; Chval et al., 2015; Doabler et al., 2016), meaningful interactions (Banse et al., 2017;

Moschkovich, 2015; Nargund-Joshi & Bautista, 2016; Warren & Miller, 2015), and application of learning (Chval et al., 2015; Doabler et al., 2016; Moschkovich, 2015; Nargund-Joshi & Bautista, 2016) as effective instructional practices for EL students. These were important components of the local issue; however the limitations to the body of literature were also considered.

Implications

The results of this study may provide essential insight for the district in addressing the local problem and improving the mathematics instruction for EL students. The results of this study showed how mathematics teachers in first through fifth grades are building background, providing opportunities for interaction, and opportunities for practice and application for EL students. Teachers were consistently providing opportunities for EL students to build background knowledge through vocabulary instruction. The participants were also consistently providing opportunities for student interactions, however there were limited supports and accountability for EL students during these activities. Teachers were providing opportunities for EL students to practice and apply learning through hands-on learning, worksheets, and computer programs. The results also showed that teachers are experiencing challenges related to not having and efficient way to assess the academic knowledge and learning needs of EL students and lack of instructional resources and support for ELs in mathematics. Considering the results of this study, the most appropriate project choice would be to design professional development which addresses both of the challenges experienced by teachers, the need for an efficient assessment and the lack of instructional resources. This project is most appropriate because these challenges are likely impacting how the teachers are incorporating building background knowledge, student interactions, and opportunities for practice and application in their mathematics instruction. It is also likely that professional development will be well-received by the teachers in the district, as many of the participants voiced this as something they felt would be advantageous.

Summary

The population of EL students continues to increase (Spees et al., 2016) making the lack of effective mathematics instruction for these students a growing problem across the country (Doabler et al., 2016). Research suggests that teachers are not providing the quality instruction needed for EL students to develop the necessary knowledge and skills to be successful in mathematics (Doabler et al., 2016; Warren & Miller, 2015). This problem was evident in the Keystone School District as demonstrated by the identified achievement gap between ELs and their peers on state tests, communications with teachers and administrators, and the state-required Action Sequence addressing the inconsistent use of effective instructional practices for ELs in mathematics. The SIOP Model (Echevarría, Vogt, & Short, 2008) was the conceptual framework for this study. Three components of the SIOP Model were chosen as the focus for this study guided by an in depth review of the current literature. I explored how first through fifth grade mathematics teachers were implementing effective instructional practices related to building background knowledge, interactions, and opportunities for practice and application for EL students. In Section 2, I will discuss in detail the qualitative research design, selection of participants, and procedures for data collection and analysis.

Limitations to this study will also be identified. The results will be presented and discussed thoroughly in relation to the local problem and the larger body of research.

Section 2: The Methodology

My purpose in this study was to explore the instructional practices related to building background knowledge, student interactions, and opportunities for practice being implemented in the mathematics instruction of first through fifth grade EL students. I explored the possible challenges experienced by teachers related to implementing effective instructional practices. This study design was a qualitative case study and included 10 first through fifth grade mathematics teachers as volunteer participants. I collected data through one-on-one interviews, classroom observations, and classroom artifacts. I conducted data analysis through triangulation and coding of all interview transcripts, observational field notes, and classroom artifacts. I used NVivo to organize the codes that I developed during trial coding and the main analysis of the interview, observation, and artifact data. I analyzed the data based on the coding frame.

Research Design and Approach

Description of the Qualitative Design

Local evidence including the documented gap in achievement between ELs and their peers, personal communications with teachers and administrators, and the state-required Action Sequence, suggested that elementary mathematics teachers were using ineffective instructional practices for EL students. The guiding questions for this study, which were informed by the SIOP Model and preliminary data gathered in connection with the local problem, were: (a) How do first- through fifth-grade mathematics teachers implement instructional practices related to building background knowledge for EL students? (b) How do first- through fifth-grade mathematics teachers implement instructional practices related to student interactions for EL students? (c) How do first- through fifth-grade mathematics teachers implement instructional practices related to practice and application for EL students? and (d) What challenges do first- through fifth-grade teachers experience related to implementing effective instructional practices for EL students in mathematics? I used a qualitative case study design to answer these questions.

According to Yin (2014), a research design should be selected based on the types of research questions, the amount of control the researcher has on events, and the amount of focus on current events. The guiding research questions listed previously suggest an exploratory study. An exploratory study was appropriate considering the nature of the local problem. My focus in this study was a current problem within the district and I did not have control over the behavioral events. These conditions justified either a survey or case study methodology (Yin, 2014). Because the research questions and problem were centered on instructional practices currently taking place in mathematics classrooms, a survey method would not have fully explored the local phenomenon. A qualitative case study design enabled me to explore the current instructional practices of mathematics teachers through interviews, classroom observations, and classroom artifacts.

According to Merriam and Tisdell (2016), a qualitative design is appropriate when the purpose is to interpret, explore, and gain insight into a phenomenon. Creswell and Guetterman (2019) expanded this claim by noting that qualitative research is helpful in studying a problem with unknown variables by exploring multiple perspectives. I explored the perspectives, teaching practices, and experiences of multiple mathematics teachers in the district to gain insight into the local problem. Merriam and Tisdell explained that researchers who conduct qualitative case studies focus on small groups or individuals within a larger group and document the experiences of those individuals in a particular setting. A case study design was appropriate for this study because I intended to explore the problem within a school district, which would be considered a bounded system as described by Creswell and Guetterman. Specifically, I used a case study design. The local problem being studied is that despite being provided with limited professional development, teachers appeared to be struggling to use instructional practices related to building background, interactions, and application for EL students in mathematics instruction. The research questions guided the exploration of how effective instructional practices related to building background, student interactions, and opportunities for application were being implemented during mathematics instruction. Understanding how these instructional practices were being used provided valuable insight into the local problem. Merriam and Tisdell added that the specificity of qualitative case studies makes this design particularly helpful in examining practical, everyday problems associated with practice. The local problem was directly related to the everyday practices of teachers which may provide practical insight for the district to inform future decisions.

Justification for Choosing the Qualitative Case Study Design

The purpose of a qualitative case study is to explore a bounded system by collecting multiple forms of data and conducting an in-depth analysis to develop rich-descriptions of the phenomenon (Merriam & Tisdell, 2016). I conducted an in-depth exploration of how effective instructional practices for EL students were being implemented in mathematics. By limiting this study to mathematics teachers in first through fifth grades within the Keystone School District, I was able to look for common trends among the practices and perceptions of teachers about how these instructional components were being implemented as well as the challenges they were experiencing.

I chose a case study design to conduct an in-depth exploration into a bounded system, the Keystone School District, to gain insight into the local problem. A case study design was more appropriate for my study than other qualitative research designs, such as phenomenological, grounded-theory, and ethnographic, for several reasons. Lodico, Spaulding, and Voegtle (2010) described a phenomenological study as one that examines the individual perspectives of participants. Although I explored the perspectives, instructional practices, and experiences of teachers, I was not focused on the "essence of the human experiences" (Lodico et al., 2010, p. 271). Rather, I explored the practices and perceptions of teachers related to providing effective mathematics instruction for ELs. A researcher would use grounded theory study to collect and continually review multiple data sources in the course of an extended period with the goal of developing a theory from the data (Lodico et al., 2010). The extended-time necessary for grounded-theory research was not practical for this problem. Also, I was not interested in developing theory. The goal of ethnographic research is to provide rich descriptions of human society and culture in a way that can only be done through researcher immersion in the course of an extended period (Merriam & Tisdell, 2016). My purpose in this study was not to understand a specific culture and its impact on individuals; rather, I explored the local problem by identifying how effective instructional practices related to building background knowledge, student interaction, and opportunities for application were being implemented during the mathematics instruction of EL students.

Participants

Criteria for Selecting Participants

The purpose of qualitative research is to explore a phenomenon or local problem and gather data to provide a detailed description of the phenomenon (Creswell & Guetterman, 2019). The ultimate goal is to develop an in-depth understanding of the topic of study (Creswell & Guetterman, 2019). I used purposeful sampling for this study. Creswell and Guetterman (2019) defined *purposeful sampling* as a procedure used in qualitative research where a researcher deliberately chooses participants to gather information about a phenomenon. Merriam and Tisdell (2016) noted that this sampling procedure is used when a researcher intentionally selects a sample from which the most can be learned about the phenomenon. Qualitative case studies conducted by Bobis, Way, Anderson, and Martin (2016) and Sanchez, Lischka, Edenfield, and Gammill (2015) also used purposeful sampling to select participants. In both studies, the researchers selected participants based on their knowledge and experience in the given topic; however, the criteria used also enabled a range of knowledge, beliefs, and interests to be represented within the selected participants (Bobis et al., 2016; Sanchez et al., 2015). The original population for this study was third-, fourth-, and fifth-grade mathematics teachers in the Keystone School District. However, only five third-, fourth-, or fifth-grade teachers volunteered to participate. To have an adequate number of participants, I extended the criteria to include first- and second-grade mathematics teachers who teach one or more

EL student. To purposefully select participants for the study, the selection criteria were (a) third- through fifth-grade mathematics teachers (b) who have been teaching for 3 or more years, and (c) who currently teach one or more EL students. By extending the criteria to include first- through fifth-grade teachers, I was able to acquire eight volunteer participants for the study.

Justification for the Number of Participants

Using purposeful sampling, I selected a limited number of participants for this qualitative case study. According to Creswell and Guetterman (2019), qualitative case studies typically involve a few individuals to enable the researcher to provide rich descriptions and paint a clear picture of the information provided by the participants. In similar case studies, 4-6 teachers were selected as participants (Becerra-Lubies & Fones, 2016; Gee & Whaley, 2016; Heineke, 2015). In order to examine the local problem, 8 elementary mathematics teachers who have been teaching for three or more years, working with one or more ELs, in Grades1 through 5, were selected. There are approximately 70 mathematics teachers across the district in third through fifth grades. This limited number of participants allowed me to explore the problem through in-depth interviews, classroom observations, and the review of classroom artifacts such as lesson plans.

Gaining Access to Participants

In order to conduct this project study, I gained written permission from the Superintendent on April 10, 2017 as well as permission to report student performance data, which was not available publicly through the state. A formal application was submitted to Walden University's Institutional Review Board (IRB). Approval was granted on February 6th, 2018 (02-6-19-0156422). After receiving written permission from the district and approval from the IRB, I met with my building Mathematics Coach to gain access to a list of all of the first through fifth grade mathematics teachers in the school district. At that time, I used the district email system to contact these individuals, to invite them to a "Meet the Researcher" event. During this event, I provided an overview of the study along with any risks and their option to withdraw at any time. I also answered any questions. After the "Meet the Researcher" event, I sent out another email providing an overview of the purpose of the study and an invitation to participate. After one week, I had not received 10 volunteers, so I sent out a second email invitation. After an additional week, I still had not reached 10 participants. At that time, I had to extend the original criteria which was third through fifth grade to include first and second grade as well. I sent out an email invitation to first and second grade teachers and ended up having 8 volunteers for my study.

Establishing a Researcher-Participant Working Relationship

Establishing a working relationship between a researcher and participants can be done in a variety of ways. It is important that participants felt comfortable talking to me about their experiences and perceptions about working with ELstudents in mathematics. It was also important for participants to feel comfortable teaching while I was conducting classroom observations.

I hosted “Meet the Researcher” event at a local restaurant. During this event, I introduced myself and provided a brief overview of my study. This was an opportunity for anyone who was interested to ask questions. I also provided drinks and snacks. During the “Meet the Researcher” event, I began by sharing my professional experience and current teaching situation. I also shared my status as a doctoral student at Walden University and my role as the researcher for this project study. By sharing my role as an elementary mathematics teacher in the district, I hoped to establish a relationship as their peer. In some cases, I already had a professional relationship with the participants, as we teach in the same school district. As the researcher for this study, I wanted the participants to know that my goal was to explore this problem so that our district can make informed decisions to improve this issue for teachers and ultimately, students. I encouraged participants to be open and honest with their input throughout the process, as that provided the most accurate data about how they were implementing instructional practices related to building background knowledge, student interactions, and opportunities for practice and application play in the mathematics instruction of EL students as well as any challenges they were experiencing.

Methods for Ethical Protection of Participants

Prior to data collection, an Institutional Review Board (IRB) application was submitted outlining the purpose and the procedures for collecting and analyzing data. After IRB approval on February 6th, 2018 (02-6-19-0156422), an invitation to participate in the study and attend the “Meet the Researcher” event was emailed to all first through fifth grade mathematics teachers in the district who have been teaching for 3 or more years and currently teach one or more EL students. During this event, I introduced myself, explained the purpose of the study, the voluntary nature of their participation, their right to opt out of the study at any time, the benefits, and possible risks of participation. The possible risks of participating in this study included possible anxiety related to classroom observations and interviews. Participants were asked to provide informed consent in writing before taking part in interviews and observations. Informed consent letters were handed out at the “Meet the Researcher” event along with a self-addressed envelope. This allowed teachers time to reflect and consider whether they would like to participate without feeling any pressure to do so. Following the “Meet the Researcher” event, I shared the same information through email to all first through fifth grade teachers meeting the selection criteria in order to reach anyone who is interested that could not attend the event. Any teachers who were interested but did not attend the “Meet the Researcher” event received a consent form through the mail with a return envelope enclosed. After signed consent forms were returned, I made a photocopy of the consent forms for each participant. I kept the original signed consent forms sealed in an envelope in a locked cabinet in my home office.

The participants chose a location where they felt most comfortable for interviews. The place of the interview needed to be quiet and free of disruptions. The times for classroom observations were also selected by the participants. I informed the participants that all identifying information would be kept confidential. All data collected was labeled with pseudonyms such as “Teacher A” or “Teacher B”. Data will be stored for five years in a password-protected file on my personal computer, to which I am the only person with access. After five years has elapsed, the file will be permanently deleted from my computer. Paper-based documents were stored in a locked cabinet during the data collection and analysis process. In order to limit the potential risk to the privacy of participants, all paper documents have been scanned into a computer file and saved in a password-protected file for 5 years. Paper-based documents were then shredded and disposed immediately. After 5 years, all computer files saved will be permanently deleted from the computer.

Data Collection

My purpose in this qualitative case study was to explore how instructional practices related to building background knowledge, student interactions, and opportunities for practice were being implemented in the mathematics instruction for ELs. Also, the possible barriers experienced by teachers related to using effective instructional practices for EL students in mathematics were examined. According to Lodico et al. (2010), qualitative researchers commonly use interviews, observations, and artifacts. Researchers conducting qualitative studies similar to the one conducted here have used different combinations of interviews, classroom observations, and artifacts to explore teachers' perceptions and practices (Bobis et al., 2016; McClintic & Petty, 2015; Sanchez et al., 2015; Smith, Preston, Haynes, & Booker, 2015). For the current study, I conducted an initial interview, follow-up interview, classroom observation, and review classroom artifacts for each of the eight teacher participants to explore the local problem. The data collection plan for this qualitative case study fostered an in-depth exploration into the local problem and was appropriate for examining how effective instructional practices were being implemented as well as the possible challenges experienced by teachers.

The teacher participants for this study represented varying levels of experience at different grade levels and were teaching at four different elementary schools within the Keystone School District. Table 4 highlights the demographic information of the participating teachers.

Table 4

Demographics of Teacher Participants

Participant	Grade	Experience
Teacher A	3	Taught in district for 10 years in first through fifth grades, taught third grade for last 7 years, teaches mathematics, science, and social studies
Teacher B	5	Taught in district for 21 years, previously taught at a private school for 3 years, teaches mathematics, science, and social studies
Teacher C	2	Taught in district for 4 years, previous experience as an ESL assistant at the high school level, teaches mathematics, science, and social studies
Teacher D	3, 4	Taught in district for 27 years in third through fifth grades, teaches third and fourth grade mathematics
Teacher E	1	Taught in district for 8 years in first grade, previously served as a long-term substitute in an ESL position, teachers all subjects
Teacher F	1	Taught in district for 4 years in first grade, teaches all subjects
Teacher G	3	Taught in district for 14 years in third grade, teaches mathematics, science, and social studies
Teacher H	4	Taught in district for 14 years in third and fourth grades, previously served as a head teacher, teaches mathematics, science, and social studies

There were two first grade teachers, one second grade, two third grade, one fourth grade, one fifth grade, and one teacher who taught both third and fourth grades. Two participants had been teaching for four years, two participants had been teaching for eight to ten years, two had taught for 14 years, and two participants had taught for more than 20 years. Half of the teacher participants had experience teaching at multiple grade levels, and half had taught only one grade level. In order to protect the confidentiality of the participants race and gender were excluded from Table 4. There were seven female participants and one male participant. There were five Caucasian participants, two African American participants, and one Hispanic/Latino participant who was also an ESL student as a child.

Interviews

I conducted initial interviews to gather information about how teachers were building background, providing opportunities for interactions, and providing opportunities for practice and application of content and language knowledge. These are three of the major components of the SIOP Model and provided the framework for this study. I also gathered information about any challenges teachers were experiencing related to implementing effective instructional practices for ELs in mathematics. Interviews are the most common method of qualitative data collection (Merriam & Tisdell, 2016) and are included in most qualitative research studies (Lodico et al., 2010). According to Yin (2014), interviews are "usually conversational in nature and guided by the researcher's mental agenda" (p. 239) which sometimes reflects pre-determined biases. Specifically, I used semi-structured interviews to gather data from the eight participants in this study. Semi-structured interviews incorporate a mix of more and less-structured questions, which can be used flexibly to elicit data from each participant (Merriam & Tisdell, 2016). A semi-structured format was the most appropriate for this study because highly-structured interviews would not have provided opportunities for the participants to share their perspectives freely (Merriam & Tisdell, 2016), and unstructured interviews are most advantageous when the researcher is not informed enough about the problem to formulate appropriate questions and therefore engages in a flexible conversation with the participant (Merriam & Tisdell, 2016).

I used self-developed interview protocol (see Appendix B) that described the purpose of the study and provided an introduction to the interview, space to record information during the interview, and a list of questions to use as a guide (Lodico et al., 2010). Merriam and Tisdell (2016) suggested that good interviews include a variety of questions with some more structured than others, and noted that researchers can obtain specific information by including more structured questions. Creswell and Guetterman (2019) highlighted that qualitative researchers utilize open-ended questions as a way to encourage participants to respond freely without being limited by the background of the researcher. I developed an interview protocol for this study which included a mix of specific questions, primarily to elicit information about the teacher's professional experience and current teaching role, and open-ended response questions to encourage the participants to engage in a conversation about their experiences working with EL students. Due to the flexible nature of this qualitative case study, I used a semi-structured interview protocol (see Appendix B), probes, and additional questions to elicit more information based on the responses of the participants (Lodico et al., 2010).

These interviews were essential to fully explore the local problem as guided by the research questions. Through these interviews, I gathered information about teachers' perceptions and their intentions regarding how they are implementing effective instructional practices for building background, fostering student interactions, and providing opportunities for practice and application during their mathematics instruction for EL students. I compared this data to the observational data and classroom artifacts during analysis through triangulation.

When IRB approval was granted, I pilot tested the self-developed protocol for alignment and clarity. Creswell and Guetterman (2019) explained that pilot tests are conducted by gathering feedback from a small group of individuals on a data collection instrument in order to make changes to the instrument. I conducted pilot interviews and observations with two teachers from one of the elementary schools in the district under study to obtain their feedback on my interview questions. These teachers were not included in the study. After conducting the pilot interviews and observations, I met with each teacher to discuss my notes and hear their feedback. One teacher had a suggestion about how to make one of the interview questions clearer. I then revised my interview protocol according to her comments. I also emailed my interview questions to the ESL head teacher for the district to get feedback from a professional specializing in working with EL students.

After teachers consented to participate, I used my Walden University email and the email address provided by each participant to schedule interview sessions. I used a digital voice recorder for all interviews, a practice commonly used to ensure accuracy of data collected (Lodico et al., 2010). I used the recordings to transcribe each interview into NVivo. Member checking is used when the researcher validates the accuracy of the findings by having one or more of the participants review the researcher’s analysis (Creswell & Guetterman, 2019). After coding of the interview transcripts was conducted, I emailed a summary of the analysis to the participants for member checking. This process allowed the participants to check the accuracy of the themes identified from the interviews (Creswell & Guetterman, 2019). I also emailed participants follow up interview questions. During data collection and analysis, I found several points that needed clarification therefore I developed follow-up interview questions to address these points. In an effort to preserve teachers’ time, I sent these follow-up interview questions (see Appendix C) through a secure email.

Classroom Observations

The theoretical framework, problem, and research questions should guide what the researcher aims to observe (Merriam & Tisdell, 2016). I used preliminary data evidencing the local problem and three components from the SIOP Model to develop the guiding research questions for this study. Therefore, by using the SIOP for classroom observations, the data collected was aligned with the problem and addressed the research questions. Specifically, gathering data through classroom observations provided insight into how effective instructional practices for EL students were being implemented, specifically those related to building background, student interactions, and opportunities for practice. This observational data was triangulated with interview data and classroom artifacts to determine validity and reliability of the analysis.

I conducted a classroom observation of each of the eight participants, approximately one hour in duration, after they completed a one-on-one interview. According to Creswell and Guetterman (2019), observations are a method of data collection during which a researcher gathers open-ended information by observing people and places. I conducted classroom observations using portions of the SIOP developed by Echevarría, Vogt, and Short (2008) (see Appendix D). Copyright permission to use the SIOP was acquired from Pearson Education (see Appendix F). I used the SIOP (see Appendix D) to observe the building background, interaction, and practice/application components as guided by the research questions for this study.

Some of the challenges experienced by observers include gaining access to sites, developing a relationship with the participants that will foster an accurate view into the phenomenon, as well as having the listening skills and attentiveness to conduct focused observations (Creswell & Guetterman, 2019). With the cooperation of the district and the participants in the study, I had access to their classrooms to conduct the observation. I developed a relationship by hosting a “Meet the Researcher” event and by sharing my role as a teacher within the school district and as well as a doctoral student. I already had at least an acquaintance relationship with some of the participants, as we teach in the same school district. In order to prepare myself to be an active listener and focused observer, I practiced using the SIOP during classroom observations of the same two teachers who helped pilot test the interview protocol. This allowed me to identify my strengths and weaknesses as an observer and then work to improve my observational skills prior to conducting the actual classroom observations. Additionally, I drew on my past experiences as an Instructional Rounds observer which required similar observational skills.

Classroom Artifacts

I included classroom artifacts as a data source for this study. Lodico et al. (2010) emphasized that classrooms are full of artifacts or "objects used in the process of teaching and learning or products that result from the process of teaching and learning" (p.133). Qualitative case studies conducted by Bobis et al. (2016) and Sanchez et al. (2015) also included classroom artifacts. Artifacts such as lesson plans, vocabulary walls, seating arrangements, and instructional posters were valuable to this study. While visiting the classrooms for observations, I took digital photos of the teacher's lesson plans, vocabulary wall, and instructional posters. Any text included on these artifacts was transcribed in the same manner as the interview and observational data. These different artifacts provided insight into how effective instructional practices related to building background, student interactions, and opportunities for application were being implemented during the mathematics instruction for EL students.

Data Organization and Management

Throughout the process of conducting interviews and observations, I kept accurate and well-organized records of the research process and data (Creswell & Guetterman, 2019). I kept a research log listing the dates and times of all interviews, observations, and reviews of artifacts. I transcribed audio recordings of interviews using a word processing program on the computer. In order to protect the privacy of the participants, I used pseudonyms such as "Teacher A" or "Teacher B" on interview transcripts, and saved transcripts by pseudonym. I also transcribed observational field notes into a narrative format using a word processing program on the computer, and identified participants using pseudonyms, saving the documents by the pseudonym. In addition to interview and observation notes, I documented classroom artifacts with digital photos, and saved each photo using the date of the observation. Any text included on the artifact was transcribed and saved by the date. I stored all interview transcripts, observational data, and classroom artifacts on a password-protected computer and kept all print versions of the data in a locked drawer in my home office while not in use. Throughout data collection and analysis, I kept a reflective journal of my thoughts and my ideas about the data. This helped me to identify any biases I had about the local problem and data.

Role of the Researcher

I am a fourth and fifth grade mathematics teacher in the Keystone School District. This is my third year in this position; however, I taught third and fourth grade mathematics for the previous six years. Prior to that, I taught first and second grade language arts and mathematics through a Class-size Reduction position for three years. Therefore, I have a peer relationship with the participants in this study, as I have taught ELs in mathematics at each of the grade levels included in this study. This was helpful in establishing a nonthreatening researcher-participant relationship.

During classroom observations, I took on the role of "observer as participant" as my presence was known to the group; however, I did not participate in the group activities (Lodico et al., 2010). Although teachers and students in the district are familiar with the presence of others in the classroom during administrative walkthroughs, instructional coaching, and other professional development activities, my presence could have affected the actions of the participant and their students. As the sole data collector for this study, I prepared a self-developed semi-structured interview protocol and conducted a pilot test to ensure clarity and alignment to the research questions. Additionally, I anticipated and planned for possible issues that may have occurred during qualitative data collection and analysis (Creswell & Guetterman, 2019). After I transcribed the interview, observational data, and classroom artifacts, I analyzed the data through qualitative coding.

Data Analysis

The following subsection outlines the procedures for data analysis that I used for this study. I coded each interview transcript using the coding frame and then looked for themes using a computer-assisted software program. I used the same process to code the observation field notes, and classroom artifacts. I asked clarifying questions during the follow-up interviews and used the same coding procedures for these emails. Finally, I coded the data sources collectively for common themes using triangulation. Discrepant cases are described in the results of this study in order to provide the most comprehensive understanding of the local problem. After outlining the analysis procedures, I will share the results and discuss how the emerging themes answer the guiding research questions.

Analysis of Interviews, Observations, and Classroom Artifacts

I followed the recommendations of several authors of research (Creswell & Guetterman, 2019; Merriam & Tisdell, 2016) by simultaneously collecting and analyzing data in order to follow the inductive nature of qualitative research. As the data was collected through interviews, I began the process by transcribing the digitally recorded interview into NVivo, a computer-assisted software program. Lodico et al. (2010) suggested that verbatim transcripts are most often used by qualitative researchers, despite how time-consuming this process can be. I used an inductive approach to analysis in which I combined data from interviews, observations, and artifacts to look for emerging themes (Merriam & Tisdell, 2016). I began analysis by developing a coding frame, as suggested by Flick (2014). Flick suggested that a coding frame consists of at least one concept-driven main category and at least two data-driven subcategories. For this study, I included four main categories aligned with the local problem, theoretical framework, and research questions: building background, student interactions, practice/application opportunities, and teacher challenges. I defined each of the main categories by including a name, description, and examples (Flick, 2014). Next, I segmented the data into units that fit into each of the defined categories (Flick, 2014).

Trial coding was the next stage of the coding process in which several pieces of data were coded and then compared to the coding frame (Flick, 2014). At this time, the coding frame was evaluated and modified based on the level of consistency of the trial coding (Flick, 2014). For this study, trial coding was conducted by myself and another coder as a means of ensuring interrater reliability of the coding (Flick, 2014). I selected a highly qualified professional educator as my second coder. She has more than 20 years of experience in public education serving as an Assistant Superintendent, Administrator of Academic Services, Director of Curriculum, Professional Development Coordinator, and a classroom teacher. She earned her Doctorate of Education in Educational Leadership from Arizona State University. Prior to participating in the coding process, the coder signed a confidentiality form. After trial coding was conducted by myself and the second coder, we then evaluated and modified the coding frame based on the level of consistency demonstrated in the trial coding (Flick, 2014). At this time, minor modifications were made to the definitions of two of the categories. After the coding frame was modified, another round of trial coding was conducted in which subcategories were inductively developed from the data (Flick, 2014). Merriam and Tisdell (2016) defined coding as an informal system for designating pieces of data so that they can be easily retrieved. I used words or phrases related to the segment of data to assign codes to subcategories (Flick, 2014).

Next, I reviewed the revised coding frame and subcategories for each interview transcript (Flick, 2014). I recorded the codes on a coding sheet which was reviewed both for themes and inconsistencies (Flick, 2014). Flick (2014) suggested that if only minor revisions to the coding frame were necessary, approximately one third of the data should be coded by a second person to ensure accuracy. Table 5 shows the coding frame categories, subcategories, and themes.

Table 5

Summary of codes, subcategories, and themes

Coding Frame	Subcategories	Themes
Building Background	Modeling appropriate vocabulary	Vocabulary instruction and supports
	Word walls	
	Questioning to elicit vocabulary knowledge	
	Hands-on learning	
	Reviewing vocabulary	Making Connections
	Fluency practice	
	Discussions	
Interactions	Cooperative learning goals	Power Teaching routines and techniques
	Seating	
	Discussion strategies	
	Teamwork	Facilitating peer discussions
	Response rubric	
	Guiding questions	
Practice/ Application	Manipulatives	Hands-on
	Creating/drawing models	
	Interactive mathematics games	
	District-wide paper resources	Practicing on paper
	Outside resources	
Teacher Challenges	Language-based mathematics assessments	Assessing EL student needs
	Observing students to assess	
	No guidance from coaches or administration	
	Language data	
	Meeting the needs of all students	Instructional resources and support
	Lack of help in the classroom	
	Finding additional instructional resources	
	Spanish documents	
	Limited professional development	

I used the SIOP for classroom observations (Echevarría, Vogt, & Short, 2008). Although this protocol is based on the eight components of the model, the SIOP has been adapted to focus on specific components in previous studies (Murillo, 2013). For the current study, I focused on the three components highlighted in the research questions: building background, interactions, and practice/application. These components were identified as areas of mathematics instruction that need to be improved at the local site (K-12 mathematics supervisor, personal communication, June 14, 2017). The SIOP includes a rating scale for each feature within the components. The rating scale is based on a zero for "Not evident" to four meaning "Highly evident." "Not applicable" is also an important option on this protocol because it helps the observer note the difference between when a feature does not apply to the lesson rather than a missed opportunity when a feature is not evident (Echevarría, Vogt, & Short, 2008). Anecdotal notes are often combined with the information gathered through the SIOP rating scale (Murillo, 2013; Trevino Calderon & Zamora, 2014). As anecdotal notes, I kept a running record, or a chronological list, of the practices and activities that took place in the classroom. I transcribed all anecdotal notes into NVivo and followed the same analysis procedures as described for the interview transcripts.

While visiting the classroom for observations, I also reviewed classroom artifacts by taking digital photos. Classroom artifacts included lesson plans, vocabulary walls, seating arrangements, and instructional posters. I uploaded the artifacts into NVivo to be coded using the same process as previously described. Additionally, the questions I developed during the trial coding process were addressed in the follow up questions that were sent to participants through email. These emails were then entered into NVivo and the same procedures for analysis took place with the follow-up data.

Finally, the codes from each document were compared to look for emerging themes across the data (Merriam & Tisdell, 2016). The use of triangulation ensured the accuracy of the findings (Creswell & Guetterman, 2019). I kept a written log of my personal biases throughout the process of data collection and analysis. Being cognizant of my own personal beliefs by writing them out helped ensure that I kept these separate from the data and my analysis of the data. I also utilized member checks of the data to ensure my analysis portrayed each participant's thoughts and actions accurately (Creswell & Guetterman, 2019).

Results

The following section is a discussion of the how the results answer the four guiding research questions:

1. How do first through fifth grade mathematics teachers implement instructional practices related to building background?
2. How do first through fifth grade mathematics teachers implement instructional practices related to student interactions for EL students?
3. How do first through fifth grade mathematics teachers implement instructional practices related to practice and application for EL students?
4. What challenges do first through fifth grade teachers experience related to implementing instructional practices for EL students in mathematics?

Research Question 1

The first research question posed in this study was "How do first through fifth grade mathematics teachers implement instructional practices related to building background knowledge for EL students?" The data shows that all eight of the participating teachers are helping EL students build background knowledge by implementing instructional practices related to mathematics vocabulary instruction. These instructional practices participants mentioned, included using a vocabulary wall, modeling appropriate mathematics vocabulary, questioning techniques, and hands-on learning activities. The data also shows that the participating teachers are implementing instructional practices to help students build background knowledge by making connections to prior learning. These instructional practices include reviewing previously learned vocabulary, incorporating fluency practice, and discussing previously learned concepts. According to the SIOP, building background involves emphasizing vocabulary, making explicit connections between new learning and prior learning, and making explicit connections to students' real world experiences (Echevarría, Vogt, & Short, 2008). Through multiple rounds of coding, the following themes emerged from the data related to building background knowledge: vocabulary instruction and supports, and making connections to prior learning. Vocabulary instruction refers to teaching students new academic vocabulary and its meaning. Supports are the strategies used to help students understand, apply, and retain this vocabulary knowledge. Making connections to prior learning happens when teachers help students build understanding of new concepts by making links to previously learned content.

Vocabulary instruction and supports. Meaningful understanding of mathematics vocabulary can enable EL students to learn new content, skills, and build conceptual understanding more efficiently (Doabler et al. , 2016; Warren & Miller, 2015). Analysis of the data demonstrated that the participating teachers are providing opportunities and supports for EL students to build meaningful understanding of mathematics vocabulary. During interviews, five of the eight participants discussed supporting their students with a vocabulary wall that includes definitions and visuals for each word. However, during classroom observations, I observed all eight participants modeling appropriate mathematics vocabulary during their instruction. This shows a discrepancy between the data collected through interviews and observations. It appears as though teachers were implementing this piece of vocabulary instruction without realizing that it was beneficial in supporting EL students. Also during classroom observations, seven of the eight participants used questioning to elicit students' knowledge of mathematics vocabulary. Six of the eight teachers incorporated hands-on learning opportunities to help students build vocabulary knowledge during classroom observations. After reviewing classroom artifacts, all eight participants had vocabulary walls with definitions and visuals posted in their classrooms. This was consistent with the information shared by teachers through interviews and what I observed during the lessons.

Interviews. During initial interviews, five of the eight participants discussed their use of their mathematics vocabulary walls during their initial interview. Teacher H described an interactive vocabulary wall that she created so that students could actually remove the pieces for the word they need and take them back to their seat to use as a reference. Teacher D shared that she builds on the use of the vocabulary wall by having her students create vocabulary word banks at the beginning of each lesson. This activity begins very structured as she introduces new vocabulary and works toward the students individually developing their own word banks to refer to during the lesson. This process takes place over several days. Teacher D commented “I need to see that they own them. I try to get them to take ownership of the words and know that they can use them…”

Teacher F discussed the importance of modelling appropriate mathematics vocabulary during his initial interview. “Honestly, at the first grade level, I feel like it’s just exposure more often than not. It’s using the terms and definitions constantly to help them to identify ‘Ok when he says that word, he also says the meaning of that word’ and they can gradually build that background knowledge or that schema around those terms.”

During the initial interview, teachers shared about the use of hands-on learning and using manipulatives to support learners. Teacher C said “I do think that visuals and hands-on activities help them because then they can relate the math vocabulary word to it actually. ‘I’m touching a tile. This is one tile so it measures 1 inch.’” During another initial interview, Teacher E said “We use a lot of manipulatives. Especially since in first grade, we are covering foundational concepts.” Some of the specific hands-on activities will be discussed in detail for Research Question 3.

Observations. Table 6 shows some of the key instructional practices and supports being used to teach mathematics vocabulary to EL students. All eight participants had key mathematics vocabulary displayed on a mathematics vocabulary wall with definitions and pictures for each term, as shown in Table 6.

Table 6

Vocabulary strategies used by teacher participants

	Vocabulary wall	Modeled appropriate vocabulary	Used questioning to elicit vocabulary knowledge	Incorporated hands-on learning activities
Teacher A	X	X	X	X
Teacher B	X	X	X	X
Teacher C	X	X		X
Teacher D	X	X	X	
Teacher E	X	X	X	X
Teacher F	X	X	X	X
Teacher G	X	X	X	X
Teacher H	X	X	X	

During a classroom observation, a student in Teacher H's class was observed utilizing the interactive vocabulary wall for group work during the classroom observation. Teacher A had her students turn around to look at the vocabulary wall and explicitly reviewed multiple vocabulary words and introduced a new word by giving examples and explaining its meaning.

It is important for teachers to model the appropriate use of mathematics vocabulary and provide meaningful opportunities for EL students to use these terms (Chval et al., 2015; Doabler et al., 2016). All eight of the participating teachers modeled the use of appropriate mathematics vocabulary throughout their lessons during the observations, as shown in Table 6. During the classroom observations, students were observed using appropriate mathematics vocabulary in four of the eight teachers' classes.

Table 6 shows that seven of eight participants used questioning to engage all students in a discussion of mathematics vocabulary during the classroom observations. Teacher A used questions like, "Remember, how many feet are in a yard? So what is the area? Is the outside of the shape or the inside all filled in?" Teacher B asked, "What is the difference between line segment AB and line AB?" The teacher participants used questioning to elicit students' knowledge of mathematics vocabulary both during class discussions and while working speaking with small groups or individual students.

During classroom observations, five of the eight teacher participants provided opportunities for students to use manipulatives to build understanding of various mathematics vocabulary through hands-on learning. These hands-on learning activities included using tools for measurement, playing games, and creating visuals related to geometry and measurement concepts. Although not all teachers were observed incorporating hands-on learning activities, a review of classroom artifacts showed that all eight participants had manipulatives available in their classroom for students to use.

Disparities. Most of the information provided during interviews was confirmed through classroom observations. However, there were a few disparities in the data. First, Teacher D discussed having her students develop word banks or individual word walls at the beginning of her lessons. This practice was not used during the lesson I observed. It is likely that this is a practice used by Teacher D and was just not incorporated into her lesson that particular day. Also, although seven of the eight participants used questioning to elicit vocabulary knowledge and student discussion, none of the participants shared this during interviews. It is possible that teachers are utilizing strategies without even being aware that they are doing so.

In summary, all of the participating teachers were helping their EL students build knowledge of mathematics content vocabulary in a few different ways. All participants had key mathematics vocabulary posted with a picture representation and definition. Some teachers referenced this during the observed lesson and in some cases, students were observed referencing the vocabulary wall in their classroom on their own. All participating teachers were observed modelling appropriate mathematics vocabulary throughout their lesson. In several classrooms, students were observed using appropriate mathematics vocabulary in their verbal interactions. Some of the participants used questioning to elicit students' knowledge of mathematics vocabulary as well as hands-on learning activities.

Making connections. A second theme which emerged related to the first research question is Making Connections. It is important for teachers to draw on students' funds of knowledge that have been developed at home, in the community, and in previous classrooms (Chval et al., 2015; Doabler et al., 2016; Nargund-Joshi & Bautista, 2016). Teachers can do this by helping students make connections with life experiences and previously learned knowledge or skills (Chval et al., 2015; Doabler et al., 2016; Nargund-Joshi & Bautista, 2016). Analysis of the data showed that all eight of the teacher participants have helped their students by making connections to prior learning in at least one way.

Observations. Table 7 displays the instructional practices used by the teacher participants to help EL students make connections to prior learning. The data for this table was taken from classroom observations. Supporting data from initial and follow-up interviews will also be discussed.

Table 7

Strategies for Making Connections to Prior Learning

	Reviewed Vocabulary	Fluency Practice	Discussion
Teacher A	X	X	X
Teacher B	X	X	X
Teacher C	X		
Teacher D	X		X
Teacher E	X		X
Teacher F	X	X	X
Teacher G	X	X	X
Teacher H	X	X	

During classroom observations, the teacher participants demonstrated helping their students make connections to prior learning experiences in a variety of ways. All eight of the teacher participants helped their students make connections between previously learned mathematics vocabulary words and new words and concepts. They did this by asking students to define or explain previously learned vocabulary. Then, the teacher would explain how this vocabulary was relevant to the current topic.

Additionally, five of the eight participants provided time for their students to practice computational fluency for addition, subtraction, multiplication, or division. Four of these participants did this by having students review and complete a worksheet of computation problems during a set amount of time. One participant had her students practice their multiplication fluency by having them recite multiples of numbers two through ten while doing various exercises such as jumping jacks and arm circles. Providing opportunities for students to practice computational fluency is a way for these students to not only improve their accuracy in computation but also learn how these skills are integrated into many other concepts.

The data also showed that six of the eight teacher participants helped their EL students make connections to prior learning through class discussions. Teachers A and G made connections to previously learned measurement concepts such as length and area. Teacher D engaged her students in a discussion about showing their work using mathematics models they previously learned. Teacher C helped her students connect the previously learned concepts of fractions with telling time to the quarter hour.

Teacher E was the only teacher I observed making connections to a student's native language. Teacher E used her cell phone to translate information to an EL student during her classroom observation. This instructional practice was not included in Table 7 due to only being implemented by one teacher, however I felt it was worth noting.

Interviews. Although only one teacher was observed making connections to a student's native language, three of the eight teacher participants discussed using this practice during their initial interview. According to Doabler et al. (2016), in addition to linking prior learning to new concepts, it is also beneficial to help EL students make connections to their primary language. Through initial interviews, I found out that Teacher C is fluent in Spanish and shared that she occasionally speaks Spanish to help students make connections to specific words. Teachers E and F shared that they have minimal knowledge of conversational Spanish and they use that to help students when they can. Teacher E also shared that she uses her cell phone to translate for her EL students who do not speak any English.

Disparities. Through classroom observations, I found that although all eight participants demonstrated the use of at least one instructional practice related to making connections to prior learning. However, only one teacher actually discussed doing so during the initial interview. It may be important to consider that although the participants are implementing these instructional practices, they may not all be aware of their benefit to EL students in mathematics.

Also, three participants mentioned making connections to students' native languages, specifically Spanish. However, only one of these teachers were observed actually doing this during their lesson. It is likely that this practice is used, but was just not used on the particular day of the observation.

The data showed that teachers were making connections to students' prior learning, however there was minimal data demonstrating that teachers were helping EL students make connections to real world experiences. During classroom observations, three of the eight participants made real world connections to vocabulary words during their lessons. Teacher A made the connection between the tetrominoes they were using during their lesson to the game Tetris. Teacher C used images of a pizza and a clock to help students make connections to quarter hour segments. Teacher F used the example of a balance to demonstrate how an equal sign connects two equal expressions. In the initial interview, Teacher B shared that she often spends time helping students understand the context of story problems by making connections to prior learning and real-world experiences, however this was not observed during the lesson observation. It is possible that other participants are making real world connections during their mathematics instruction, however these were the only examples which occurred during my observations. No other participants discussed making real world connections during their interviews.

Related Challenge. One of the common challenges experienced by the participating teachers, which will be discussed in detail under Research Question 4, was that they have no way to assess the learning needs of EL students. Teachers were struggling to identify what foundational knowledge and skills EL students are coming in with, especially those students who speak a limited amount of English, which is making it difficult for teachers to provide effective mathematics instruction for those students. If teachers had an efficient way to assess what knowledge and skills EL students have previously learned as well as identify their specific needs to move forward, teachers may be able to make more connections to these students' background experiences. Four of the eight teacher participants expressed that this makes building background through connections to prior learning and real world examples particularly challenging due to students coming in with varying levels of formal education, differences in cultures, students arriving later in the year and missing foundational instruction, and having gaps in their learning.

In summary, all eight teachers were helping EL students make connections to prior learning. All participants helped students make connections between previously learned mathematics vocabulary and new vocabulary. Five of the eight teacher participants helped students make connections to prior learning through fluency practice and six of the eight participants utilized class discussions. A few teachers helped EL students make connections to their knowledge of their native language. There were minimal connections made to background or real world experiences. Having an efficient means to assess EL students' knowledge and learning needs may help teachers make connections to students' background experiences and prior learning.

Research Question 2

The second research question for this study was "How do first through fifth grade mathematics teachers implement instructional practices related to student interactions for EL students?" According to the SIOP, there are four components to fostering effective interactions: frequent opportunities for discussion, grouping students to support language needs, consistently providing adequate wait time for student responses, and sufficient opportunities for students to clarify concepts in their native language (Echevarría, Vogt, & Short, 2008). Nargund-Joshi & Bautista (2016) added that EL students need to have a variety of opportunities for these interactions both with teachers and their peers. Analysis of the data suggested that the participating teachers are providing opportunities for EL students to interact during mathematics instruction by implementing instructional practices related to Power Teaching and facilitating peer discussions. Some of the practices that were implemented related to Power Teaching were seating students in pairs or teams, team points, cooperative learning goals, turn and talk, and random reporter. Six of the teacher participants were using questioning to facilitate peer discussions. There were some inconsistencies in how seats were selected for EL students and how students can clarify new concepts in their primary language. The data did not support or deny the use of sufficient wait time for student responses. Through several rounds of coding, the following themes were developed from the data: Power Teaching Practices and Facilitating Peer Discussion.

Power teaching routines and techniques. Power Teaching is an instructional framework that connects state standards to school curricula to engage students in rigorous research-based instructional practices (Success For All Foundation, n.d.). The Keystone School District has trained all mathematics teachers in grades 3 through 5 in Power Teaching and some first and second grade teachers have voluntarily been trained (K-12 mathematics supervisor, personal communication, December 12, 2018). A review of the data demonstrated that all 8 participants had their students seated in either partners or teams. Six of eight participants were implementing cooperative learning goals while five implemented team points. All eight participants incorporated turn and talk into their mathematics instruction. Five participants implemented random reporter while three participants extended that activity by including a response rubric.

Observations and artifacts. Table 8 highlights the Power Teaching routines and techniques that were implemented during classroom observations. As shown in Table 8, all eight of the teacher participants had students seated in either pairs or groups of 3 to 5 students. The purpose of seating students in pairs or groups is to foster interaction and discussion.

Table 8

Power teaching routines and techniques

	Seating in Pairs or Teams	Team Points	Cooperative Learning Goals	Turn and Talk	Random Reporter	Team Huddle	Response Rubric
Teacher A	X	X	X	X	X	X	
Teacher B	X	X	X	X			X
Teacher C	X	X	X	X	X	X	X
Teacher D	X		X	X	X		X
Teacher E	X			X			
Teacher F	X			X			
Teacher G	X	X	X	X	X		
Teacher H	X	X	X	X	X	X	

Five of the eight teacher participants were observed using a point system as feedback and a reward for their teams. The system of how points were given and tracked varied between teachers. Teacher A handed out little plastic people to represent points for each team. Observations and artifacts showed that Teachers B, C, G, and H had point cards where their students moved a clip to represent their points earned. These point systems were based on each team's ability to exhibit the cooperative learning goals. The cooperative learning goals are: active listening, explain your ideas/tell why, help and encourage others, everyone participates, and complete tasks. Six of the eight teacher participants had the cooperative learning goals posted in the classroom.

In order for interactions between EL students and their peers to be effective, they should take place often, be purposeful, and allow students to share their thinking, as well as evaluate the thinking of others (Banse et al., 2017; Doabler et al., 2016; Ernst-Slavit & Wenger, 2016; Moschkovich, 2015; Nargund-Joshi & Bautista, 2016). All eight of the participating teachers provided opportunities for EL students to engage in peer discussions through “turn and talk” during classroom observations. This is done by giving students a short amount of time to share with a peer, usually prior to calling on an individual to share with the class. Students seemed to be actively engaged in discussions with their partner during these “turn and talk” opportunities.

Another instructional practice that was implemented was random reporter. Random reporter is used when a teacher poses a question, provides time for students to discuss with their peers, and then calls on a random student to share their response. The purpose of this is to foster authentic discussion among peers and provide them opportunities to prepare their response before sharing with the class. Most often teachers use a system of pulling sticks from a cup to choose a random person. Five of the eight participants incorporated random reporter during the observed lessons.

Three teachers were observed using team huddle. Team huddle is when students work together in groups of three or four on a specific problem. One person is recording the team’s work on a paper or whiteboard. Team huddle usually ends with a teacher using random reporter to have teams share with the class.

Response rubrics were sometimes implemented along with random reporter activities. Response rubrics outline the expectations for oral and written responses using a scale ranging responses from poor to exceptional. The expectations and scales used varied between teachers. The purpose of using response rubrics is to provide clear expectations for oral and written responses, allow students to provide feedback to their peers, and encourage students to evaluate their own responses. When used with random reporter, teachers often had the class rate a student's response based on the rubric and then offer feedback on how to improve the response. Three of the eight teacher participants had response rubrics posted in their classrooms and provided opportunities for students to use it during their observed lesson. Students seemed to be familiar with the process of using the response rubric to guide their discussions and provide constructive feedback for their peers.

Interviews. Teacher participants were using different strategies to select seats for EL students. During the initial interview, Teacher D reported that she chooses seats for her EL students based mostly on their academic level in mathematics. When an EL student is new, she seats them with a stronger mathematics student and makes sure there is another student nearby that speaks their native language. After a while, she seats the EL student with a peer who is on a closer academic level. Teacher B reported that she tries to spread out her EL students so they cannot rely on speaking their native language with other students during class. However, when a student speaks little to no English and needs help navigating school procedures, she will pair them up with another student who speaks their native language, when possible.

During interviews, teachers discussed several ways that provide opportunities for EL students to interact during mathematics. Four of the eight participants talked about using turn and talk to engage EL students in discussions with their peers. Two teachers shared that they use random reporter along with “turn and talk”. Only one teacher discussed using cooperative learning goals with her students. The three teachers who were observed using team huddle, also discussed this during their interviews.

Disparities. Although all eight participants had their students seated in pairs or teams, interview responses showed that the strategies used to decide where and how to seat EL students were inconsistent. Some teachers felt that EL students should be paired with students who spoke their native language, when possible. Others felt that limiting the opportunities for students to speak their native language would encourage them to learn English.

Additionally, more participants were observed using Power Teaching techniques than actually discussed in the interviews. For example, all eight participants were observed using “turn and talk” while only four teachers discussed using this in their interview. Six teachers used cooperative learning goals, while only one teacher brought this up in her interview. And, five teachers used random reporter while two discussed using this in their interviews.

It is worth noting that some of the variation in Power Teaching practices being implemented may be related to the grade level being taught, the needs of the particular group of students, or the instructional cycle used. For example, Teachers E and F teach first grade. These teachers have their students sitting in groups and provided opportunities for “turn and talk”. These teachers provided their math instruction through a guided math rotation. This allowed them to provide small group instruction to their students, while the rest of the class worked on independent practice of the concept or math centers. Therefore, some of the other Power Teaching practices, such as Team Points, may not have been appropriate for their students and the way they have their instructional block set up.

Although students were presented with these opportunities for discussion and interaction, there was no way to ensure that EL students were actively engaging in these experiences. The only supports that the participating teachers reported using to help EL students engage in mathematics discussions were allowing them to repeat or mimic their peers, working with them individually, and having another student translate for them. Random reporter and response rubrics, which were not used for all student interactions, were the only strategies used for holding all students, including ELs, accountable for participating in these interactions or discussions. Although teachers were consistently providing opportunities for student interactions, EL students may not have fully benefitted from these interactions if they were not fully engaging in them.

Related challenges. One common challenge experienced by the participating teachers, which will be discussed in detail in a following section, was having efficient ways to assess the academic knowledge, skills, and learning needs of EL students, especially those with limited English. Without having the foundational information about an EL student which would be provided by an assessment, teachers have no systematic way of selecting the most appropriate seat for those students. Another challenge was the lack of resources available to help provide effective instruction for EL students in mathematics. Both of these challenges could have contributed to the fact that teachers have limited strategies for supporting EL students and limited strategies for holding EL students accountable during student interactions.

To summarize, all of the participants were utilizing Power Teaching routines and techniques, however on varying levels. All participating teachers had their students seated in pairs or teams and incorporated opportunities for “turn and talk.” Teachers incorporated other Power Teaching components such as team names, team points, cooperative learning goals, “turn and talk”, random reporter, and response rubrics to varying degrees. Although the data showed that teachers were consistently providing opportunities for interactions through Power Teaching routines, there were limited strategies used to support EL students while engaging in these interactions and there were limited means of holding EL students accountable for these interactions. This is likely related to the challenges experienced by teachers related to not having an efficient way to assess the academic knowledge of EL students and the lack of support and resources for EL students in mathematics.

Facilitating peer discussions. Another theme which emerged is Facilitating Peer Discussions. According to Doabler et al. (2016), EL students need frequent opportunities to explain and justify their thinking as well as elaborate on their ideas. Purposeful interactions such as these can be guided by teachers' questioning (Banse et al., 2017; Doabler et al., 2016). Analysis of the observation data demonstrates that teachers are using questioning to guide the interactions of their students. Six of the eight teacher participants used questioning to facilitate and guide student discussions during lesson observations. The data for this subsection comes from observations only, as none of the participants discussed using questioning to facilitate peer discussions during their interviews. The observation data also shows that the frequency and levels of questions vary among the teacher participants during the hour long lesson observation. Table 9 shows the frequency to which this instructional practice was used during the observed lesson.

Table 9
Frequency of guiding questions in a 1 hour lesson

	1-5 times	6-10 times	10 + times
Teacher A			X
Teacher B		X	
Teacher C	X		
Teacher D			
Teacher E			
Teacher F	X		
Teacher G	X		
Teacher H	X		

As shown in Table 9, the frequency to which the participants utilized questioning to facilitate student discussions varied. There are several different reasons that may have impacted this variance including content, grade level, student needs, and lesson organization. Teachers A and B incorporated guiding questions throughout their instruction both during whole group discussions and small group discussions. Teachers C and H used guiding questions primarily to facilitate whole group discussions. Teachers F and G used questions to facilitate discussions primarily within small groups of students.

The data also showed different levels of questioning used between teachers. Table 10 provides examples of questions teachers used during classroom observations. The examples displayed in Table 10 were selected to demonstrate the different levels and types of questions used by the participants. This table does not include all of the questions found in the data.

Table 10

Examples of questioning to facilitate discussion

Teacher Observed	Observation Field Notes
Teacher A	Student: We multiplied 3 times 12 to get 36. Teacher A: Why are you multiplying 3 times 12? Did you explain that to your team? Can you explain it? Ok, why don't you go over it again with your team.
Teacher B	Teacher B: Ok so there is a pattern to line AD and every point that falls along line AD. Turn and talk in your groups about what the pattern is. *Students talk in groups* Teacher B: Ok who can share? Student: The x and y coordinate are the same. Teacher B: The x and y coordinate are the same. Would someone say it a different way? Student: The x and y coordinate goes in 1s. Teacher B: What do you mean 'goes in 1s'? Student: They go up 1 each time. Teacher B: Ok, would (5, 5) be on line AD? Can anyone give me a point that would be on line AD but not on the grid?
Teacher C	Teacher C: John says this is 6:9. Do we agree? Kelly says 6:45. Do we agree with her? Why is it 45? Student: Because we count by 5s to get 45. Teacher C: And where do you count by 5s? Do you start anywhere? Student: You start at the 12.
Teacher F	Teacher F: Teacher holds up one marker in each hand (out to the side like a balance) and explains they are equal. What if I have 3 in one hand and 1 in the other? Student: You need 2 more. Teacher F: Right, they wouldn't be equal, they would be off balance. If we add 2 more then it's equal. Ok, what if I have 8 = 5 + ____ . Don't let that equal sign mess you up! It's just a balance. Student: That's like 4 + 5 = 9, it's just 1 less.
Teacher G	Teacher G: How do we find area? Turn and talk in your group, how do you find area? *Teacher walks around to check in with different groups.* Teacher G: 5, 4, 3, 2 ,1 … *(pulls a random reporter stick).* Number 19. Student: Multiply the two different side lengths together.
Teacher H	*Teacher projects application problem.* Teacher H: Ok, I need to you to figure out which table has the smallest perimeter. Go ahead and turn and talk. *Teacher gives students a minute to talk and pulls random reporter stick.* Student: A is the smallest because if you look at the other ones, 54 cm is really small. If you look on a meter stick you can see that it's smaller than the others. Teacher H: What about B and D? Because they are both less than 1. And A is 54 so that's bigger than 1? Student: There's also another way, because 100 cm makes a meter. And D says 0.8 which means it would be 8/10 of a meter and would be 80 cm. Teacher H: How do you know that equals 80 cm?

	Student: Because of the decimal point. It would be the same thing with liters. You have to move the decimal point. So D is 80 cm. And then for B 69/100, since 100 equals one meter, it’s kind of like D so it would be 69 cm.

For example, Table 10 shows that Teacher B asked students to identify a pattern for line AD and also asked for students to restate someone’s response in a different way. Teacher F used the question “What if I had 8 = 5 + ____?” to build on students’ thinking and discussion about equal signs and equations. Teacher G said “How do we find area?” to connect back to a previously learned concept. These variations may have been due to differences in grade level, content, or student needs. However, each example showed the teacher participant using questioning to further student thinking and facilitate meaningful discussion. This data in Table 10 also showed the integration of some of the Power Teaching Practices previously discussed. As mentioned, the Power Teaching Practices help to set routines and expectations for student interactions as well as fosters a learning environment where meaningful opportunities for peer interaction are provided frequently. The Power Teaching Practices used along with questioning helped the teacher participants facilitate the interactions of their students. In these examples, you can see that Teachers B, G, and H incorporated Turn and Talk to initiate discussion and then used questioning to extend their students’ thinking. Teachers G and H also used Random Reporter to ensure all students were participating in their team’s discussion and prepared to share with the class.

Research Question 3

The third research question for this study was “How do first through fifth grade mathematics teachers implement instructional practices related to practice and application for EL students?” In the SIOP, Echevarría, Vogt, and Short. (2008) highlighted the use of hands-on materials or manipulatives, activities that enable students to apply language and content knowledge, and activities that integrate reading, writing, listening, and speaking. The data revealed that the participating teachers are implementing instructional practices such as hands-on learning, practicing on paper, and computer programs as opportunities for students to practice and apply their learning. The hands-on learning activities that were implemented utilized various manipulatives including rulers, clocks, counters, and cubes. The teacher participants are also using several worksheets that are provided in the district-wide mathematics program for students to demonstrate and apply their learning. After a review of the data, the following themes were identified: Hands-on Activities and Practicing on Paper.

Hands-on activities. Analysis of the data showed that one way teachers were providing opportunities for their EL students to practice and apply their learning was through hands-on activities. Table 6 shows how the data from interviews, observations, and artifacts supported the development of this theme. Six of the eight teacher participants implemented hands-on learning activities during the observed mathematics lesson. These teachers utilized various manipulatives including measurement tools, clocks, counters, and cubes. Some of the hands-on activities were completed during whole group instruction and others were during small group practice.

Interviews. During initial interviews, six participants discussed their use of hands-on learning and manipulatives. Teacher D shared that she felt she had incorporated a limited use of manipulatives and that hands-on learning was something she wanted to use more often. Teacher G discussed pulling her EL students in a small group to teach subtraction with manipulatives. Teacher E emphasized her use of manipulatives to build foundational mathematics concepts in first grade. Teacher C added that she felt her students built understanding of mathematics vocabulary through the use of manipulatives. Several teachers also mentioned that all of the manipulatives and supporting resources they have available for EL students are offered for all students who may need them.

Observations and artifacts. During the classroom observation, Teacher A engaged her students in an activity using tetrominoes (a shape formed by four square units connected by sides, not corners). For this activity, students had to draw the different tetrominoes on grid paper, cut them out, and then manipulate them to solve problems about area. They traced their tetrominoes and color coded them so they could discuss their thinking in detail with their teams and the whole class. Teacher G also had her students exploring the concept of area by having them create robots using grid paper. Students had to create the different parts of their robot based on specified dimensions. Students in Teacher B's class were plotting points, drawing lines and line segments on coordinate grids. Students used these tools to create visuals to help them identify patterns using the coordinates. Teacher C had her students using clocks that they had made in a previous lesson to solve problems about time.

Teachers E and F have structured their mathematics block in a guided math rotation. Their students received their instruction in a small group setting and then rotated through other stations. In both classes, students were working with partners to play hands-on games involving cubes, counters, hundreds charts, and other manipulatives.

A review of classroom artifacts showed that the participating teachers had cubes, pattern blocks, tiles, dice, and flashcards for a variety of content available for their students. Although all teachers had these materials, I did not observe the use of hands-on materials in every teacher's classroom. Teacher C had student work displayed which were cube models formed by putting toothpicks and marshmallows together, which suggested that she used hands-on learning in a previous mathematics lesson.

Related Challenges. One of the challenges experienced by the participants was a lack of instructional support for EL students in mathematics. Several teachers voiced that it would be beneficial to have another adult, teacher or aide, to help meet the needs of the diverse learners. Having an extra set of hands in the classroom would make hands-on learning activities more manageable for teachers and perhaps more effective for EL students.

The data showed that six of the participating teachers were incorporating hands-on learning activities. Some teachers did this through a whole-class activity while others had mathematics centers in which students played games using cubes, hundreds charts, counters, and other manipulatives. All teachers had various manipulatives in their classrooms, however I did not observe these being used in all classrooms during my observations. Teachers shared that any manipulatives that are available to EL students are also available to all students. The lack of instructional support in mathematics may have impacted teachers' ability to effectively incorporate hands-on learning in their classrooms.

Practicing on paper. The data showed that the participating teachers are providing opportunities for students to practice and apply their learning on paper worksheets which are included in the district-wide mathematics program. Also, some teachers have incorporated computational fluency practice on paper. None of the paper resources are specifically designed or used for EL students, rather they are for all students.

The mathematics program implemented district-wide has worksheets available for each lesson called problem sets. The problem sets are practice problems specifically aligned to that particular lesson and are arranged from easiest to most difficult. There are also homework pages for each lesson which mirror the problem set. The district-wide math program also includes an exit ticket for each lesson to assess the specific skills covered.

Interviews. During initial interviews, seven of the eight participants discussed their use of the paper resources as a way for students to practice and apply their learning. Six teachers said that they used the problem sets that come with the district-wide mathematics program on a regular basis. Two teachers said that they incorporate the homework pages while five teachers said that they use exit tickets. Two teachers discussed providing opportunities for students to practice mathematics fluency on paper.

Observations and artifacts. Seven teacher participants were observed using the problem set, homework, or both. While four of the eight participating teachers were observed incorporating the exit ticket into their mathematics lesson. Also, four participating teachers incorporated fluency practice on paper in their observed lesson. The fluency worksheets that were utilized came from two different sources. One of the first grade teachers used a fluency worksheet that was provided by the district-wide mathematics program. These fluency worksheets are only available for first and second grades. Other teachers used an outside source for fluency practice. Some teachers had students practice orally with a partner while also practicing on paper. Table 11 highlights which paper resources teacher participants were observed using for their students to apply their mathematics learning.

Table 11

Paper resources used for applying mathematics learning

	Problem Set	Homework	Exit Ticket	Fluency
Teacher A	X	X		X
Teacher B	X	X	X	X
Teacher C	X		X	
Teacher D				
Teacher E	X		X	
Teacher F		X		X
Teacher G	X	X		
Teacher H	X	X	X	X

Disparities. Although Teacher D discussed using the problem sets and exit tickets during her initial interview, neither of these resources were utilized in the lesson I observed. However, she did have students practicing on paper but she was using a supplemental resource that she found outside of the district-wide mathematics program. Teacher E did not discuss her use of paper resources during her interview however she was observed using the problem set and the exit ticket during her lesson.

Related Challenges. One of the challenges experienced by the participants was a lack of resources to effectively meet the needs of EL students. Four of the teachers voiced that there are no available resources specifically for EL students. The questions on the problem sets which come with the mathematics program are organized from most basic to most challenging for each lesson. However, Teacher D commented “The problem set might be leveled, but I can’t have a student do 1 or 2 problems and feel that I’ve given them enough to work on or enough to assess them.” She felt that even though the worksheets are leveled, there was not enough practice for a student who may need additional practice at the basic level.

Seven teachers were observed utilizing some or all of the worksheets provided through the district-wide mathematics program. Some teachers also provided students with an opportunity to practice computational fluency on paper. Several teachers pointed out the lack of instructional resources for EL students in mathematics. The data suggested that there is a need for additional practice pages for EL students in mathematics.

Research Question 4

The fourth research question for this study was “What challenges do first through fifth grade teachers experience related to implementing instructional practices for EL students in mathematics?” The two themes which emerged from the data in this category demonstrate a need for a reliable way to assess the mathematics knowledge and skills of EL students and instructional resources and supports for teachers working with EL students in mathematics. All of the data used to answer this research question came from initial and follow-up interviews. However, it is likely that these challenges have impacted teachers’ abilities to implement instructional practices related to the other research questions in this study.

Assessing EL student needs. Before teachers can provide effective mathematics instruction to EL students, they must first assess where the student is academically and identify that child’s learning needs. Five of the participating teachers in the Keystone School District stressed that they were struggling to assess the academic needs of EL students. Six of the eight participants voiced that the current available assessments do not accurately assess EL students because the tests are too language dependent and EL students may not understand the questions. Two teachers got visibly upset when discussing how and what they do to assess EL students. These teachers shared that they basically pull random worksheets to try to figure out what an EL student already knows.

In order for teachers to be able to identify EL students’ needs, an accurate means of assessing their current knowledge is needed. Six of the eight participants pointed out that the current assessments available through the district are too language dependent and inaccurately assess the knowledge and skills of EL students. When an EL student attempts these assessments, all of the questions are in English and many require reading comprehension. It is likely that many EL students do not understand what many of the questions are asking them to do. Teacher H commented “The EL kids are at a disadvantage before they even begin.” These assessments also do not provide teachers with accurate insight into the knowledge and skills that these students have.

When asked about assessing a new EL student’s needs, two participants got visibly upset and their frustration was obvious. Teacher E commented “It is just ‘Here you go’ and you’re scrambling to try to teach your curriculum plus figure out where they are and build them back up.” Teacher G shared “I feel like I don’t have a direction right now and I’m just going all over the place.” Teacher B stressed that it is difficult to figure out what EL students already know in order to decide how to most effectively teach them.

Participants had varying strategies for attempting to assess EL students' needs in mathematics. Five of the participants said that they get language proficiency data from the building English as a Second Language (ESL) teacher. Although this information does provide insight into the students' language knowledge and skills, it does not provide any information regarding mathematics knowledge or skills. Four participants said that they usually observe the student over several days during mathematics instruction to get an idea where they are academically in mathematics. Teacher G shared "Honestly, I don't really have a rhyme or reason to finding this out. I actually wish that I did." Teacher E shared a similar thought. Teacher F was the only participant that said he uses a combination of some of the available assessments to help him figure out where an EL student is academically. Although all of the teachers discussed trying to assess new EL students in their classrooms, there does not seem to be any consistency in how this is accomplished.

Teachers B and D added that some EL students have moved from other countries where they may have had limited access to formal education. Teacher D pointed out that students are placed in a grade level based on their age rather than academic level. Teacher H also shared an experience where an EL student was placed in the wrong grade level, further disrupting his learning.

The participating teachers emphasized a need for an efficient means of assessing the academic knowledge and learning needs of EL students in mathematics. EL students who move into the district come in with varying levels of language proficiency as well as academic knowledge. Without an accurate assessment, teachers are essentially "flying blind" when providing mathematics instruction. The participants felt that the current assessments used for mathematics in the district were too language-based to provide an accurate assessment for students with little language proficiency. ESL teachers do assess the language proficiency levels of all incoming EL students, however this information is not always communicated to mathematics teachers and it is not enough to guide their mathematics instruction for these students.

Instructional resources and support. One of the challenges stressed by participants was a lack of instructional resources and support in the classroom. Several teachers shared concerns about the lack of available instructional resources for EL students in mathematics. Seven of the eight participants reported a need for support in the classroom while six participants shared their frustration that any available support always goes to English Language Arts rather than mathematics. All eight participants said that they had received little to no professional development on how to effectively teach mathematics to EL students.

Teacher G shared "The most frustrating thing is the lack of resources and just the lack of help [in the classroom]" referring to trying to meet the needs of all students without the support of another teacher or instructional aide in the classroom. Seven participating teachers emphasized a need for instructional help in the classroom for EL students in mathematics. While six participants were frustrated that it seems that the focus is always on English Language Arts and mathematics is left without any intervention programs or support staff to help in the classrooms. Only two of the participants were receiving any type of support in the classroom during their mathematics instruction. Teacher D had an instructional aide helping with her EL students in the classroom and Teacher C had an English as a Second Language (ESL) teacher helping for a short time in her class. All other participants had no help in their classrooms. In order to meet the needs of EL students while meeting the needs of the rest of the students in the class, all teacher participants felt that having an extra set of hands is necessary.

Teachers also demonstrated a need for instructional resources to use to help provide effective instruction for EL students in mathematics. Teacher G stressed her frustration about spending hours trying to find “random things” for her EL students to do in mathematics. Teacher G shared “We don’t have any resources. I kind of feel like I’m flying by the seat of my pants sort of thing.” Teacher E emphasized that there are no resources available to support the learning of EL students in mathematics and that she has to try to find things on her own. Three of the eight participants discussed pulling additional activities from the district-wide curriculum which are also available in Spanish. However, these teachers also pointed out that having these activities in Spanish is not helpful to students who are not literate in Spanish and those students who have native languages other than Spanish. Teacher D brought up that even though there are Math Coaches in the district, she often did not know what questions to ask or what resources were available to utilize. Teacher D also felt that there was not enough differentiated practice in the district-wide curriculum to meet the needs of EL students who needed more time with basic skills.

All eight of the participants reported that they have not received any professional development, other than possibly a short 20 minute presentation from ESL teachers or a handout of strategies, on how to meet the needs of EL students in mathematics from the district. The participants shared that professional development specific to helping EL students in mathematics is essential. Teacher G noted that she shared this on a recent survey done by the Keystone School District. Teacher F emphasized the need for practical professional development that teachers will be able to apply in the classroom.

The participating teachers felt that there is a lack of instructional resources and support for EL students in mathematics. The participants shared that they spent a significant amount of time finding random activities and resources to use with their EL students in mathematics. All participants shared that they have not received any significant professional development from the district on providing effective mathematics instruction to EL students. Teacher G was visibly upset when she shared:

> "I feel that in general it is very challenging to work with any EL student when resources are lacking and NO training is being provided so that we can support these students the way that they deserve to be supported. It's very frustrating as an educator to have students in your classroom that you know need help and you are unable to do so because you don't have the resources or the training to assist them."

Discrepant Cases

During data analysis, sometimes researchers encounter discrepant cases. This occurs when data provided by one or more persons or sources conflicts with other sources. In order to gain a comprehensive, in-depth understanding of the local problem, it is important to include all perspectives and experiences in the findings, even those differing from the collective group. For the current study, there were no discrepant cases found during data analysis.

Evidence of Quality

As the researcher for this study, I used several strategies to ensure the quality of my research and the accuracy of my findings. First, I maintained well-organized records and kept a research log with dates and times of interviews and observations. Prior to data collection and after IRB approval, I pilot-tested the self-developed interview protocol (see Appendix B). I also conducted practice observations to familiarize myself with using the SIOP (see Appendix D). All interviews were audio recorded and then transcribed verbatim. During classroom observations, a running record of the events taking place was taken as field notes. Digital photos were taken of all classroom artifacts. Verbatim responses to the follow-up interviews were also used.

By using triangulation of data from interviews, observations, and classroom artifacts, I was able to ensure the validity of my findings as well as explore different dimensions of the problem of study I used a semi-structured interview protocol (see Appendix B) for the initial interviews and conducted follow up interviews through email (see Appendix C). I used the Sheltered Instruction Observational Protocol (SIOP; see Appendix D) for observations and also kept a running record of my observations. By comparing and contrasting the data collected through interviews, observations, and artifacts, I was able to find out what practices were consistently represented in all three sources. This also brought to light some pieces of data that were evident in one or two of the data sources but not necessarily consistent through all three sources. This helped to point out discrepancies between participants' perceptions and their observed actions. For example, all eight participants were observed modeling appropriate mathematics vocabulary. This evidence was supported by all eight participants also having a vocabulary wall posted in their classroom. However, the participants did not discuss modeling vocabulary as an instructional strategy that they use during interviews. Therefore, this discrepancy shows that teachers may be implementing this practice without realizing the benefits for EL students.

In addition to using triangulation, I had another expert code part of my data to compare for consistency and ensure reliability. I conducted member checks to ensure that my analysis accurately reflected the perceptions of the participants. Throughout data collection and analysis I kept a reflective journal to note my thoughts and any biases.

Summary of Findings

The goal of this study was to explore what instructional practices mathematics teachers were using related to building background knowledge, student interactions, practice and application of learning for EL students. Additionally, I wanted to explore any challenges teachers were experiencing related to implementing these instructional practices. The results provide a current look into what practices are being utilized by the teacher participants and the challenges they are facing. The following section highlights the important findings and how they have answered the research questions.

The findings demonstrated that the participating teachers were consistently emphasizing vocabulary by reviewing, modeling, making connections, and providing opportunities for students to use the vocabulary. According to the K-12 mathematics supervisor, building background knowledge through vocabulary instruction has been a district focus for the past few years (K-12 mathematics supervisor, personal communication, June 14, 2017). This follows what has been presented in the literature, that most schools focus primarily on vocabulary in mathematics, rather than the academic language as a whole (Hopkins, Lowenhaupt, & Sweet, 2015; Moschkovich, 2015). Although teachers are demonstrating consistency in their incorporation of mathematics vocabulary in their instruction, it may be more beneficial for teachers to focus more on the academic language of mathematics.

Doabler et al. (2016) emphasized that making connections to prior learning and experiences has a significant impact on a student's ability to learn new content. The participants helped EL students to make connections to prior learning through vocabulary review, fluency practice, class discussions, and occasionally linking students' native language. Teachers made minimal connections to EL students' real world experiences. The literature points out the need to make explicit connections to life experiences, prior learning, and native languages (Chval et al., 2015). Although the participants made connections to prior learning and occasionally students' native languages and real world experiences, they did not explicitly point out how the topics were related. Rather, the teacher participants often covered the related material without explaining how they were connected.

However, teachers reported having no efficient way of assessing academic knowledge of EL students in mathematics. This made it difficult for teachers to make connections to prior learning and real world experiences for these students. Having an effective way of identifying the strengths and needs of EL students in mathematics may enable teachers to provide more connections for these students.

The findings also suggested that the participating teachers provided opportunities for interaction and discussion and are attempting to seat students based on their language needs. The participating teachers implemented Power Teaching routines and techniques on varying levels. These routines are what set the foundation for student interactions in mathematics class. According to the data, all eight participants had students seated in pairs or groups. However, the strategies and criteria used to select EL students' seats was inconsistent. All eight participants also utilized "turn and talk" to promote frequent interactions. Six of the participants also incorporated Cooperative Learning Goals to encourage students to engage in meaningful interactions. Three of the participants allowed students to clarify concepts in their native language, however it seemed to be inconsistent. One teacher was fluent in Spanish, however she emphasized that she rarely speaks Spanish to her students. Two other teachers noted that they know minimal conversational Spanish that they use to communicate with some of their EL students. One teacher also used a translation application on her phone to communicate with an EL student.

Warren and Miller (2015) noted that instructional practices which incorporate opportunities for meaningful interactions and discussions of mathematics concepts are most effective. The participating teachers were consistently providing opportunities for mathematics discussions, however it is not clear whether or not EL students are actively engaging in these interactions consistently. The participating teachers did not provide any additional supports for EL students during interactions or have any other strategies for holding them accountable. The two challenges expressed by the participants, no effective way to assess the academic needs of EL students and a lack of resources and support for ELs in mathematics, both may be impacting teachers' ability to support and hold these students accountable during interactions.

The findings showed that the participating teachers incorporated hands-on learning into their mathematics lessons. During classroom observations, six of the eight participants incorporated hands-on learning activities into their lessons, all of which were on different concepts. All eight participants provided opportunities for EL students to practice on paper using the worksheets from the district-wide mathematics program and additional fluency activities. The teacher participants also incorporated opportunities for discussion and collaboration with partners or groups. Therefore, teachers did provide opportunities for students to apply content and language knowledge during their mathematics lessons.

The third component of Practice/Application is providing activities that integrate all language skills (Echevarría, Vogt, & Short, 2008). This component is challenging as the relationships between reading, writing, listening, and speaking are complex (Echevarría, Vogt, & Short, 2008). The data showed that through interactions and practicing mathematics concepts on paper, EL students are most often engaging in each of the language skills during mathematics lessons. However, in some cases, the manner in which the skills were incorporated into the lessons seemed to be disjointed. Also, there were no supports observed to ensure that EL students would feel comfortable engaging in all of the language skills throughout the lessons. For example, Teacher G had her students creating robots using their knowledge of area. During this activity, students had to read the directions or specifications for the different parts of the robots and then apply their knowledge of area to create a shape on their grid. Students were allowed to discuss their work, although they were each creating their own robot. The EL students, who did not have a prior understanding of area, attempted to create robots however there was little to no interaction between them, their peers, or their teacher.

Teacher A had her students manipulating tetrominoes to explore their understanding of perimeter and area. During this activity, all students were actively engaging in discussions and working collaboratively with their teams. However, students were not provided with an opportunity to write about their learning during that activity. Doabler et al. (2016) emphasized the need for teachers to incorporate all forms of communication throughout instruction to be most effective. Chval et al. (2015) added that integrating language and mathematics instruction simultaneously is most effective. These two observed lessons demonstrate that teachers have incorporated the language skills, however in this case, they missed important pieces that would have more effectively support the needs of EL students in mathematics.

Lastly, the findings showed that the two challenges expressed by the teacher participants may be impacting their ability to implement instructional practices in all of the areas previously discussed. The teacher participants emphasized a need for an effective way to assess the academic needs of EL students in mathematics, as the current available assessments are too language dependent and therefore are not accurate. Without having an accurate assessment, teachers are essentially “flying blind” when trying to provide instruction for EL students. This makes it very difficult for teachers to implement effective instructional practices for building background knowledge, providing supports for EL students during interactions, and appropriate practice and application opportunities.

The teacher participants also emphasized a need for both instructional resources and support in the classroom for EL students in mathematics. The current district-wide mathematics program is not designed specifically for EL students. Teacher D pointed out that the program does not provide enough practice at the most basic levels. Teachers E and G both shared that they spend hours trying to find random activities for their EL students to practice various mathematics concepts. In order for these students to be provided with consistent support, additional instructional resources, designed to meet the needs of language learners is needed. 7 out of the 8 participants emphasized a need for help in the classroom while only 2 teachers were actually receiving help from a teacher or aide during their mathematics instruction. Having an extra person would make it easier for teachers to provide additional supports for EL students while still meeting the needs of the other learners in the classroom.

In short, the lack of an effective assessment for EL students in mathematics and a lack of instructional resources and support, are impacting the participating teachers’ ability to implement effective instructional practices for EL students in mathematics classes. The participating teachers are currently implementing instructional practices to help students build background knowledge, interact with teachers and peers, and apply their learning. However, if the previously mentioned challenges are addressed, teachers may be able to more effectively provide mathematics instruction for EL students.

Assumptions and Limitations

The purpose of this study was to explore how instructional practices related to building background, student interactions, and opportunities for practice and application were being implemented in the mathematics instruction for ELs as well as the possible challenges experienced by teachers. This qualitative case study was based on the experiences and perceptions of eight teachers from one district. The results of this study are not generalizable to other settings; rather this study could provide insight to guide future decisions of the Keystone School District.

The teachers in this district have received a limited amount of professional development about mathematics instruction for EL students. None of the participants have been trained on the SIOP Model. The purpose of this study has been to explore how instructional practices related to building background, student interactions, and application opportunities are currently being implemented as well as identify possible challenges experienced by teachers in relation to using effective instructional practices for EL students.

Conclusion

Section two described the research design and methodology which was utilized in this project study. I implemented a qualitative case study design to explore how effective instructional practices related to building background, student interactions, and practice/application opportunities were being implemented in the mathematics instruction of first through fifth grade ELs students. Also, possible challenges experienced by teachers related to implementing effective instructional practices for ELs were examined. After teachers were selected to participate in the study, I collected data through interviews, classroom observations, and classroom artifacts. I used qualitative coding to identify emerging themes within the data to create rich descriptions about the local problem. The results of the study were shared and I discussed how the data answers the guiding research questions.

Section 3: The Project

Introduction

To address the results of the study, I created a plan for professional development (see Appendix A). The results of this study showed that the participating teachers believed that they had no way to assess the mathematics knowledge and skills of EL students. For teachers to provide appropriate instruction for these students, an assessment that accurately demonstrates EL students' mathematics knowledge and skills is needed. The participating teachers also shared that they need instructional resources to meet the diverse needs of their EL students in mathematics. Although the participating teachers were providing consistent opportunities for students to engage in mathematics discourse, the data did not clearly show whether EL students were actively participating in these interactions. The participants were not implementing any specific supports for EL students during these interactions and the teachers shared that they had no way to hold EL students accountable for their participation. The goals of this professional development are to address the need for an effective way to assess the mathematics knowledge and skills of EL students, provide instructional resources that can be used to support EL students in mathematics, develop a platform for teachers to share resources, identify strategies for supporting EL students during mathematics discussions, and identify strategies for holding EL students accountable during mathematics discussions. The design of this professional development is aligned with current research recommending that professional development be data-driven(Babinski, Amendum, Knotek, Sánchez, & Malone, 2018; Desimone & Pak, 2017; Heineke, Papola-Ellis, Cohen, & Davin, 2018; Johnson & Wells, 2017), collaborative (Babinki et al, 2018; Fahmi Dajani & Mohammed, 2014; Hadjioannou, Hutchinson, & Hockman, 2016; Heineke et al., 2018), and ongoing (Babinski et al., 2018; Desimone & Pak, 2017; Hadjioannou et al., 2016; Johnson & Wells, 2017).

This professional development will take place in the course of a school year to allow time for teachers to process, apply, and reflect on the strategies and resources presented. This professional development will include classroom teachers, ESL teachers, instructional coaches, and building administrators. It will begin with 3 days of training to share the knowledge and skills that teachers will need in order to continue their professional learning through the collaborative inquiry process throughout the school year. The first day will be an overview of how to analyze language and cultural data, including home language surveys and World-Class Instructional Design and Assessment (WIDA) scores. Then, teachers will work with colleagues from their school to explore the language and cultural data which pertains to their students. Teachers will then have time to collaborate to develop a vision and collective goals based on their language and cultural data. In the afternoon, teachers will conduct a data dive of the academic data for their EL students. Teacher teams will reflect on their findings and share back with the whole group.

The second day will begin with an overview of language acquisition and how this impacts EL students in mathematics. Teachers will learn about the WIDA Can Do Descriptors and engage in activity where they will modify a Eureka mathematics lesson to meet the needs of varying language proficiency levels. Teachers will then have an opportunity to organize their language, cultural, and academic data for EL students to create student profiles to be used to guide differentiation. In the afternoon, teachers will learn about several instructional strategies which can support EL students during interactions. At the end of the day, teachers will have time to create and modify resources for EL students.

On the third day, I will share a primary and intermediate assessment that can be used to test the mathematics knowledge of EL students with limited English proficiency. I will then share some additional assessment strategies that are effective for EL students. Teachers will have time to create and modify current mathematics assessments for their students. In the afternoon, teachers will learn about the collaborative inquiry process that they started on Day 1. After an overview of the process, teachers will meet with their specific PLC teams begin working through the steps of the process. The information, resources, and skills shared during these first 3 days aim to establish an opportunity for ongoing professional learning related to providing effective instruction for EL students. The district has already implemented PLC meetings twice a week for elementary teachers. Therefore, teachers will be able to use this PLC time for collaborative inquiry throughout the school year.

The purpose of this professional development is to provide teachers with the knowledge, skills, and resources needed to support the learning of ELs in mathematics. The following learning outcomes will be addressed in the initial three days of training:

- Engage teachers in a data dive to get to know the language, cultural, and academic characteristics of their EL students.
- Provide teachers with an overview of language acquisition and resources to help teachers support the learning of EL students in mathematics.
- Provide teachers with instructional strategies to support EL students during mathematics discussions and collaborative activities.

- Engage teachers in creating and modifying lessons, activities, and assessments to meet the varying language needs of EL students.
- Assist teachers in creating student profiles to help guide the differentiated instruction of their EL students.
- Provide strategies to help teachers create modify mathematics assessments to meet the varying language needs of EL students.
- Outline the process of collaborative inquiry and provide time for PLC groups to engage in foundational steps of the process to be continued throughout the school year.
- Provide mathematics assessments to help teachers identify EL students' mathematics skills and needs.
- Establish a platform for sharing instructional resources to support EL students in math.

The professional development was designed to address the above learning outcomes in alignment with the results of the current study. In addition, this professional development plan has been designed to provide teachers with the knowledge and skills needed to continue their learning through Professional Learning Communities throughout the school year.

Rationale

I selected a plan for professional development for the project for this study, because it is the most appropriate way to address the gaps in practice and teacher-reported challenges associated with providing effective mathematics instruction to ELs that were identified in the results of this study. By addressing the gaps in practice and teacher-reported challenges through professional development, teachers will be more prepared to provide effective mathematics instruction for EL students. This will foster positive social change related to the educational experiences and outcomes of EL students within this district.

The other project options included a curriculum plan and a policy recommendation paper. I did not select a curriculum plan for this project, because the results of the study demonstrated gaps in instructional practices, not in the content of instruction. A policy recommendation paper was not selected, because a change in policy would not address the gaps in practice or challenges shared by the teacher participants of this study. Therefore, I chose a plan for professional development, because it is most appropriate to address the gaps in instructional practices and the challenges reported by teachers related to providing effective mathematics instruction for EL students.

One reason that a professional development plan is most appropriate for this study is that all eight participants shared that they had received no professional development on teaching mathematics to ELs beyond a 20 minute presentation or a handout. The participants emphasized the need for professional development specifically focused on meeting the needs of EL students in mathematics and that is relevant and practical for application in the classroom. Heineke et al. (2018) suggested that obtaining authentic buy-in is more effective than making professional development a requirement.

Another reason is that professional development has been an effective way to improve instructional practices (Tong, Luo, Irby, Lara-Alecio, & Rivera, 2017), teacher self-efficacy (Ortaçtepe & Akyel, 2015), and teacher knowledge (Hadjioannou et al., 2016) related to ELs. Therefore, a professional development plan may address the gaps in practice and teacher-reported challenges related to effective instructional practices for EL students that were identified in the results of this study. First and foremost, the teachers emphasized a need for an accurate way to assess the mathematics knowledge and skills of EL students. In order for teachers to begin to provide effective mathematics instruction, they must first be able to assess what mathematics knowledge and skills their students are coming in with. This professional development will provide teachers with strategies and resources for effectively assessing the mathematics knowledge and skills so that they can make informed decisions about how to provide appropriate instruction for their students.

Unfortunately, there is limited research on the impact of professional development on student outcomes. However, the research reviewed in the following section demonstrates mixed results related to professional development impact on student achievement. Studies conducted by Babinski et al. (2018) and Andersson and Palm (2017) both found that teacher professional development had a positive impact on student performance. Conversely, a study conducted by Garet et al. (2016) showed that teacher professional development did not have a significant impact on student performance. It is obvious that more research is needed to fully understand the impact that teacher professional development has on student outcomes. However, there is research, although limited, to support that professional development can not only positively impact teachers' knowledge and practice, but also student performance.

The second challenge reported by teachers was the lack of instructional resources and support for EL students in mathematics. This professional development plan will include the participation of math coaches and provide a model for ongoing instructional coaching related to providing EL students with effective mathematics instruction. Heineke et al. (2018) emphasized the need for all educators to participate in professional development initiatives and share the responsibility of providing effective instruction for EL students. Additionally, I will share instructional resources which can be used to support EL students in mathematics as well as develop a platform for teachers to continually share any resources they find helpful for their students. This platform for sharing resources will serve two purposes. First, it will acknowledge the time and effort teachers have already put into locating and creating resources for their EL students in mathematics. Second, this platform will be an evolving resource library which teachers can access at any time rather than having to search multiple places for activities for their students.

Finally, the results of this study showed that the participating teachers had limited strategies for supporting EL students during math discussions as well as holding them accountable. This piece of the professional development will tie back into the strategies and resources for assessing EL students' mathematics skills and knowledge. However, there will be information shared specific to supporting EL students during mathematics discussions and measures of accountability.

A plan for professional development is the most appropriate project to address the results of this study for two main reasons. First, the teacher participants emphasized the need for professional development focused on providing effective mathematics instruction for EL students. Second, by providing professional development, the teacher-reported challenges that were identified in the study can be addressed as well as findings that the participants had limited strategies for supporting and holding EL students accountable during mathematics discussions.

Review of the Literature

There is an increasing need for all teachers to be prepared to meet the needs of linguistically diverse students (Bohon, McKelvey, Rhodes, Robnolt, 2017; Bunch, Aguirre, & Téllez, 2015; Hadjioannou et al., 2016). The results of the current study showed that the teacher participants were implementing various instructional practices related to building background, interactions, and application for ELs in mathematics. However, the participants had encountered some related challenges that may have led to some of the inconsistencies in the instructional practices used. The teacher participants emphasized the need for an effective way to assess the mathematics knowledge and skills of EL students and for additional instructional resources and support for ELs in mathematics. In order to address the results of the study and the needs of the teachers, a three-day professional development training was developed. The purpose of this review of literature is to provide an overview of the importance of professional development, teacher and student outcomes, and the design and content of effective professional development. Additionally, the developed professional development plan will be aligned to this current literature as well as the results of the study. One way to influence teachers' and their ability to deliver effective instruction is through professional development. There is evidence that professional development can have a significant effect on teacher practice (Andersson & Palm, 2017; Kiemer, Gröschner, Pehmer, & Seidel, 2015; Lee, Llosa, Jiang, Haas, O'Connor, & Van Booven, 2016; Polly et al., 2015; Sedova, Sedlacek, Svaricek, 2016), content knowledge (Garet et al., 2016), and self-efficacy (Carney, Brendafur, Thiede, Hughes, & Sutton, 2016). The available current research on EL student outcomes of professional development provided mixed results.

This professional development program has been developed based on Kolb's (1981; 1984) Experiential Learning Theory, which foundationally stems from Dewey's (1938) philosophy. The content to be covered in the professional development program will foster the skills needed to use data to drive instruction, provide resources and skills for assessing the mathematics knowledge of EL students primarily through formative assessments, knowledge and skills related to collaborative goal setting for teachers and students, and a platform for teachers to share instructional resources for EL students in mathematics.

Need for Professional Development

With the continued rise in linguistically diverse students across the country it becomes increasingly important for all classroom teachers to be prepared to meet the needs of these students (Bunch et al., 2015; Hadjioannou et al., 2016). However, a significant number of teachers have received little to no professional development on how to meet the needs of ELs (Hadjioannou et al., 2016), especially in mathematics (Hopkins et al., 2015). Teachers should not be expected to implement knowledge and skills which they have not yet been taught (Babinski et al., 2018). Hadjioannou et al. (2016) noted that it is important for teachers to understand the added challenges faced by EL students in order to provide the necessary support to help them be successful. In order for teachers to provide quality instruction for EL students in mathematics, professional development is needed. Tong et al. (2017) emphasized this point by saying that professional development is “an accompanying component of quality instruction” (p. 294).

Specifically, there is a need for professional development focused on providing effective instruction to ELs through the use of best practices (Babinski et al., 2018; Cavazos, Linan-Thompson, & Ortiz, 2018). Teachers who provide effective instruction for EL students possess content and specialized knowledge and skills (Choi & Morrison, 2014). Teachers need to have access to ongoing professional development opportunities and support in order to gain the knowledge and implement the skills (Babinski et al., 2018; Hopkins et al., 2015). Babinski et al. (2018), found that teacher feedback revealed that teachers felt that ongoing professional development on best practices was important.

Teacher Outcomes of Professional Development

Evidence suggested that professional development can influence teacher practice, knowledge, and self-efficacy related to working with EL students. In order to reach saturation of current research, the search was broadened to include studies about the effect of professional development on teachers of mathematics and science.

Collectively, the studies that explored the influence of professional development on teachers of EL students showed that professional development can have an effect specifically on a teacher's instructional practices, knowledge, and self-efficacy. Tong et al. (2017) conducted a study examining the effect of ongoing intensive professional development on the amount of time teachers spent teaching English language proficiency. Over the course of the two-year study, Tong et al. found that the difference between the treatment and control groups demonstrated that teachers' practices can be altered as a result of effective professional development. The teacher participants in this study made noticeable changes to their instructional practices related to differentiating both content and language instruction, differentiating assessments, and incorporating multicultural views (Tong et al., 2017). Although the results of this study demonstrate clearly that teacher practice was positively affected by professional development, the following two studies present somewhat convoluted results.

Ortaçtepe and Akyel (2015) conducted an eight-month study examining the relationship between teachers' self-efficacy and self-reported instructional practices for EL students and the effect of professional development on these variables. Ortaçtepe and Akyel found that the professional development improved teacher self-efficacy but did not have a significant effect on teachers' self-reported instructional practices for EL students. However, these authors found that data collected during classroom observations suggested that teachers had demonstrated changes in their practices with EL students related to the professional development.

Lastly, Hadjioannou et al. (2016) conducted a longitudinal case study exploring the effect of professional development on the teachers' knowledge and instructional practices for supporting the English language acquisition of EL students. Hadjioannou et al. found that the participants showed growth in their knowledge and ability to support EL students as a result of the professional development. Teacher surveys showed positive changes in knowledge and confidence related to working with EL students and classroom observations initially showed positive changes in teaching practices (Hadjioannou et al., 2016). However, when classroom observations were conducted a year later, teachers were not demonstrating the use of the instructional strategies covered in the professional development and, in fact, were not aware that they were not doing so (Hadjioannou et al., 2016). This suggests that although the professional development did initially have an effect on teacher practice, the changes to instruction were not maintained over time. Hadjioannou et al. added that these results may have been affected by changes in student populations, changes in teaching placements, or new district mandates.

All three studies included ongoing professional development rather than a single day training. The results do suggest that effective professional development can influence teacher practices, knowledge, and self-efficacy; however more research is needed to confirm or refute these findings. Due to the lack of research related to professional development for teachers working with EL students (Tong et al., 2017), I also reviewed current research related to professional development for mathematics and science teachers.

The current literature shows that professional development for teachers of mathematics and science has positively influenced teacher practices (Andersson & Palm, 2017; Kiemer et al., 2015; Lee et al., 2016; Polly et al., 2015; Sedova et al., 2016). Two studies showed that professional development led to changes in teachers' practices related to student discourse (Kiermer et al., 2015; Sedova et al., 2016). Polly et al. (2015) found that teacher participants shifted from using a teacher-centered to a student-centered instructional approach as a result of professional development. Andersson and Palm (2017) found that teachers were able to implement instructional practices as a result of participating in professional development, which then positively affected student performance.

Interestingly, Garet et al. (2016) found that professional development had a significant effect on teachers' content knowledge and instructional practices; however, this did not have an effect on student achievement. Carney et al. (2016) studied the influence of a statewide mathematics professional development and found that teachers experienced a significant increase in teacher content knowledge and self-efficacy.

Student Outcomes of Professional Development

There is limited research on the relationship between professional development, instructional practices, and EL student outcomes and achievement (Tong et al., 2017). Findings from the available research are inconsistent, therefore the effect of professional development on student outcomes is unclear. Babinski et al. (2018), conducted a study which examined the influence that language and literacy professional development had on EL students' language and literacy skills. The study included 45 English as a Second Language (ESL), kindergarten, first, and second grade teachers from three school districts (Babinski et al., 2018). Latino students who qualified for ESL services and spoke Spanish were included in the study (Babinski et al., 2018). Of those students, 72 were in intervention classrooms and 46 were in control classrooms (Babinski et al., 2018). The data was collected through three classroom observations, using two different observation protocols, including the Classroom Quality for English Language Learners (CQELL) and a researcher-developed observation tool (Babinski et al., 2018). Babinski et al. found that the overall quality of instruction, as measured by the CQELL, showed no differences between teachers in the intervention group and the control group. Teachers in the intervention group did demonstrate greater use of adapted strategies (measured by the CQELL) and Developing Collaboration and Consultation Skills (DCCS) strategies (measured by the researcher-developed observation tool; Babinski et al., 2018). Students were assessed twice using the Woodcock Muñoz Language Survey- Revised Normative Update (WMLS-R; Babinski et al., 2018). The results showed that those students who were in intervention classrooms made significantly greater growth on two of the seven subtests (Babinski et al., 2018). Also, Babinski et al. found positive effects on story recall (Hedge's *g*= 0.29) and verbal analogies (Hedge's *g*=0.23). Since the observation data showed that the overall quality of instruction was similar in both sets of classrooms, the main difference between classrooms was the professional development received by the intervention teachers (Babinski et al., 2018).

Andersson and Palm's (2017) study showed that teachers who participated in a professional development program on formative assessment implemented instructional practices that had a positive effect on their students' mathematics achievement. The students who were in the randomly-assigned intervention classrooms significantly outperformed thos e students in control classrooms (Andersson & Palm, 2017). Andersson and Palm noted that these teachers were provided with time and expert support in implementing these instructional practices.

However, Garet et al. (2016) found that although mathematics professional development increased teachers' content knowledge and improved the use of instructional practices, there was not a significant effect on student achievement. This study included fourth grade teachers from 94 schools that were randomly assigned to either the intervention or control group (Garet et al., 2016). Teacher knowledge was assessed before the professional development, after one part of the professional development, and after the entire professional development was completed (Garet et al., 2016). Garet et al. found that teachers who participated in the professional development scored on average 7 points higher in the fall and 6 points higher in the spring than teachers in the control group. Teachers' instructional practices were assessed using the Mathematical Quality of Instruction (MQI) rubric by reviewing three video-recorded lessons in the fall and spring (Garet et al., 2016). Garet et al. found that the average teacher in the intervention group demonstrated *Richness of Mathematics*, one dimension measured by the MQI, at a middle or high level during 63% of their lesson in comparison to the 46% demonstrated by the average teacher in the control group. *Student*

Participation in Mathematics and *Errors and Imprecision* were two other dimensions measured by the MQI for this study (Garet et al., 2016). Garet et al. found that although these dimensions did follow the expected trend, the results were not statistically significant. Garet et al. pointed out that it appeared that teachers' content knowledge and instructional practices were not largely correlated to student math achievement according to the measurements used in this study. Another possibility is that despite the change in teacher knowledge and instructional practices, there was not a significant change in student participation therefore this could be limiting the effect on student achievement. More research is needed to clarify these results and explore the effect that professional development, teachers' knowledge, and instructional practices have on student mathematics achievement.

For the current study, the local problem demonstrated a need to improve teachers' use of effective instructional practices to meet the needs of EL students in mathematics. The results showed that teachers were implementing various instructional practices related to building background, interactions, and application for EL students in mathematics, but participants had encountered some related challenges that may have led to some of the inconsistencies in the instructional practices used. The participating teachers felt that professional development on how to meet the needs of EL students in mathematics is needed. In order to address these findings, this professional development training was developed. A review of the current research related to the effect that professional development has on teachers and students is relevant because this is directly related to the goal of this project. The goals of this project are to prepare mathematics teachers with the knowledge, skills, and resources to provide effective instruction for EL students, with the overarching goal of improving the educational experience and achievement of EL students in mathematics. These goals are closely aligned with the results of the current study. This review of the current literature showed that professional development can have a significant influence on teacher practice, content knowledge, and self-efficacy. However, more research is needed to have a clear understanding of the effect that professional development has on student achievement.

Professional Development Design and Content

Current literature demonstrated some key elements to consider when designing effective professional development for teachers. Effective professional development should be ongoing (Babinski et al., 2018; Desimone & Pak, 2017; Hadjioannou et al., 2016; Johnson & Wells, 2017), supported by experts and peers (Andersson & Palm, 2017; Babinski et al., 2018; Choi & Morrison, 2014; Hadjioannou et al., 2016; Johnson & Wells, 2017; Szpara, 2017), collaborative (Babinki et al, 2018; Fahmi Dajani & Mohammed, 2014; Hadjioannou et al, 2016; Heineke et al., 2018) and driven by data (Babinski et al., 2018; Desimone & Pak, 2017; Heineke et al., 2018; Johnson & Wells, 2017). The design and content covered in this professional development training are interconnected and both were intentionally developed to address the findings from the current study. The content of this professional development will support teachers in developing, collecting, and analyzing various forms of assessment (Curry, Mwavita, Holter, & Harris, 2016; Hiatt & Fairbairn, 2018; Kim, Erekson, Bunten, & Hinchey, 2014; Randel, Apthorp, Beesley, Clark, & Wang, 2016; Polly et al., 2018) to guide the ongoing instruction of EL students; provide information to help teachers understand the process of language acquisition (Hansen-Thomas & Richins, 2015; Hiatt & Fairbairn, 2018; Shea, Sandholtz, & Shanahan, 2018) and how this relates to mathematics instruction; establish an ongoing collaborative support system for teachers to discuss and reflect on the use of these skills in their current teaching contexts (Curry et al., 2016; Ransom & Esmail, 2016); and provide a platform for teachers to find and share resources for EL students in mathematics.

The inter-related nature of the design and content of the professional development is highlighted by Figure 1. The purpose of this figure is to demonstrate how the design of the professional development program is supported by the content which will be presented to teachers.

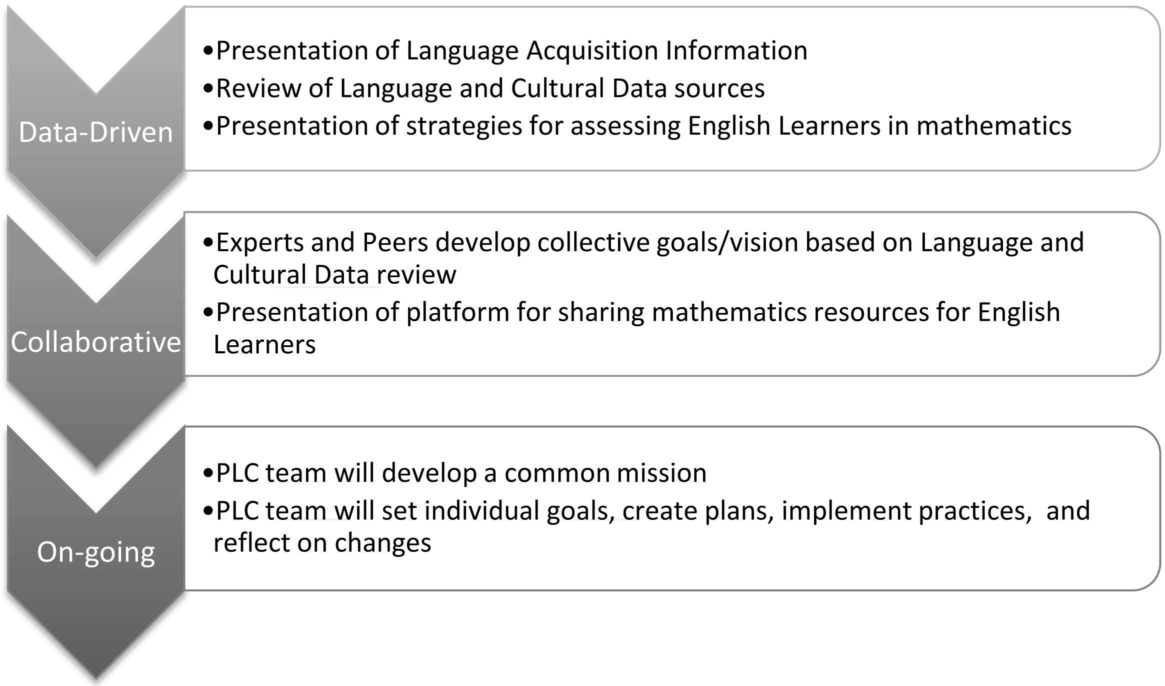

Figure 1. Components of PD design and content to be presented.

Ongoing. Johnson and Wells (2017) pointed out that one-day workshops are not an effective means of providing professional development for teachers. To effectively gain the knowledge and skills provided through professional development, teachers need time and frequent opportunities to practice and apply these new ideas in their classroom (Andersson & Palm, 2017; Desimone & Pak, 2017; Szpara, 2017). In a study examining the influence of professional development on the language and literacy learning for ELs, teachers reported the importance of the ongoing professional development they received (Babinski et al., 2018). Hadjioannou et al. (2016) recommended that professional development should be ongoing over the span of multiple years in order to help teachers maintain the changes to their instruction. The professional development program designed for this study will be planned to take place over the course of a school year. At that time, it will be evaluated for effectiveness. Due to the nature and design of this professional development program, this type of professional development can be continued over multiple years if the district decides to continue its implementation.

Along with the need for professional development to take place over time, teachers also need ongoing support throughout the process. Szpara (2017) emphasized that teachers need time and support to successfully incorporate language instruction into other content areas. Choi and Morrison (2014) used a multilayered approach to supporting teachers through professional development in order to foster a change in instructional practices. Support can be provided by instructional coaches (Babinski et al., 2018) experts (Andersson & Palm, 2017), or peers (Hadjioannou et al., 2016). These supporting individuals can provide feedback to teachers as they try implementing new skills. It is most helpful when feedback is specific and supported by data such as observations or student work (Desimone & Pak, 2017). This design of ongoing supported professional development allows teachers the opportunity to learn, experiment, and reflect on new skills (Babinski et al., 2018; Heineke et al., 2018; Johnson & Wells, 2017).

Data-Driven. Heineke et al. (2018) emphasized the need to consider the unique qualities of schools, teachers, and students when developing professional development. In order to make professional development opportunities most effective, they must be driven by data analysis. Heineke et al. emphasized that by having teachers analyze data such as language surveys, language proficiency scores, standardized test scores and other sources related to literacy levels, languages, countries of origin, and cultural background they begin to see the “heterogeneity within the homogenizing label of EL” (p.38) This will allow teachers to begin to understand the diverse nature of the strengths and struggles that their EL students are coming to class with. Along with this, Hiatt and Fairbairn (2018) recommended that teachers receive training on how to interpret state language proficiency data which will enable teachers to build a better understanding of language acquisition. This is important because teachers need to be able to gauge whether EL students have the language knowledge and skills to understand a mathematics lesson (Hiatt & Fairbairn, 2018). Shea et al. (2018) emphasize that content teachers, such as mathematics teachers, have the opportunity to provide an organic context in which students can discuss content while building language skills simultaneously. Unfortunately, Shea et al. added that most professional development programs fall short in preparing teachers to incorporate strategies for language development. Therefore, professional development which helps teachers learn how to integrate language and content learning is imperative to improving content-area literacy and academic vocabulary (Shea et al., 2018).

Since the enactment of the No Child Left Behind (NCLB) Act of 2001, there has been a nationwide push for teachers to use data to drive instruction (Curry et al., 2016). However, in order for teachers to effectively utilize data to drive instruction, they must be given the opportunity to learn and develop these skills (Curry et al., 2016). Additionally, teachers must be supported by the school district in this endeavor by being provided with time to review and discuss data with colleagues (Curry et al., 2016). Kim et al. (2014)

emphasized the need to improve teachers' knowledge of how to effectively assess EL students in order to meet the demands of the Common Core standards. Hiatt and Fairbairn (2018) added that teachers need professional development on effective assessments for EL students as well as effective accommodations. Teachers are expected to utilize formative and summative assessments (Randel et al., 2016). Therefore, it is important that practical testing materials, both formative and summative, for ELs be shared through professional development as well as how to adapt other materials to make them appropriate for different levels of language acquisition (Kim et al., 2014). According to Orosco (2014), there is a need for mathematics assessments which consider the value in student and teacher interactions in the classroom. Teachers in a study conducted by Fahmi and Dajani (2014) emphasized the need for training on how to make students' learning more visible.

One way that teachers can obtain ongoing assessment data about their students is through the use of formative assessment. Curry et al. (2016) conducted a study exploring a teacher-centered professional development approach to formative assessment within one school district. Curry et al. highlighted that by using a teacher-centered approach, the professional development opportunity allows teachers to build the capacity to create and use formative data to effectively inform instructional decisions. Polly et al. (2018) found that the higher the frequency of formative assessments used by teachers, the higher students performed. This is likely due to the fact that continuous use of formative assessments provide teachers with multiple snapshots of students' understanding and skills which more effectively guides instruction (Curry et al., 2016; Polly et al., 2018).

Polly et al. did caution teachers that taking this finding to the extreme and overusing formative assessment may have detrimental effects. A study conducted by Andersson and Palm (2017) showed students whose teacher participated in a professional development about integrating multiple modes of formative assessment significantly outperformed those students in the control group. Through the professional development, the teachers improved their practices related to using multiple formative assessments, clarifying learning goals, adapting instruction and providing feedback based on student data (Andersson & Palm, 2017). However, Randel et al. (2016) found that although the professional development program increased teacher knowledge of classroom assessments, student performance was not significantly affected. Randel et al. pointed out that this may have been due to limited levels of fidelity and noted that the professional development program therefore was not feasible for teachers to implement.

It is important for teachers to have a non-threatening environment to review and discuss data in order to improve their instructional practices (Curry et al., 2016). It is through collaboration with instructional coaches and peers that teachers can develop their skills for generating and using data to drive instruction (Curry et al., 2016). This collaborative component will be discussed in the following subsection.

Collaborative and Supported by Experts and Peers. Ongoing collaboration is essential to creating an environment of shared responsibility for the learning of ELs ((Hadjioannou et al., 2016; Heineke et al., 2018). Through collaboration with instructional coaches and peers, teachers will be supported in developing new practices and skills (Babinski et al., 2018; Johnson & Wells, 2017). Additionally, through ongoing collaboration, teachers will be able to use continual goal setting for their instructional practices and with students (Curry et al., 2016).

The responsibility of providing effective instruction for EL students should be shared by all educators (Heineke et al., 2018). Mainstream classroom teachers cannot be expected to support the learning of EL students on their own, collaboration with other educators, such as ESL teachers, is needed (Hadjioannou et al., 2016). Therefore, when school-based professional development is provided, it should include the majority of the teachers in the building (Shea et al., 2018). Heineke et al. (2018) emphasized the point that all in order to build common practices, all educators should be involved in professional development programs. Heineke et al. added “any school reform effort related to ELs cannot be approached as an add-on initiative for select classrooms, but rather as an all-encompassing commitment from the entire school community” (p. 37). The professional development program designed for this study will include mathematics teachers, instructional coaches, English as a Second Language (ESL) teachers, and building administrators.

Along with this, it is important to ensure the information presented during professional development is practical and applicable. Kim et al. (2014) emphasized the need for professional development to be practical and applicable to individual teaching contexts, in order to effectively engage teachers in the learning experience. Kim et al.

added that this can be done by providing opportunities for teachers to individually or collaboratively set goals and make plans to achieve the goals.

Collaborating with peers is a powerful learning tool for teachers to set goals, discuss, and reflect on practices and experiences (Curry et al., 2016; Fahmi Dajani & Mohammed, 2014). Curry et al. (2016) highlighted that collaborative goal setting benefits teachers in several ways. The authors continued to share that collaborative goal setting helps teachers work to improve their own practices by using formative assessments. Curry et al. noted that teachers can actively involve students and parents in the goal setting process by using a common language. Parents become more actively involved in helping their students meet their academic goals when this information is shared with them (Curry et al., 2016).

Bohon, McKelvey, Rhodes, and Robnolt (2017) recommended that professional development opportunities include a significant amount of time for teachers to reflect on their teaching. Despite its importance to teacher learning, Bohon et al. shared that reflection opportunities often get cut out of professional development due to time constraints. Professional learning communities is one way to incorporate collaboration in professional development consistently over time. Fahmi Dajani and Mohammed (2014) described learning communities as a place where teachers can discuss and reflect on the new skills they have tried, without fear of judgement. Fahmi Dajani and Mohammed continued to note that it is important for teachers to feel that they are part of a trusting and respectful environment in order to take risks that may help their students learn. Also, Fahmi Dajani and Mohammed added that it is important for teachers to feel comfortable sharing and providing constructive feedback to colleagues. Through collaborative opportunities, school-wide professional development has the potential to increase teacher knowledge, improve instructional practices, and provide ongoing support for teachers (Shea et al., 2018).

Experiential Learning Theory and Professional Learning Communities

This professional development plan has been developed in alignment with the literature discussed above and the results of the study. This professional development training will be based on Kolb's Experiential Learning Theory and also guided by the foundational ideas of Dewey. Professional Learning Communities (PLCs) will be utilized as a means of providing ongoing collaborative learning opportunities and reflection among teachers.

David Kolb developed the Experiential Learning Theory, however foundationally this theory was derived from Dewey's philosophy of experience (Roberts, 2003). Dewey's philosophy stated that students learn knowledge through experiences and all human experiences are socially based (Roberts, 2003). Dewey (1938) pointed out the importance of the "organic connection between education and personal experience" (p. 25). Under Dewey's philosophy, teachers are responsible for knowledge of the content and of the students' needs (Roberts, 2003). This is necessary so that teachers can provide opportunities for learning experiences which will be most beneficial to the students (Roberts, 2003). Dewey (1938) emphasized the importance of the quality of learning experiences. Traditionally education involved older individuals passing on information to the next generation (Dewey, 1938). Dewey's philosophy went beyond this to say that simply gaining knowledge does not mean that students are able to apply this knowledge in new contexts (Roberts, 2003). Therefore, it is important for experiences to be based in real-life situations so that students' learning can be applied to real world contexts (Roberts, 2003).

Kolb drew foundational ideas from Dewey's philosophy of experience to develop Experiential Learning Theory (Bohon, McKelvey, Rhodes, & Robnolt, 2017; Roberts, 2003). Experiential Learning Theory is based on six basic principles: Learning is a process which takes place through experience; learning is enhanced when a person's beliefs and ideas are integrated; learning involves an ongoing cycle of internal conflict resolution; learning is a dynamic process in which a learner adapts to their environment based on their thoughts, perceptions, feelings, and behaviors; learning produces new knowledge (Kolb, 1984). Kolb (1981) also developed a learning cycle based on his theory. The four stages of this learning cycle include concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb, 1981). Following these stages, a learner participates in an experience, spends time reflecting on this experience, devises theories or ideas about the experience, and then applies these ideas into an action (Bohon et al., 2017).

Bohon, McKelvey, Rhodes, and Robnolt (2017) evaluated the alignment between a professional development for teachers of EL students and Experiential Learning

Theory. Bohon et al. found that the teacher engaged in concrete experiences both through a simulation activity and teacher demonstrations. After both of these experiences, teachers were given an opportunity to reflect on their learning as well as their own teaching practices (Bohon, McKelvey, Rhodes, & Robnolt, 2017). After reflecting on their learning experience, teachers found ways to apply their ideas to their teaching practices (Bohon et al., 2017). Active experimentation took place as teachers began adapting their teaching practices based on their new learning (Bohon et al., 2017). The professional development training developed for the current study will take on a similar format drawing from the Experiential Learning Theory.

Drawing from Experiential Learning Theory and the foundational ideas of learning through socially-based authentic experiences from Dewey (Roberts, 2003), this professional development plan will be collaborative in nature and follow the four stage Experiential Learning Cycle (Kolb, 1981). Additionally, data will be used to drive the specific directions of the learning experience for the teachers. Teachers will likely have different learning experiences through this professional development, as the goal is to provide information and learning opportunities that are most relevant to the needs of each school of teachers.

The district of study is already utilizing Professional Learning Communities (PLCs), a method of collaborative practice-based learning, as a means of providing ongoing professional learning opportunities and support to teachers. Therefore, this professional development program will begin with three days of initial training to provide information about language acquisition, a review of language and cultural data, resources and strategies to assess ELs, and share the process of collaborative inquiry. Teachers will then be able to take the information and skills learned in these initial training sessions and use this to support their ongoing learning cycle through PLCs at their school.

Collaboration can be defined as “active engagement and interaction among group members to achieve a common goal (Nokes-Malach, Richey, & Gadgil, 2015, p. 646). PLCs are a method of professional collaboration which has been used across the country (Spencer, 2016). Owen (2015) noted that PLCs are an effective means of professional development to improve student learning. Although there are many variations in how PLCs are implemented (Spencer, 2016), the research identifies characteristics of effective PLC structures. First, it is essential that the individuals participating in the PLC share a common vision and mission for the group (Adams & Vescio, 2015; Owen, 2015). In the case of this professional development program, the overarching vision for the PLCs will be related to meeting the needs of EL students in mathematics. However, it is important that the PLC groups have the opportunity to develop the specific language of their vision and more specifically the mission of their group.

Spencer (2016) emphasized the need for PLCs to be focused on instructional practice. Adding to this, Spencer encouraged administrators to participate in PLCs in a collaborative capacity, rather than supervisory. However, Spencer made clear that teachers must have control over the focus and activities of the PLC. If the focus of the PLC must be aligned to a district-level goal or initiative, then teachers must have the control to decide the focus within the larger goal (Spencer, 2016). The development of the vision and mission can set the stage for this process.

Another component to consider is the differences in knowledge, experiences, and needs of the individuals participating in the PLC. Adams and Vescio (2015) emphasized:

> Just as educators differentiate learning for diverse students in their classrooms, they must also remember that professional learning communities consist of individuals who need different things in order to learn and who may be at drastically different places in their careers or their teaching capabilities (p. 26).

Along with this is the need for teachers to feel comfortable sharing their thoughts, experiences, practices, and student data in a non-threatening environment (Adams & Vescio, 2015; Curry et al., 2016). Additionally, the content shared in the PLC must be focused both on the needs of the collective group and the individuals (Adams & Vescio, 2015). For example, even when one teacher is sharing their instructional practices or student work, the other teachers should be reflecting on how this connects to their students and their particular teaching situation (Adams & Vescio, 2015).

Owens (2015) found that teachers felt that collaborative reviewing students' assessments were a vital part of their PLC experience. This process provided teachers with an opportunity develop rubrics, select criteria, and identify different levels of quality within student work through professional dialogue (Owen, 2015). Spencer (2016) added that reviewing student work and specifically focusing on strategies for ongoing instruction and assessment is essential.

Search Terms

The review of literature is centered on the need for professional development related to meeting the needs of EL students in mathematics, effective assessment strategies for EL students in mathematics, teacher and student outcomes of professional development, and the design and content of effective professional development. There is a limited amount of current research on the effects of professional development on instructional practices and student outcomes for EL students (Tong et al., 2017). In order to reach saturation for the literature review, the search was broadened to include professional development and instructional practices for other groups of students and content areas. Relevant research was found by searching peer-reviewed journals from the Walden University Library.

The following databases were utilized: Education Source, ERIC, Academic Search Complete, SAGE Journals, and Teacher Reference Center. Search terms used included the following: *professional development, professional development for teachers of English Learner, professional development for mathematics teachers of English Learners, professional development for mathematics teachers, effective professional development, teacher outcomes of professional development, student outcomes of professional development, professional development collaboration, language acquisition, language acquisition professional development, data-driven professional development, professional development on assessments for English Learners, professional development on assessment strategies, effective assessments for English Learners, professional development theories, collaborative learning theory, practice-based professional* *learning, experiential learning theory, and professional learning communities.* Searches were also conducted using synonyms such as English Language Learners or ELLs for English Learners. Additionally, I reviewed the list of sources for each journal article for relevant peer-reviewed journal articles.

Summary

A collective review of the current research from multiple content areas shows that professional development that is ongoing, data-driven, and collaborative, can be effective in improving teacher knowledge, practice, and self-efficacy. To meet the recommendations of the literature, this professional development plan was designed based on the Collaborative Learning Theory, specifically through Professional Learning Communities. This professional development program will address the issues identified in the results of the current study related to the knowledge and skills to utilize multiple forms of language and cultural data to understand the language needs of students; providing resources and skills for assessing the mathematics knowledge of EL students primarily through formative assessments; knowledge and skills related to collaborative goal setting for teachers and students; and a platform for teachers to share instructional resources for EL students in mathematics. Through the dissemination of this knowledge, skills, and resources, teachers will be more prepared to provide effective instruction for ELs in mathematics, thus encouraging positive social change related to the educational experiences of these students.

Project Description

This professional development training, Supporting ELs in Mathematics, was designed to address the gaps in practice and teacher challenges related to providing effective mathematics instruction for EL students identified in the current study. This training will be conducted as three initial full-day trainings followed by ongoing professional learning opportunities through Professional Learning Communities (PLCs). The district is already implementing PLC meetings twice a week throughout the school year. Therefore, the three initial days of training are designed to provide teachers with the knowledge and skills to carry out the collaborative inquiry process and continued professional learning through PLCs throughout the school year. The potential barriers, possible solutions, and proposed timeline will be discussed in the following sections.

Needed Resources

Several resources are needed in order to successfully implement this professional development training. First, time to conduct the training is most important. The initial part of this professional development will take place over the course of three full days. These three full-day trainings will take place in one of the elementary schools of the Keystone School District. This professional development is designed to prepare teachers with the knowledge and skills to continue the collaborative inquiry process throughout the school year during Professional Learning Community (PLC) meetings. The district is already implementing PLCs twice a week, therefore teachers will just need permission to spend their PLC time on collaborative inquiry.

A facilitator to conduct the training is needed. The researcher for this study works in the Keystone School District and would be available to conduct the training with permission from the administration. However, another person could follow the plans for the training and conduct the sessions if necessary.

A few materials and equipment are needed for this training including a computer with a projector, internet access, Power Point, tables and chairs, computer access for teachers, evaluation forms, and copies of student data. The facilitator will need access to a computer which can be projected for teachers to see during the training. Teachers will also need access to computers. These computers will need to have Power Point and internet access. Teachers will be working collaboratively throughout the training, therefore tables and chairs which support type of interaction would be beneficial. Evaluation forms (see Appendix A) will need to be printed and copied for teachers to complete at the end of each session. Also, the final evaluation form will need to be copied and distributed at the end of the school year. For the three days of training, teachers will need copies of the data from home language surveys, family interviews, and WIDA scores for the EL students at each school. Teachers will be asked to bring copies of the PSSA and MAP data for their students.

Existing Support

The K-12 mathematics supervisor and the English as a Second Language (ESL) head teacher for the Keystone School District are supportive of this research study and implementation of this project. Additionally, the participating teachers in the study emphasized a need for professional development on how to meet the needs of ELs in mathematics. Therefore, there is existing support from some of the teachers in the district.

Potential Barriers and Possible Solutions

The most significant potential barrier that will likely impact the implementation of this project is time. The Keystone School District does not have many opportunities for professional development for teachers. There are a few possible solutions to this problem. For the upcoming school year there are three in-service days planned for the beginning of the school year. One possible solution to the time issue is to allow elementary mathematics teachers to attend this training for those three days. Another possibility is to provide substitutes for mathematics teachers during the school year so that they could attend this training. Another option is to offer this training over the summer and have teachers carry out collaborative inquiry during their PLCs the following school year.

Proposal for Implementation and Timeline

This professional development training was designed with the goal of preparing teachers with the knowledge, skills, and resources needed to support the learning of ELs in mathematics. This professional development begins with three full days of training which cover the following learning outcomes:

- Engage teachers in a data dive to get to know the language, cultural, and academic characteristics of their EL students.
- Provide teachers with an overview of language acquisition and resources to help teachers support the learning of EL students in mathematics.

- Provide teachers with instructional strategies to support EL students during mathematics discussions and collaborative activities.
- Engage teachers in creating and modifying lessons, activities, and assessments to meet the varying language needs of EL students.
- Assist teachers in creating student profiles to help guide the differentiated instruction of their EL students.
- Provide strategies to help teachers create modify mathematics assessments to meet the varying language needs of EL students.
- Outline the process of collaborative inquiry and provide time for PLC groups to engage in foundational steps of the process to be continued throughout the school year.
- Provide mathematics assessments to help teachers identify EL students' mathematics skills and needs.
- Establish a platform for sharing instructional resources to support EL students in math.

This project includes a detailed plan for each day of training and the activities which will cover these learning outcomes (see Appendix A). Ideally, these three days of training would be spread out over the course of several weeks. However, the limited time available for professional development in the Keystone School District will likely require these days to be consecutive at the beginning of the school year. After teachers participate in the initial three days of training, they will be prepared to continue professional development through the collaborative inquiry process during Professional

Learning Communities (PLCs). PLCs are already implemented across the district and teachers meet with their PLC group twice a week. The design and timeline for this professional development allow the teachers to focus on extending their knowledge and skills in the specific areas of math instruction and support for ELs which is more relevant to their teaching situation.

Roles and Responsibilities

In order for this professional development training to be implemented, the Director of Curriculum, K-12 mathematics supervisor, and English as a Second Language (ESL) head teacher must approve for the training to take place. After approval, a location and date will be selected and registration will be made available to teachers.

The role of the facilitator is to adequately prepare and follow the planned professional development (see Appendix A). The facilitator needs to be familiar with the Power Point presentations (see Appendix A) so that the information can be presented accurately. Also, the facilitator needs to be knowledgeable of all of the content covered in this training as teachers are likely to have questions that are not necessarily covered in the Power Points or notes. Another role of the facilitator is to model professionalism and create an environment where teachers are comfortable analyzing data and reflecting on their teaching practices as a group.

The role of the elementary mathematics teachers will be to attend all three days of training and actively engage in the collaborative learning and reflective activities. Teachers will also be asked to fill out an evaluation form at the end of each session and at the end of the school year. The expectation and hope is that teachers will provide honest feedback during their evaluations that can be used to improve the professional development for the future. Teachers will be encouraged to continue the collaborative inquiry process during their PLC meetings throughout the school year.

Project Evaluation Plan

Evaluating the effectiveness of a program is essential to successful implementation. For this professional development project, formative and summative evaluations (see Appendix A) will be used. These evaluations will allow teachers the opportunity to provide feedback on the clarity, relevance, and application of the content presented. Teachers will also be asked to discuss any barriers they encountered related to applying their learning in the classroom as well as any recommendations for future trainings. The information gathered through the formative and summative evaluations will be used to modify the content and resources for future professional development trainings.

The formative evaluation (see Appendix A) will be given to teachers at the end of each of the three days of training. The purpose of the formative evaluation is to assess the clarity of the learning outcomes and content, relevance of the resources and information presented, teachers' overall satisfaction with the session, how the teachers plans to apply what they have learned, and recommendations for future trainings. This information will be used to refine the content, presentation, and resources during the implementation phase of this professional development project. The summative evaluation (see Appendix A) will be given to teachers at the end of the school year during their final Professional Learning Community (PLC) meeting. The purpose of the summative evaluation is to determine the overall impact of the professional development training and the collaborative inquiry process. Teachers will be asked to provide feedback related to how they have applied the knowledge, skills, and resources they gained through the professional development to their classroom. The feedback gathered through the summative evaluation will be used to modify the professional development for future implementations.

The key stakeholders for this project evaluation will be the facilitator, teachers, and possibly some administrators. The facilitator will be the person who gives the evaluation form to the teachers and collects them at the end of the session. The facilitator will also be responsible for sending the summative evaluations to teachers at the end of the school year and collecting all of the feedback. Teachers will be encouraged to complete each of the formative evaluations and the summative evaluation by providing feedback. District administrators may be involved in the review of the data collected through the evaluations and this information will help to guide future decisions related to supporting teachers of EL students.

Project Implications

The purpose of this professional development project was to provide teachers of the Keystone School District with the knowledge, skills, and resources needed to support the learning of ELs in mathematics. This project was designed to address the challenges and gaps in practice identified in the results of the current study. The participating teachers emphasized the need for an effective assessment to identify the academic strengths and needs of EL students in mathematics. Teachers also reported needing instructional resources and support for meeting the diverse learning needs of EL students in mathematics. Classroom observations showed that the participants were consistently providing opportunities for students to engage in mathematics discussions, however the teachers were not implementing any supports or accountability measures to ensure that EL students were actively engaging in these interactions. This three-day professional development training will address these issues as well as prepare teachers to continue their professional learning through the process of collaborative inquiry throughout the school year.

This project will foster positive social change for the teachers who engage in this training, their current, and future EL students. Local data demonstrated an achievement gap between EL students and their native English speaking peers in mathematics. In addition to this, the participating teachers voiced concerns for needing guidance, support, and resources to work towards meeting the needs of EL students in mathematics. This project will provide teachers with knowledge, skills, and resources to meet the diverse needs of language learners. Teachers will benefit from having knowledge of effective instructional practices and assessment strategies for EL students in mathematics as well as a platform for sharing resources. EL students across the district will benefit from having teachers who are more equipped to meet their language and academic needs in mathematics.

Importance of Project to Local Stakeholders

This project has the potential to positively impact local stakeholders including the teachers and EL students of the Keystone School District. This project was designed to address the challenges reported by teachers and the gaps in practice identified by the results of the current study. This professional development project was intended to improve local teachers' knowledge and skills in supporting EL students in mathematics and provide teachers with additional resources. Therefore, implementation of this project is important because local teachers and students will likely benefit from the knowledge, skills, and resources shared.

Importance of Project in Larger Context

Although this project was designed to address the local issues of the Keystone School District, this professional development training will be available for other school districts to utilize. The information, skills, and resources shared through this project (see Appendix A) could benefit any mathematics teachers who work with EL students. Extending this even further, all of the knowledge and skills presented could also apply to other content areas. Reviewing language and cultural data as well as learning about language acquisition are beneficial experiences to teachers of all curricular areas. The instructional strategies can easily be modified to work for other content areas. Although the mathematics assessments will not be helpful in other areas, the discussion of effective assessment strategies can certainly benefit teachers from all content areas. Lastly, the process of collaborative inquiry is not specific to mathematics and can benefit teachers of all curricular areas. Therefore, this project may foster positive social change far beyond the district of study by reaching teachers and students of other content areas and other school districts.

Section 4: Reflections and Conclusions

My purpose in this project was to provide teachers of the Keystone School District with the knowledge, skills, and resources needed to support the learning of ELs in mathematics. The specific topics and activities covered in this professional development training were developed to address the issues identified in the results of the current study as well as satisfy recommendations of current research on effective professional development. In the following sections, I will outline the strengths and limitations of this project. I will discuss scholarship, project development, leadership, and change. I will conclude with implications for future research.

Project Strengths and Limitations

Strengths

One strength of this project is that I developed it based on the results of the current study. The results of the current study showed that teachers needed an effective way to assess the mathematics knowledge of EL students to provide them with appropriate instruction. The results also showed that teachers believed that they needed support, including professional development, and resources for meeting the diverse learning needs of EL students. Finally, classroom observations showed that although teachers were consistently providing opportunities for student interactions, there were no supports or accountability measures in place to ensure that EL students were actively participating in these discussion. This project covers instructional strategies to support EL students during interaction and assessment strategies. In addition, teachers will receive a

K-2 and a 3-5 mathematics assessment that can be used to identify the academic strengths and needs of EL students, specifically those with limited English.

Another strength of this project is that the content and design are also aligned with the recommendations of the literature. A review of the current literature showed a need for professional development focused on providing effective instruction to EL students by implementing best practices (Babinski et al., 2018; Cavazos et al., 2018). The literature also suggests that effective professional development often shares several key features such as it is ongoing (Babinski et al., 2018; Desimone & Pak, 2017; Hadjioannou et al., 2016; Johnson & Wells, 2017), supported by experts and peers (Andersson & Palm, 2017; Babinski et al., 2018; Choi & Morrison, 2014; Hadjioannou et al., 2016; Johnson & Wells, 2017; Szpara, 2017), collaborative (Babinki et al, 2018; Fahmi Dajani & Mohammed, 2014; Hadjioannou et al, 2016; Heineke et al., 2018) and driven by data (Babinski et al., 2018; Desimone & Pak, 2017; Heineke et al., 2018; Johnson & Wells, 2017). This project begins with 3 days of initial training which will be followed by ongoing collaborative inquiry during the district's previously initiated Professional Learning Community (PLC) meetings twice a week. During the initial trainings and throughout the collaborative inquiry process, teachers will engage in collaborative discussions and reflections with their peers, Math Coaches, and ESL teachers. PLC teams will work together to support each other's needs throughout the collaborative inquiry process. Finally, teachers will engage in a data dive of language, cultural, and academic data of their students. This data will be used to create student profiles which will guide teachers in differentiating their instruction according to the specific needs of each learner. Ongoing data analysis will also take place during the collaborative inquiry process.

Limitations

The limited amount of time allotted for teachers to engage in professional development within the Keystone School District adds to the limitations of this project. First, in the upcoming school year, there are three in-service days scheduled for teachers before students begin classes. In order for teachers to be able to engage in this professional development project, they would need to spend all three of these days doing the initial training. This would limit teachers' ability to engage in other activities and meetings that are essential at the beginning of the school year.

Another limitation is the lack of follow up sessions. Although this project allows for teachers to continue their professional learning through the collaborative inquiry process during PLC meetings, there are no follow up sessions in which the entire group will meet after the initial three days of training. According to the literature, effective professional development should be ongoing (Babinski et al., 2018; Desimone & Pak, 2017; Hadjioannou et al., 2016; Johnson & Wells, 2017). Teachers will have the opportunity to continue the collaborative inquiry process with their PLC team, however they will not have the benefits of engaging in whole group reflections and follow up activities. This could limit some teachers' ability to fully process their learning.

Recommendations for Alternative Approaches

For teachers to participate in this 3-day training at the beginning of the school year, they would have to miss out on any other beginning of the year meetings or activities. This may be a problem for some teachers. To avoid this, there are some alternative approaches to implementing this professional development. First, teachers could spend 2 of their beginning of the year in-service days participating in this training while using the third day to attend other important meetings. The district could then provide substitutes for teachers to attend the third day of training at a later date. Another alternative approach would be to divide the sessions into shorter segments and deliver the training during PLC meetings throughout the school year. A third alternative would be to offer these professional development sessions during the summer.

Scholarship, Project Development and Evaluation, and Leadership and Change

Scholarship

Prior to starting this doctoral journey, I would have described a scholar as someone who has completed multiple levels of schooling, is an expert in their field, and is an active life-long learner. Scholarship would be attributes that one would need to be a successful scholar such as being intrinsically motivated, inquisitive, passionate, and reflective. This journey has taught me a lot about scholarship and what it means to truly be a scholar. Although I still think that a scholar would need to have all of those attributes, I now know that being a scholar also requires a significant amount of tenacity. Now, when I think of a scholar I think of someone who has struggled. I think of someone who has received critical feedback time and time again but found a way to persevere to meet the expectations that were set for them. Scholarship is not about earning a title, it is about the struggle and how it shapes you as a person.

Of course I have learned a lot about the research process and effective instructional practices for ELs in mathematics. However, my learning extends well beyond my research topic. This doctoral journey has taught me a lot about myself as a student. I learned how to struggle with content I did not understand. I learned how to persevere and problem solve and eventually I learned how to ask for help. As a teacher, I always encourage my students to ask for help when they do not understand. As a student, I struggled to do this even though it seems like such a basic task. I learned how to respectfully advocate for myself. I believe my biggest take away from this journey is not the knowledge about the research process or my topic, rather it is the attributes that I have developed along the way.

Project Development and Evaluation

When I began working on this project study I really wanted to choose something that was relevant and practical. One of the university's requirements for a doctoral project study are create positive social change. In my opinion, I cannot imagine engaging in this research process for any reason other than to help create positive social change. So, I decided to explore the instructional practices teachers were using for ELs in mathematics for two reasons. First, my experience as a mathematics teacher in the district and my interactions with other teachers and administrators made this seem like a glaring problem. Second, I work with some amazing EL students and I believe they deserve the very best educational experience. My hope was to improve this issue both for teachers and EL students through my research and project development.

After reviewing the results of my study, I found that designing a professional development training would be the most appropriate project for addressing the teacher reported challenges and gaps in practice. Through my interactions with the participants in the study, I could see that teachers were feeling exasperated and overwhelmed. A few teachers teared up during their interviews while talking about struggling to meet their EL students' needs in mathematics. I knew that I needed to design a practical and relevant professional development training that provided teachers with the knowledge, skills, and resources they needed as well as time to implement and reflect on their practices.

Designing the professional development project was my favorite part of this doctoral project study. I felt like this piece is where I could really create that positive social change by supporting teachers who were striving to support their EL students. I am excited at the opportunity to share my professional development training with my district in the upcoming school year. The evaluation component of this project is essential to ensuring that teachers are receiving the knowledge, skills, and resources needed to support their El students in mathematics. I will use the formative and summative evaluations to determine what went well and what needs to be changed to improve the professional development training for the future.

Leadership and Change

Completing this project study has not only taught me a lot about conducting research and meeting the needs of EL students in mathematics, but I believe I am also prepared to be a teacher leader in my district. As I mentioned previously, I chose to explore the instructional practices being implemented for EL students in mathematics because of my experiences in the district. My main goal in selecting this was to create positive social change by bringing this issue into focus for the district.

I believe that school leaders strive to make the learning environment and experience better for teachers, parents, and of course, students. Leaders create positive change by listening and gathering information from their peers, parents, students, and the community. School leaders gather information from multiple resources. Leaders are problem solvers and consider both the big picture and the details of an issue. School leaders collaborate with other stakeholders and make decisions based on what is best for students. School leaders use self-reflection to monitor their own progress and work to improve their abilities as an educator and leader. School leaders model professionalism, perseverance in problem solving, and passion for learning.

Reflection on Importance of the Work

Working on this project study has encouraged me to be a reflective practitioner. Every step of this journey has been a challenge and I have grown as a student, educator, and a person. I have learned how to conduct research and design professional development. By reviewing current scholarly literature, I have learned many new instructional strategies and techniques which will likely benefit my students. Collectively, all of the knowledge and skills I have gained through this work has prepared me to be a school leader.

Having the opportunity to interview and observe teachers in my district was such an incredible experience. I was so grateful that the participants in my study welcomed me into their classrooms and took time to allow me to interview them. I believe I was able to get some truly honest input from them which was crucial to getting a clear understanding of the instructional practices they were implementing and the challenges they were experiencing related to teaching ELs in mathematics. I also think that the participants felt that they were taking part in bringing this local problem into focus and hopefully creating positive social change for our EL students.

When this professional development training is implemented, teachers within the district will be receiving support for a problem that has never been addressed by the district previously. The teacher participants emphasized the need for professional development and it is likely that many other teachers in our district will be excited to have an opportunity to learn how to better support ELs in mathematics. As teachers gain knowledge and skills in this area, their instructional practices are likely to change hopefully improving the learning experience for EL students across the district. Teachers and administrators outside of the Keystone School District will have access to this project study. The professional development training could easily be modified to suit the needs of other districts who are looking to improve their mathematics instruction for EL students. In this way, the work from this project study has the potential to possibly benefit teachers and students across the country.

Implications, Applications, and Directions for Future Research

The participating teachers for this study emphasized the need for professional development on how to provide effective mathematics instruction to EL students, as they had not received any professional development on this before. Guided by the results of the study and a review of the current literature, I developed a professional development project which will provide teachers with the knowledge, skills, and resources to improve their ability to support EL students in mathematics. The number of linguistically diverse students is increasing in the Keystone School District, just as it is across the country. This challenge that teachers are facing related to meeting the needs of EL students in mathematics is only going to increase.

This project study can provide insight to the Keystone School District on the current instructional practices being used to support ELs in mathematics as well as the related challenges teachers are encountering. The results of this study can be used to guide future decisions for the district in relation to the local problem. By contributing to future informed decisions, this project study will be positively impacting the administrators, teachers, and students of the Keystone School District.

The professional development training that was developed for this project study has the potential to improve the knowledge and skills of the elementary mathematics teachers in the Keystone School District. This professional development will also provide teachers with instructional and assessment resources, a platform for sharing resources with other teachers, and an ongoing collaborative inquiry opportunity. All of these components are likely to improve teachers' ability to meet the diverse learning needs of their EL students in the mathematics classroom. As teachers improve their instruction, EL students' learning experiences will also improve. In this way, this project study has the potential to create positive social change for teachers and students on the classroom level. As the number of EL students enrolling in school continues to increase, more research is needed to guide the instructional practices of teachers. A recommendation for future research is to explore the effectiveness of particular instructional practices for EL students in mathematics. Additionally, research is needed to evaluate new technologies designed to support ELs learning mathematics concepts.

Conclusion

The purpose of this doctoral project study was to explore what instructional practices elementary mathematics teachers were using to support EL students. Specifically, I examined instructional practices related to building background, student interactions, and practice/application. I also investigated the challenges teachers were experiencing related to providing effective mathematics instruction for ELs. The results of the study showed that although students were consistently provided with opportunities for discussion, teachers lacked instructional supports and measures of accountability to ensure that EL students were fully engaging in these discussions. Additionally, teachers emphasized a need for an effective way to assess the mathematics knowledge of EL students, particularly those with limited English proficiency. Teachers also reported needing instructional resources and support in the classroom. In light of these results, a professional development project was developed to address the gaps in practice and the challenges reported by teachers.

Through my interactions with the participating teachers and reviewing the data collected, I feel that I truly gained a clear understanding of the level of frustration teachers were experiencing related to this issue. For most of us, teaching is not just a job, it is our purpose and our students are our passion. As educators, it is essential for us to grow and change with our students. The results of this study prompted the development of a professional development training to better prepare teachers to provide effective instruction for EL students in mathematics. It is important for teachers to have access to professional development opportunities which will continue to improve their capacity to meet the needs of EL students in mathematics.

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Appendix A: The Project

Supporting ELs in Mathematics: Professional Development Goals/Objectives

The purpose of this professional development is to provide teachers with the knowledge, skills, and resources needed to support the learning of English Learners in mathematics.

Learning Outcomes:

- Engage teachers in a data dive to get to know the language, cultural, and academic characteristics of their EL students. (Day 1)
- Provide teachers with an overview of language acquisition and resources to help teachers support the learning of EL students in mathematics. (Day 2)
- Provide teachers with instructional strategies to support EL students during mathematics discussions and collaborative activities. (Day 2)
- Engage teachers in creating and modifying lessons, activities, and assessments to meet the varying language needs of EL students. (Day 2)
- Assist teachers in creating student profiles to help guide the differentiated instruction of their EL students. (Day 2)
- Provide strategies to help teachers create modify mathematics assessments to meet the varying language needs of EL students. (Day 3)
- Outline the process of collaborative inquiry and provide time for PLC groups to engage in foundational steps of the process to be continued throughout the school year. (Day 3)
- Provide mathematics assessments to help teachers identify EL students' mathematics skills and needs. (Day 3)
- Establish a platform for sharing instructional resources to support EL students in math. (Day 3)

Target Audience: All elementary mathematics teachers, mathematics coaches, English as a Second Language (ESL) teachers, and building principals will be invited to this professional development.

Supporting ELs in Mathematics: Professional Development Agenda

Day 1		
Time	Session Topics	Activities
8:00-8:15	Welcome/Opening Remarks	
8:15-8:35	Overview of Study and Professional Development	Facilitator presents (Slides 1-5).
8:35-9:00	Creating a Common Vision	PLC teams discuss and develop a vision statement (Slide 6).
9:00-9:15	Break	
9:15-9:45	Overview of Language and Cultural Data	Facilitator shares Home Language Surveys, Family Interviews, and WIDA data sources (Slide 7).
9:45-11:45	Language and Cultural Data Dive	Teachers will examine student language and cultural data individually and collectively with PLC team (Slide 8).
11:45-12:00	Reflections and Sharing	Teachers will reflect individually and with their PLC team. PLC teams will share out with the entire group (Slide 9).
12:00-1:00	Lunch	
1:00-1:20	Cultural Proficiency Discussion	Facilitator will lead discussion in cultural proficiency (Slides 10-11)
1:20-3:00	Student Learning Data Dive	Teachers will examine student academic data individually and collectively with PLC team (Slide 12).
3:00-3:15	Reflections and Sharing	Teachers will reflect individually and with their PLC team. PLC teams will share out with the entire group (Slide 13).
3:15-3:30	Wrap-up PD Evaluation form	Facilitator will summarize the activities covered on Day 1 and provide a quick look at what will be covered on Day 2. Teachers will be asked to complete an evaluation form for the PD session.

Day 2

Time	Session Topics	Activities
8:00-8:15	Welcome/Opening Remarks	Facilitator will welcome teachers, recap Day 1, and share the learning outcomes for Day 2 (Slides 1-3).
8:15-8:35	Introduction to Language	Facilitator will introduce the different settings of language acquisition discussion about how this applies to the mathematics classroom (Slides 4-6).
8:35-9:15	WIDA Can Do Descriptors	Facilitator will provide an overview of the WIDA Can Do Descriptors and discuss how these can help guide instruction in mathematics. Teacher teams will have time to explore the Can Do Descriptors (Slides 7-8).
9:15-10:10	Modifying a Eureka Lesson	Teacher teams will use the WIDA Can Do Descriptors to modify a Eureka lesson to meet the needs of language learners at all proficiency levels (Slides 9-11).
10:10-10:25	Reflections and Sharing	Teacher teams will have time to reflect on the previous activity and share their modifications with the group (Slides 12-13).
10:25-10:40	Break	
10:40-11:40	Documenting Student Levels	Teachers will have an opportunity to organize language/cultural/academic information for students into class lists or profiles to help guide their instruction (Slide 14).
11:45-12:00	Emoji Article	Teachers will have time to read and discuss a blog post about incorporating Emoji symbols into instruction.
12:00-1:00	Lunch	
1:00-1:15	Introduction and Learning Outcomes	Facilitator will introduce the session by going over the learning outcomes and sharing some instructional strategies which are already being implemented across the district (Slides 1-6).
1:10-1:30	Scripting	Facilitator will describe Scripting as a strategy and provide examples. Teachers will have an opportunity to create a script that could be used to support their EL students (Slides 7-9).
1:30-1:50	Leveled Questioning	Facilitator will describe Leveled Questioning as a strategy and provide examples. Teachers will have an opportunity to create a series of questions on a given mathematics topic (Slides 10-12).
1:50-2:00	Preview/Review	Facilitator will describe Preview/Review as a strategy and provide examples. Teacher teams will discuss ways to incorporate this into mathematics (Slides 13-14).
2:00-2:20	Modeled Talk	Facilitator will describe Modeled Talk as a strategy and provide examples. Teachers will create an example Modeled Talk based on a classroom routine (Slides 15-17).
2:20-3:05	Applying the Strategies and Creating Resources for Classroom Use	Teachers will reflect on how they can apply these strategies in their classrooms. Teachers will have time to create examples of scripts, leveled questioning, preview/review plans, and modeled talk to use as resources in their classrooms (Slide 18-19).
3:05-3:15	Sharing	Teachers will have an opportunity to share any resources they created (Slide 20).
3:15-3:30	Wrap-up PD Evaluation	Facilitator will summarize the activities covered on Day 2 and provide a quick look at what will be covered on Day 3 (Slides 21-23). Teachers will be asked to complete an evaluation form for the PD session.

Day 3

Time		Session Topics	Activities

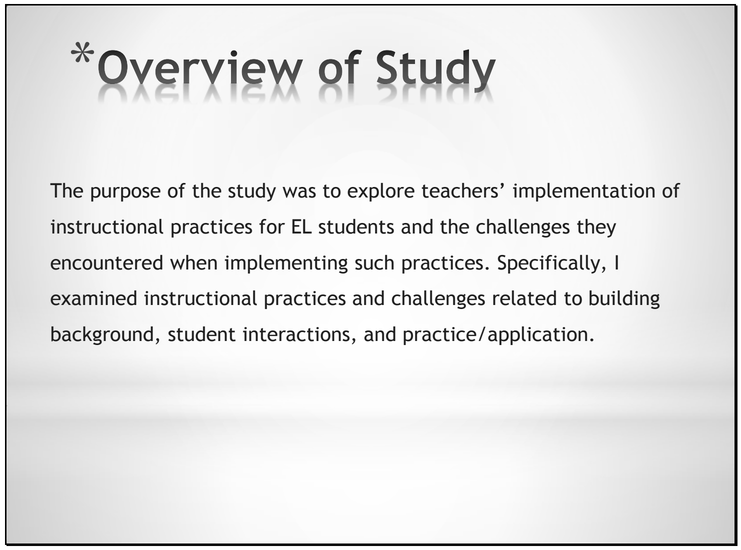
8:00-8:20	Welcome/Opening Remarks	Facilitator will welcome teachers, recap Days 1 and 2, and share the learning outcomes for the session. Also, the facilitator will discuss the major findings form the doctoral study and how they will be addressed in this session (Slides 1-4).
8:20-8:50	Identifying Strengths and Struggles	Facilitator will provide an overview of how and why the assessments were developed. Teachers will be given a paper copy of the K-2 assessment and 3-5 assessment to review, complete, and discuss. Digital copies will be emailed (Slide 5).
8:50-9:30	Assessment Strategies for EL Students	Facilitator will provide an overview of strategies to effectively assess EL students in mathematics. (Slides 6-11)
9:30-9:45	Break	
9:45-11:15	Creating/Modifying Assessments	Teachers will have time to create and/or modify assessments for upcoming Eureka lessons.
11:15-12:00	Introduce Platform for Sharing Resources Time to Explore and/or Share	Facilitator will introduce the Google Doc (shared through district email) as a platform for sharing any resources for EL students in mathematics. The facilitator will demonstrate how to open this document and upload/download items from it. Teachers will then have an opportunity to upload any resources they have created during Days 1-3.
12:00-1:00	Lunch	
1:00-1:10	Recap and Learning Outcomes	Facilitator will go over the learning outcomes for the session (Slides 1-2).
1:10-1:25	Introduction to Collaborative Inquiry	Facilitator will provide a brief overview and rationale for collaborative inquiry and data analysis (Slides 3-5).
1:25-1:40	Building the Foundation/Revisiting Vision Statements	Facilitator will provide a brief review of cultural proficiency from Day 1 and provide time for PLC teams to revisit and/or revise their vision statements (Slide 6).
1:40-2:00	Identifying a Student-Learning Problem and Creating a SMART Goal	The facilitator will provide an overview of the steps to identifying a student-learning problem and creating a SMART goal. Teacher teams will create a SMART goal for the example student-learning problem (Slides 7-9).
2:00-2:15	Verifying Causes, Generating Solutions, Implementing and Monitoring Action Plans	The facilitator will provide an overview of the steps for verifying causes, generating solutions, and implementing/monitoring action plans (Slides 10-12).
2:15-3:15	PLCs Work on Identifying a Student-Learning Problem and Creating a SMART goal	PLC teams will have time to review data to identify a student-learning problem and then create a SMART goal (Slide 13).
3:15-3:30	Wrap-up PD Evaluation	Facilitator will summarize the activities covered on Day 3 (Slides 14-15). Teachers will be asked to complete an evaluation form for the PD session.

Slide 1

* Supporting ELs in Mathematics

Day 1- Reviewing Data Sources

Slide 2



The facilitator will share that the content of this professional development series was developed based on the results of a doctoral study conducted in the district. The facilitator will provide an overview of the research questions and data collection. The research questions for this study were:

How do first through fifth grade mathematics teachers implement instructional practices related to building background knowledge for EL students?

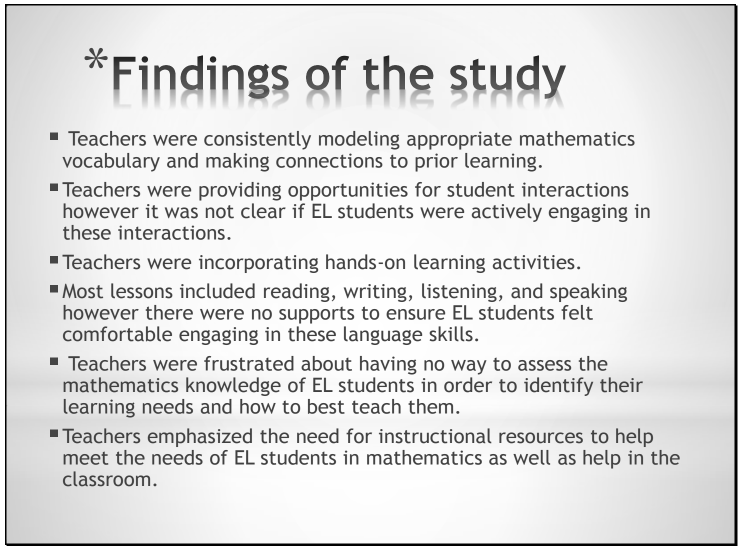
How do first through fifth grade mathematics teachers implement instructional practices related to student interactions for EL students?

How do first through fifth grade mathematics teachers implement instructional practices related to practice and application for EL students?

What challenges do first through fifth grade teachers experience related to implementing effective instructional practices for EL students in mathematics?

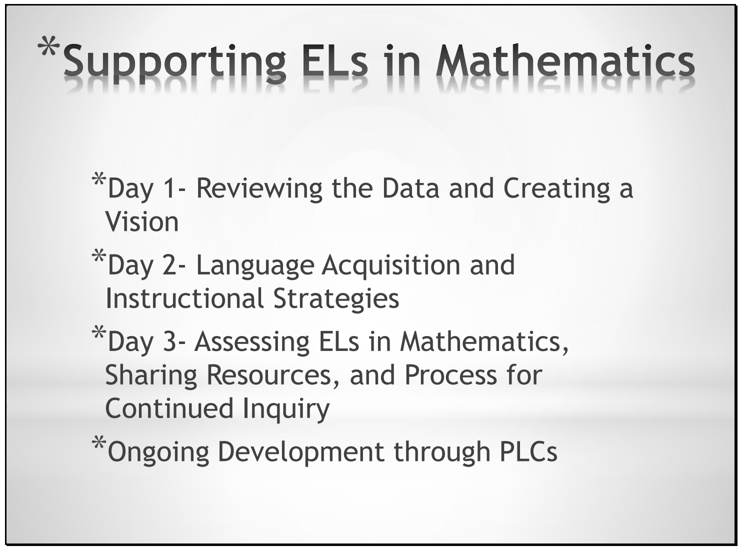
Data was collected through an initial one-on-one interview, classroom observation, and a follow-up interview through email.

Slide 3



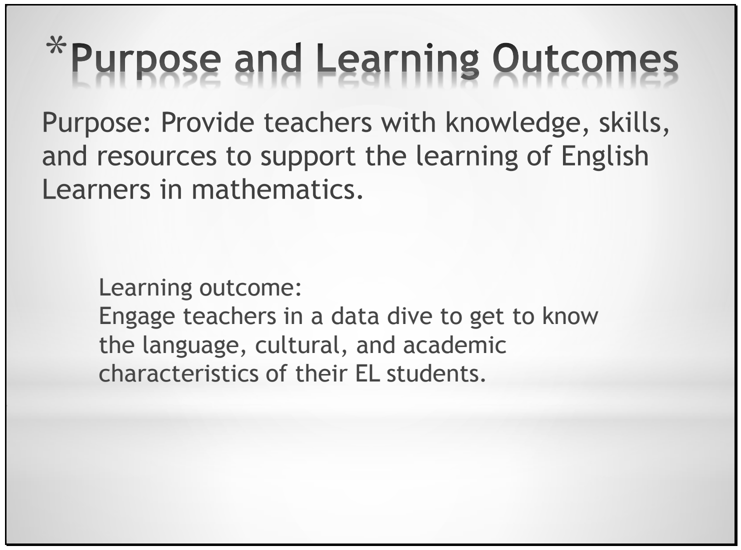
The facilitator will provide an overview of the findings from the study and how these provided the foundation for this professional development series.

Slide 4



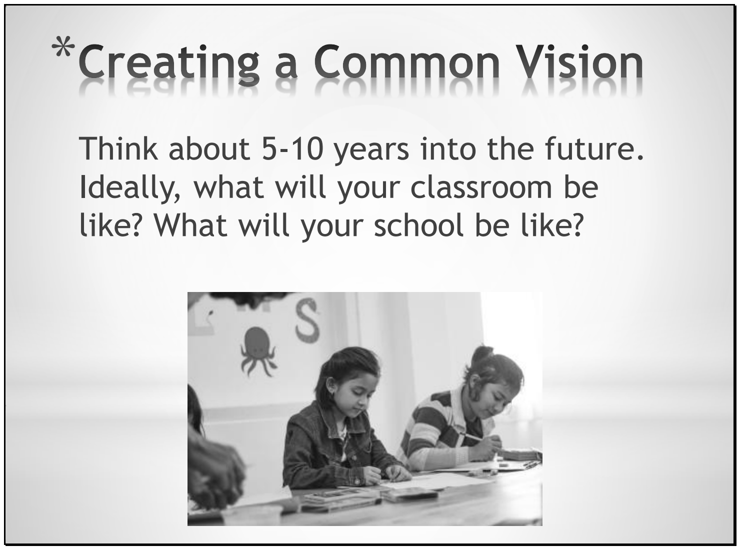
The facilitator will provide an overview of the professional development plan that begins with three days of training and will be followed by ongoing development through Professional Learning Communities throughout the school year.

Slide 5



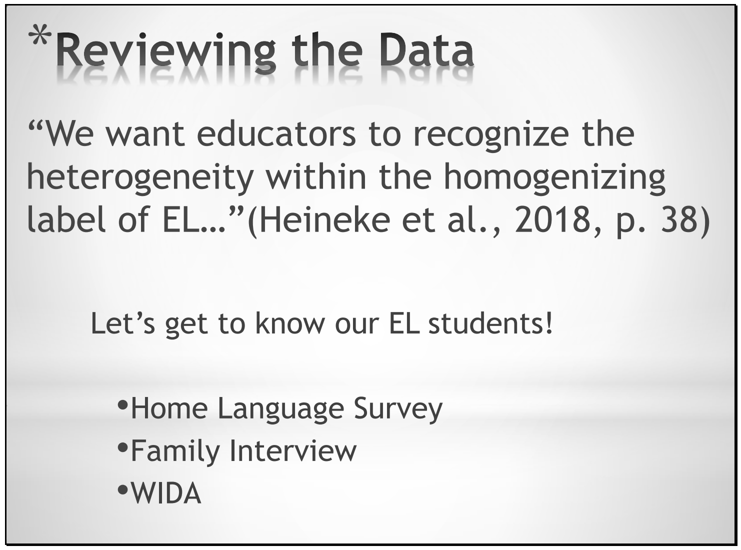
According to Burstein et al. (2014), in order for professional development to effectively impact instructional practice, the knowledge and skills of the teachers as well as the reality of time constraints must be considered. This professional development series was developed based on the findings of the doctoral study and also with those aspects in mind. The purpose is to provide teachers with knowledge, skills, and resources to support EL students in mathematics. Over the course of this 3 day training, you will: explore various data sources to get to know the language, cultural, and academic characteristics of your EL students; you will learn about language acquisition and instructional strategies to support EL students, you will be given, create, and modify various resources to help guide your instruction and assessments for EL students in mathematics, and you will learn about the process of guided inquiry which you will use to continue your professional learning throughout the course of the school year. With such a wide range of school demographics across the district, a “one-size fits all” approach would not be beneficial. Therefore, the goal for these 3 days of training is to provide you with a foundation of knowledge and skills that will enable you to engage in collaborative professional learning which is most relevant to your particular teaching situation, as your PLC groups will be comprised of colleagues from your school.

Slide 6



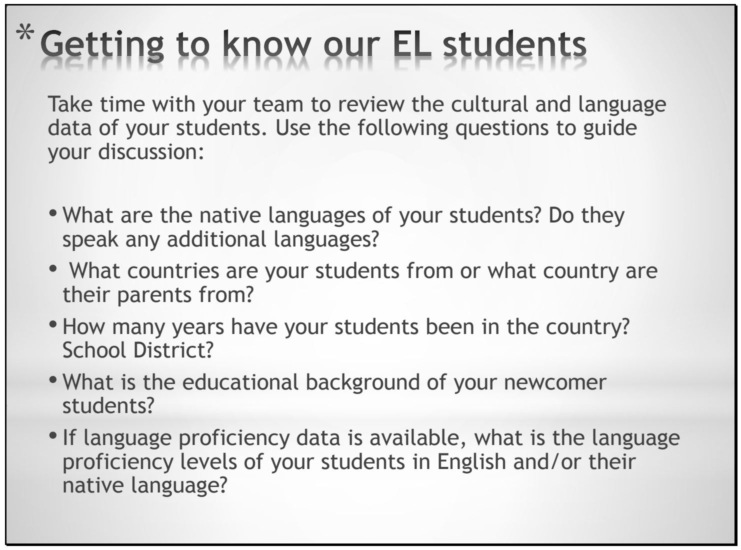
The facilitator will introduce the idea of ongoing collaborative inquiry through PLCs. In order for PLCs to be effective, everyone in the group needs to share a common vision (Heineke, Papola-Ellis, Cohen, & Davin, 2018; Love, 2009). The facilitator will first have teachers think about and write down their thoughts to these questions individually. Then, the teacher teams will be given time to share and generate a common vision for their PLC group. Each team will share their vision statement with the group. Teams will have an opportunity to tweak this vision statement on Day 3, if needed.

Slide 7



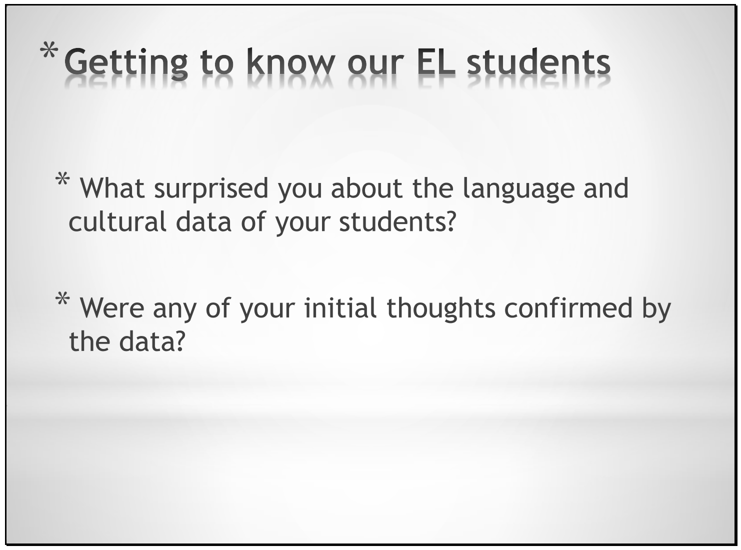
The facilitator will read the quote from Heineke et al. (2018) and explain that EL students differ in many was such as their native languages, proficiency in their native languages and English, countries, and cultural backgrounds. The facilitator will provide a brief overview of the cultural and language data sources including how and when this data is collected, how the data is presented, and how this information is helpful.

Slide 8



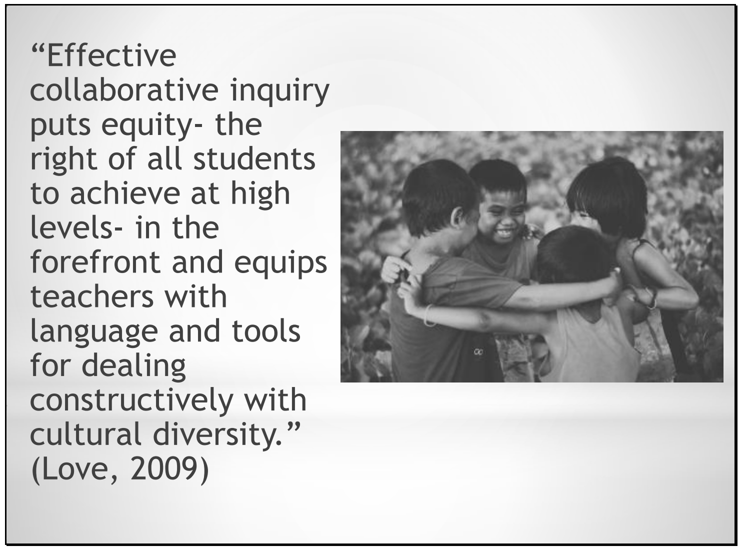
The facilitator will introduce the data dive activity by going over the guiding questions. Heineke et al. (2018) emphasizes the need for teachers to have the opportunity to explore the language and cultural data of their students to help design appropriate classroom settings and instructional opportunities for these students. This activity is designed for teachers to be able to examine the individual data of their EL students and for PLC groups to look at the data collectively across the school (Heineke et al., 2018). Also, the facilitator will note that we will be discussing language proficiency levels in detail during a later session. At this time, the goal is to simply review the data and look at the information about EL students both individually and collectively.

Slide 9



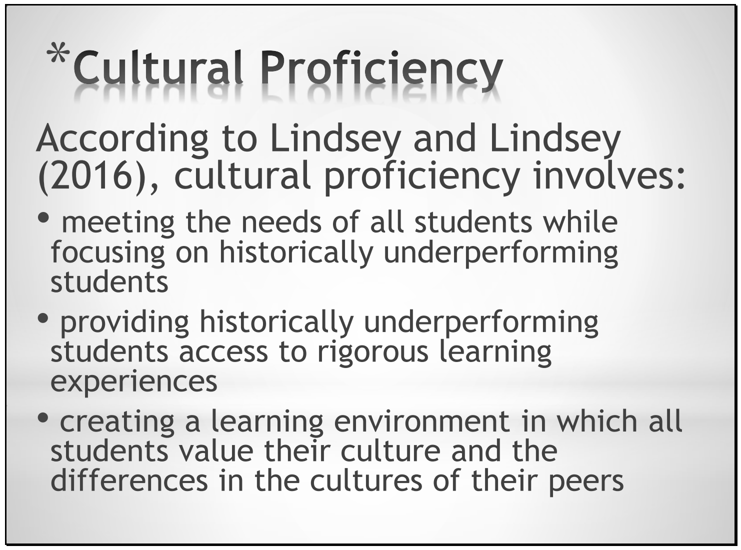
After the teacher teams have had time to review and discuss their data, the facilitator will initiate a reflective activity. For this activity, teams will discuss what surprised them about their data. Also, they will reflect on any initial thoughts they had that were confirmed by the data. Teams will then have an opportunity to share with the group.

Slide 10



The facilitator will set the foundation for this data dive by introducing the importance of shared responsibility in providing effective content and language instruction for EL students (Heineke et al., 2018).

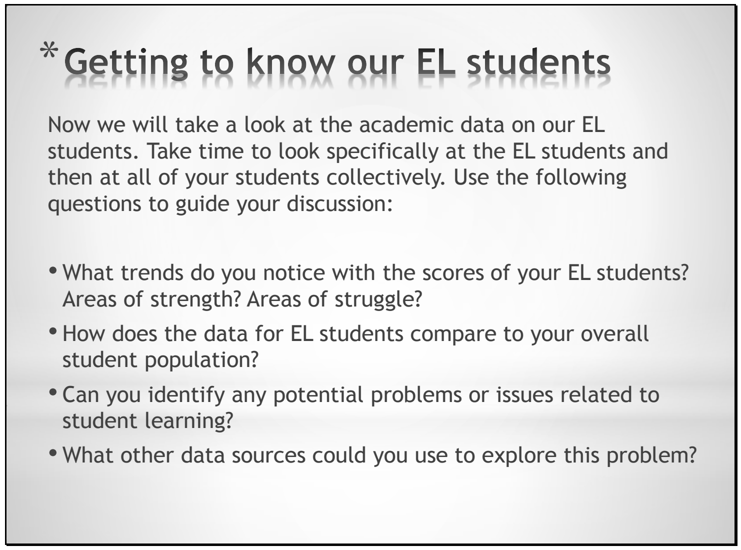
Slide 11



Before engaging in the data dive, it is important for teachers to keep in mind the importance of cultural proficiency. The facilitator will lead a discussion on what cultural proficiency means and how this impacts the mathematics classrooms. The discussion will be guided by slide 11 and the following questions:

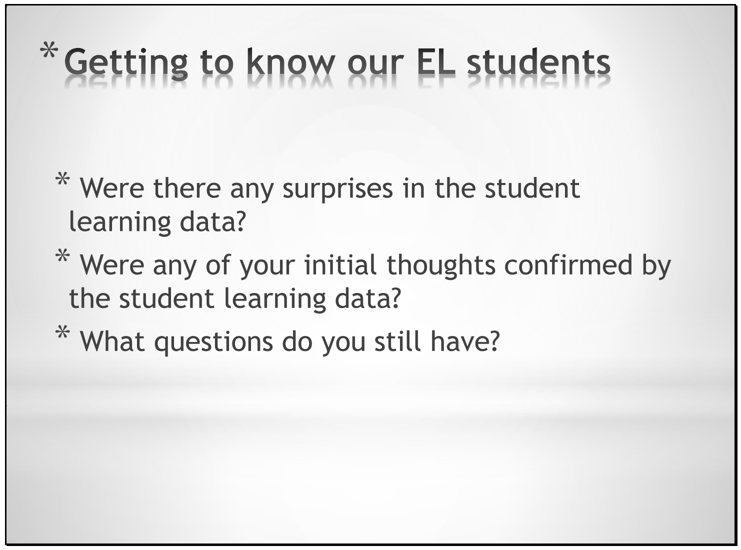
- What cultures are represented by your students?
- In your experience, what cultural differences have you noticed between the different cultures represented by your students?
- What differences have you noticed between the cultures of your students and yourself?
- In what ways have you found that cultural diversity has positively impacted your students?

Slide 12



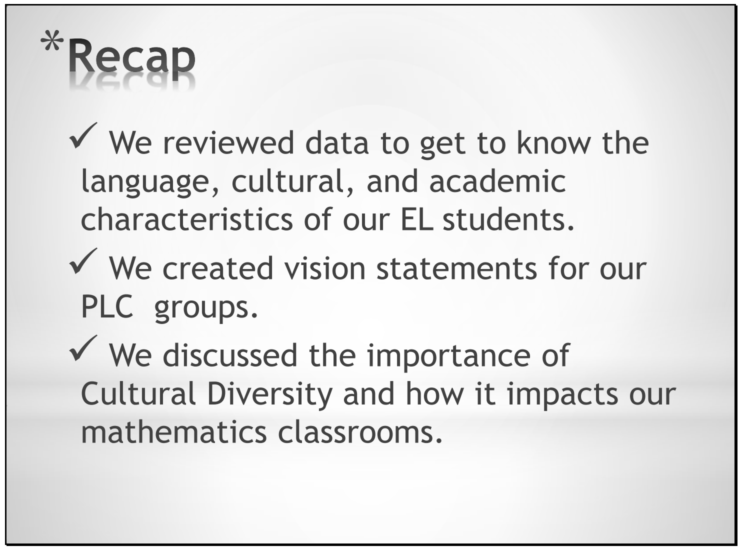
The facilitator will introduce this continuation of the data dive activity by going over the guiding questions. This activity will mirror the previous data dive activity, however this activity is focused on academic data. Teachers will be given an opportunity to examine the data of their individual students and PLC groups will explore the data across grade levels and their school (Heineke et al. 2018).

Slide 13



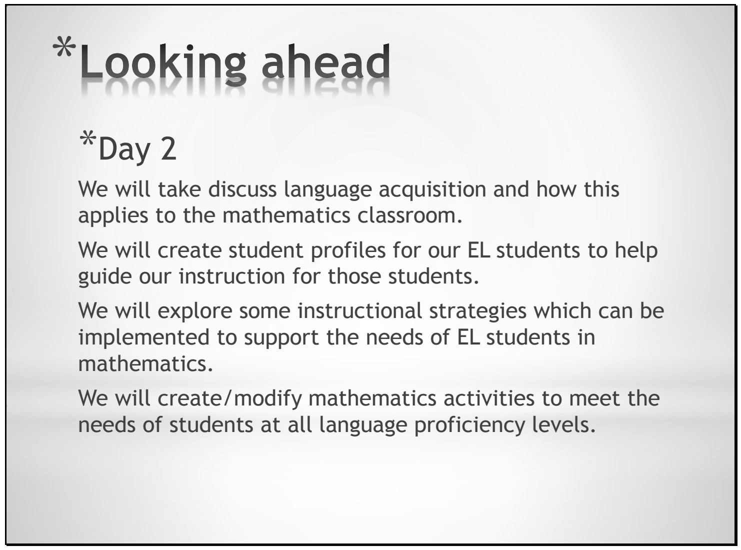
After the teacher teams have had time to review and discuss their data, the facilitator will initiate a reflective activity. For this activity, teams will discuss what surprised them about their data. Also, they will reflect on any initial thoughts they had that were confirmed by the data and any questions they still have. Teams will then have an opportunity to share with the group.

Slide 14



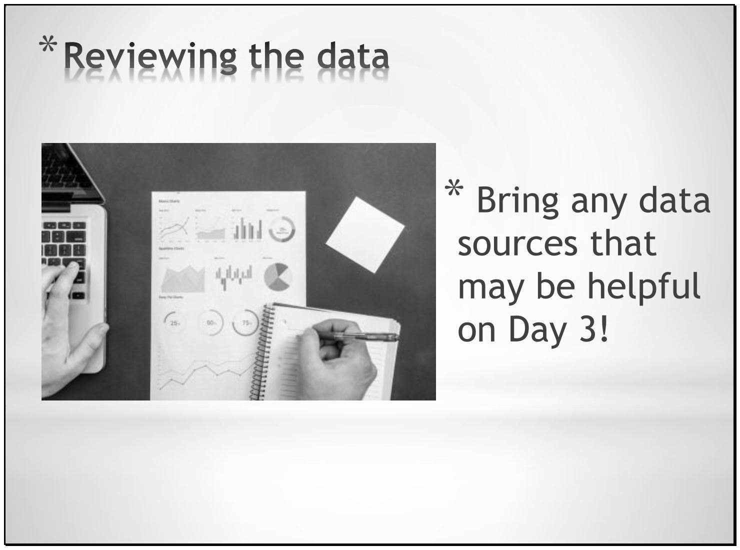
The facilitator will give a brief summary of the activities covered in the professional development on Day 1.

Slide 15



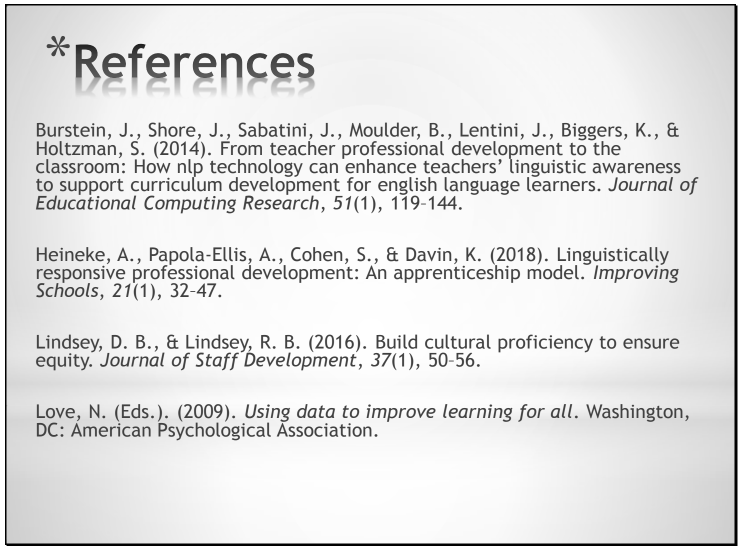
The facilitator will provide a brief overview of the topics and activities to be covered on Day 2 of the training.

Slide 16

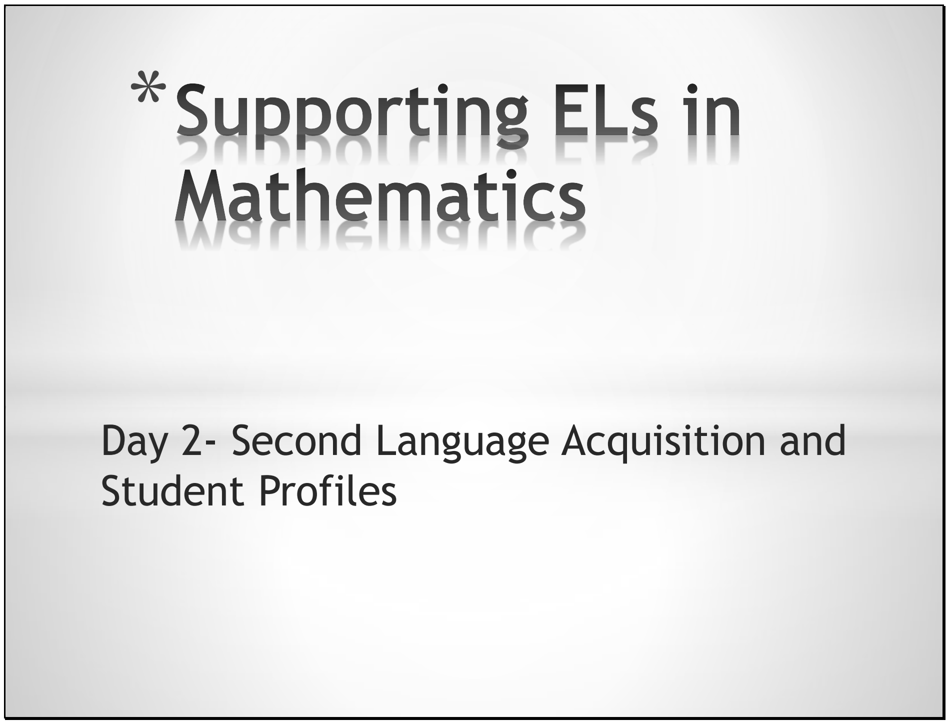


The facilitator will encourage teacher teams to gather any data sources that may provide insight into the potential student learning problems they identified during their data dive. Multiple data sources must be reviewed to effectively identify student learning problems (Love, 2009). We will be continuing the collaborative inquiry process on Day 3, so teachers will be encouraged to bring any and all data to help make the inquiry productive.

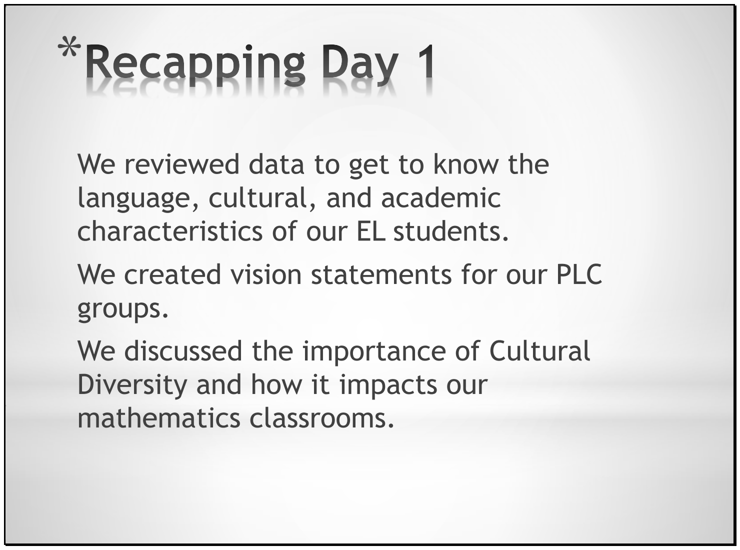
Slide 17


*References
Burstein, J., Shore, J., Sabatini, J., Moulder, B., Lentini, J., Biggers, K., & Holtzman, S. (2014). From teacher professional development to the classroom: How nlp technology can enhance teachers' linguistic awareness to support curriculum development for english language learners. Journal of Educational Computing Research, 51(1), 119–144.
Heineke, A., Papola-Ellis, A., Cohen, S., & Davin, K. (2018). Linguistically responsive professional development: An apprenticeship model. Improving Schools, 21(1), 32–47.
Lindsey, D. B., & Lindsey, R. B. (2016). Build cultural proficiency to ensure equity. Journal of Staff Development, 37(1), 50–56.
Love, N. (Eds.). (2009). Using data to improve learning for all. Washington, DC: American Psychological Association.

Slide 1

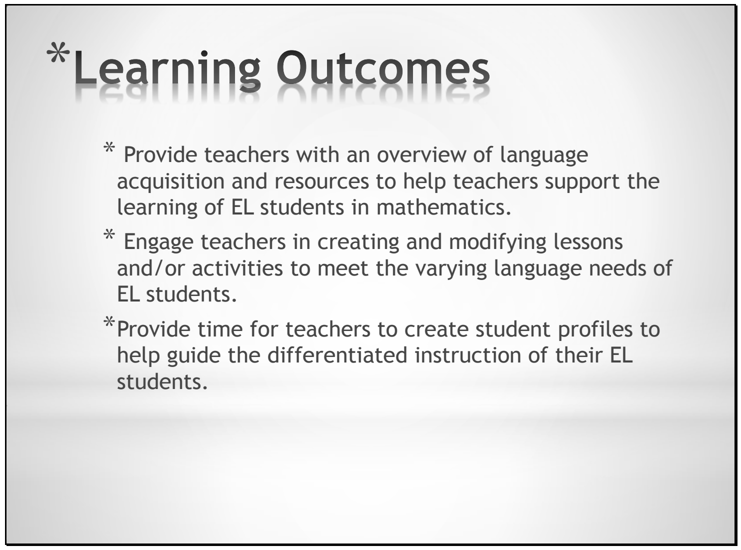

*Supporting ELs in Mathematics
Day 2- Second Language Acquisition and Student Profiles

Slide 2



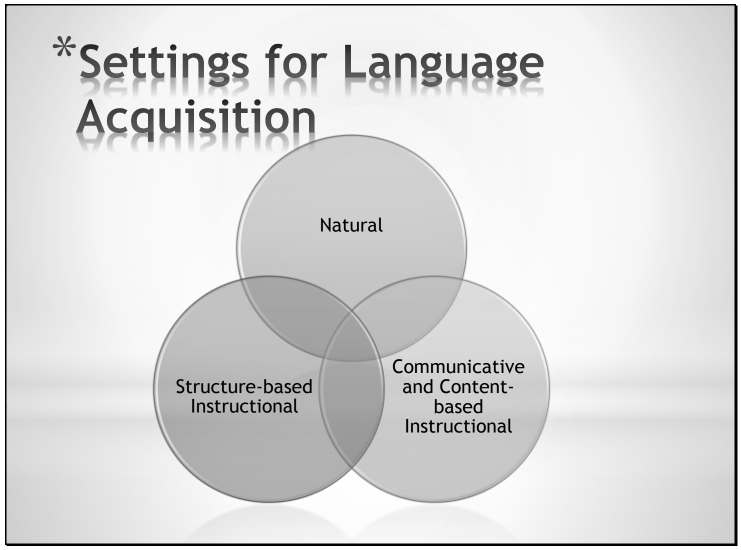
The facilitator will review the topics and activities covered during Day 1 of the training. The facilitator will ask teachers to share any “Aha” moments from the data dive on Day 1. Also, the facilitator will ask if teachers have any lingering questions.

Slide 3



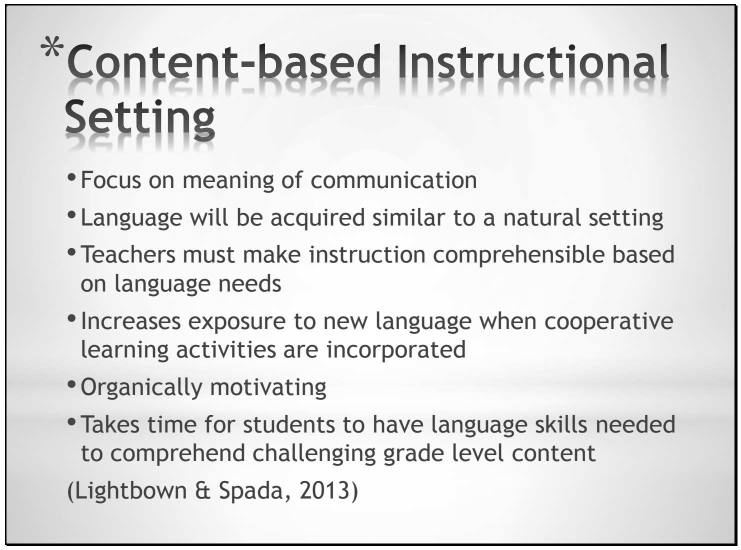
The facilitator will go over the learning outcomes for the session.

Slide 4



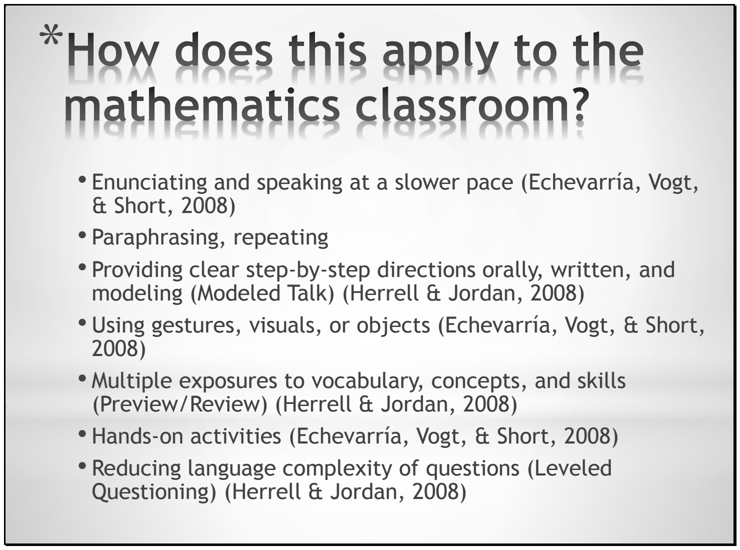
The facilitator will provide an overview of each of the settings of language acquisition. The natural setting is when students learn a language through common interactions in social situations in the classroom or on the playground (Lightbown & Spada, 2013). The structure-based instructional setting is when students learn language through repetition and isolated activities where one skill is taught at a time (Lightbown & Spada, 2013). The communicative and content-based instructional setting is when the emphasis is put on communicating the meaning through interactions with teachers and peers (Lightbown & Spada, 2013). The thought behind this is that students will learn language as they focus on conveying the meaning of their message and understanding the messages conveyed by others in a similar way to what happens in a natural setting (Lightbown & Spada, 2013). Most of our EL students experience a combination of all of these settings while they are learning English. As mathematics teachers, our classroom will most likely fit into the Communicative and Content-based Instructional setting.

Slide 5



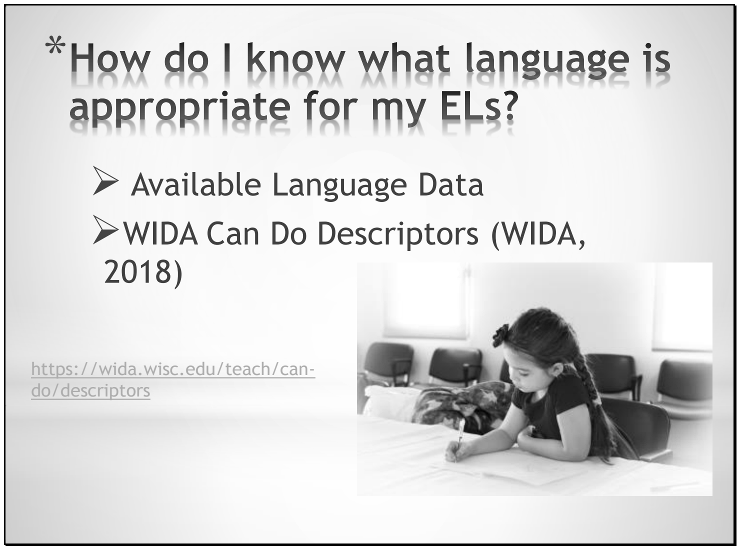
The facilitator will share a general description of the content-based instructional setting including the focus, instructional characteristics, benefits, and challenges (Lightbown & Spada, 2013).

Slide 6



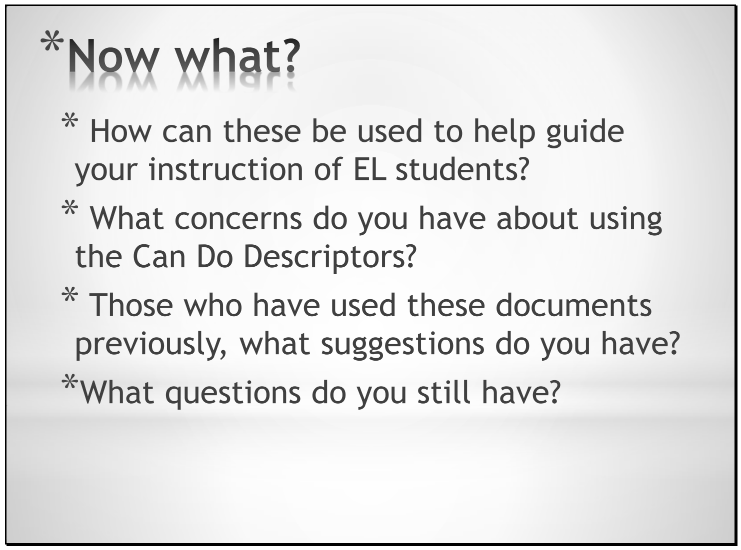
The facilitator will share and model some general strategies for making instruction comprehensible for EL students (Echevarría, Vogt, & Short, 2008; Herrell & Jordan, 2008). It is important for content teachers to make sure EL students have access to the grade level content. Making sure the content is presented in a way that they can understand is part of that. The facilitator will also make the connection that some of these strategies are already being implemented across the district. The purpose of going over these is really to make ourselves aware of these strategies so that we can be more intentional with their implementation. Modeled Talk, Preview/Review, and Leveled Questioning (Herrell & Jordan, 2008) will be discussed in detail in the following session.

Slide 7



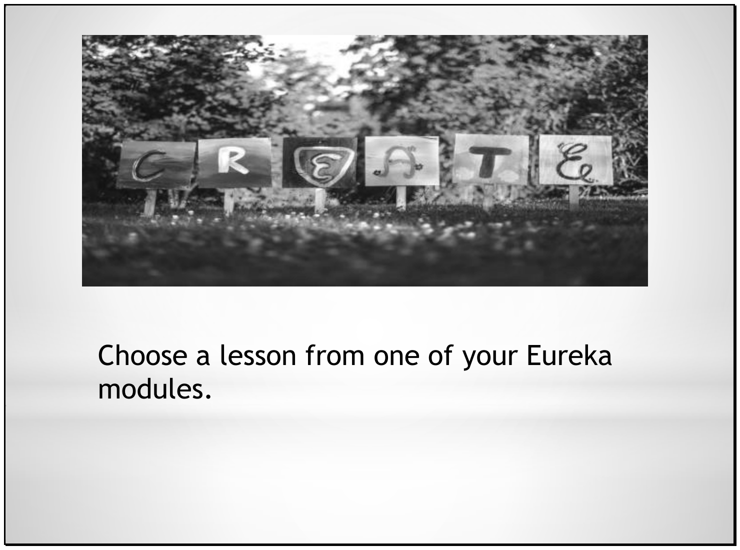
Hiatt and Fairbairn (2018) recommended that teachers are trained on how to interpret state language proficiency data in order to help teachers to build a better understanding of language acquisition. This is important because teachers need to be able to identify what supports are needed to help EL students understand a mathematics lesson (Hiatt & Fairbairn, 2018).The facilitator will guide teachers is pulling up the WIDA Can Do Descriptors on the computer and display the website using the link. This is a resource published by WIDA (2018) to help teachers understand what EL students can do at each level of language acquisition and guide them in differentiating instruction. The facilitator will then show the different forms of the WIDA Can Do Descriptors which includes the Key Uses form, the original document, and Spanish translation (WIDA, 2018). The facilitator will provide an overview of the key uses. Recount means to retell or summarize information (WIDA, 2018). Explain means to answer the “how” or “why” for a particular event or item (WIDA, 2018). Argue means that the student can make a claim and provide supporting evidence (WIDA, 2018). Discuss means that the student can share ideas and build meaning through interactions with others (WIDA, 2018). The facilitator will share that the original document was arranged by Listening, Speaking, Reading, and Writing rather than the Key Uses (WIDA, 2018). Teachers will be able to choose which document they feel is most helpful in guiding their instruction, as both the Key Uses and the original document can be used for teaching mathematics. For the purposes of this training, the original document will be used. After pulling up the original document, the facilitator will give a brief overview of the layout of the document. Then, teacher teams will have time to explore the Can Do Descriptors individually and as a group.

Slide 8



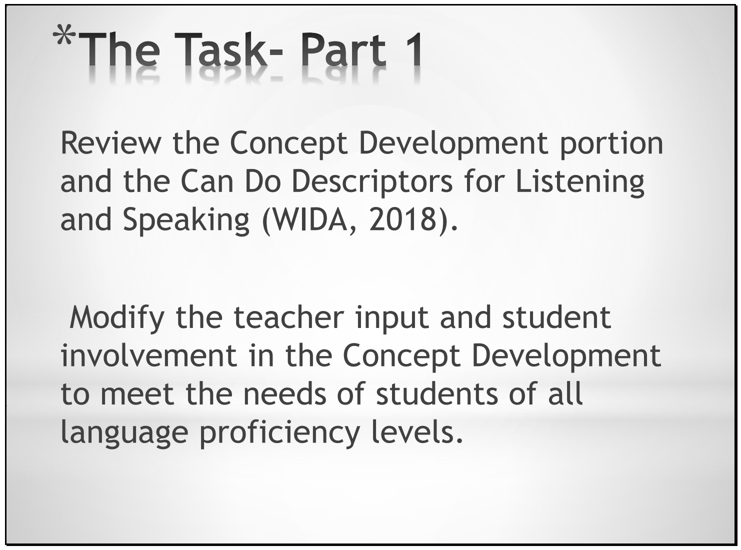
The facilitator will lead a whole group discussion guided by the above questions. This will be an opportunity for teachers to voice concerns and questions. This will also provide an opportunity for teachers who have had experience using these documents to share their thoughts.

Slide 9



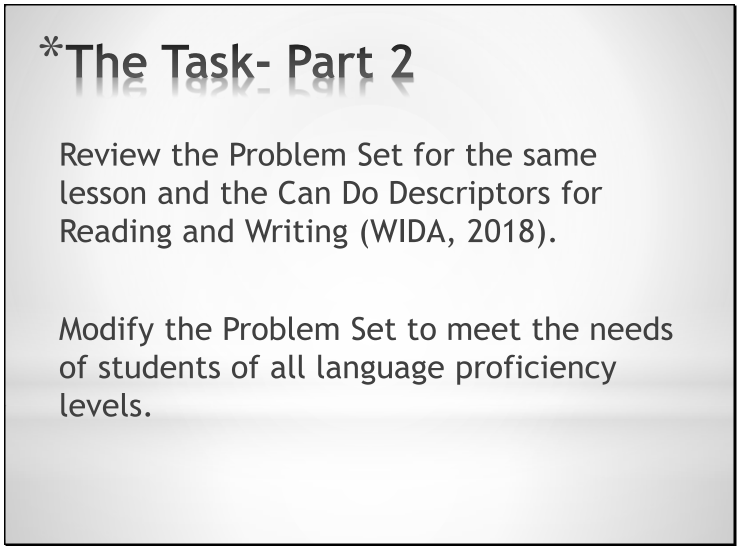
Teacher teams will be given a few minutes to select a math lesson from their Eureka modules.

Slide 10



The facilitator will use the following two slides to go over the directions for this collaborative planning activity. The facilitator will circulate and monitor teacher teams' progress, answer questions, and provide guidance as needed.

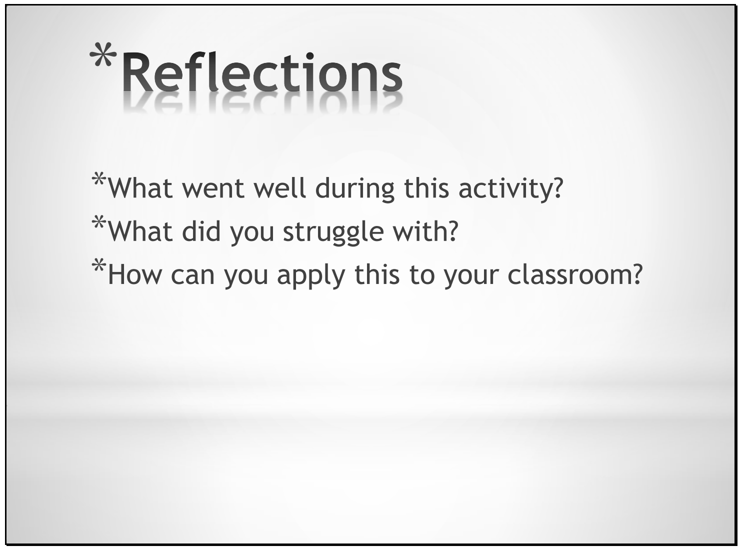
Slide 11


*The Task- Part 2
Review the Problem Set for the same lesson and the Can Do Descriptors for Reading and Writing (WIDA, 2018).
Modify the Problem Set to meet the needs of students of all language proficiency levels.

Slide 12

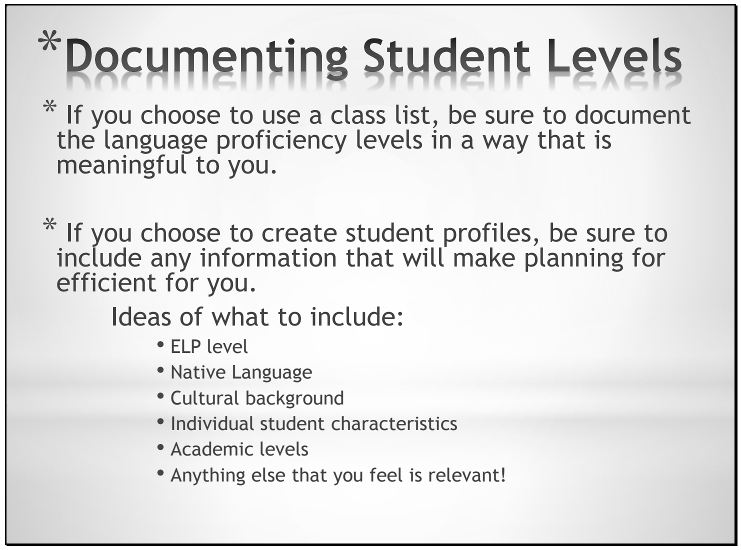
The facilitator will provide time for teacher teams to share their lessons with the group.

Slide 13



Teachers will have time to reflect on the above questions individually and with their team. Unfortunately, it is not practical for teachers to be able to spend this same amount of time to plan every lesson for every day. Burstein et al. (2014) emphasized that time constraints need to be acknowledged if changes in practice are the goal. This reflective activity is where the facilitator will help teachers find ways to pull pieces of this activity that they can practically implement while planning for their students. As a whole group, the facilitator will guide a discussion of how to best implement this practice in the classroom. The facilitator will ask, “How can some of these modifications be built into instruction regularly without taking an unreasonable amount of planning?” The facilitator will remind teachers that we will be exploring some specific instructional strategies in the next session, there will be opportunities later in the day for planning such activities, as well as a platform for sharing resources which will be presented on Day 3.

Slide 14

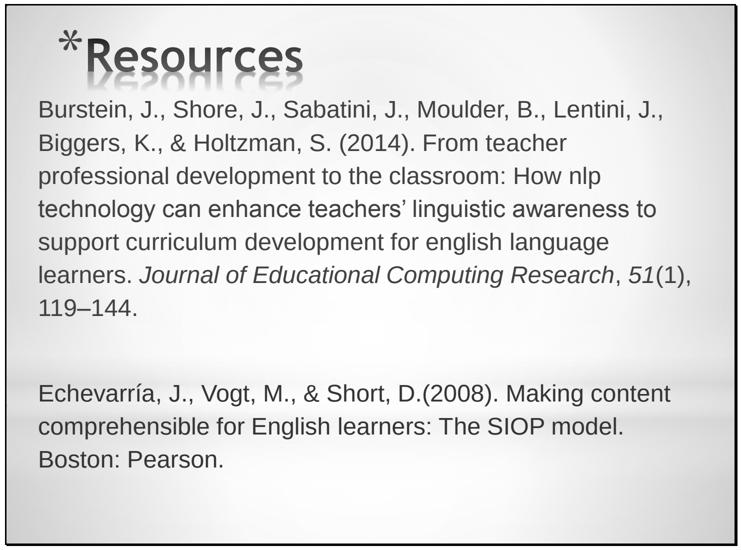


Now let’s look at how this will apply to our particular EL students and how we can manage this information. Herrell and Jordan (2008) suggested using a class list and writing the language level next to each student’s name. The facilitator will encourage teachers to document this information in a way that makes sense to them. This list will not be helpful if it is not easy to use. It may also be helpful to create a more complete student profile with more detailed information. The facilitator will encourage the teachers to choose a format that is most helpful for their teaching situation. Teachers will then have this opportunity to refer to any language and cultural data reviewed on Day 1 to create their student profiles.

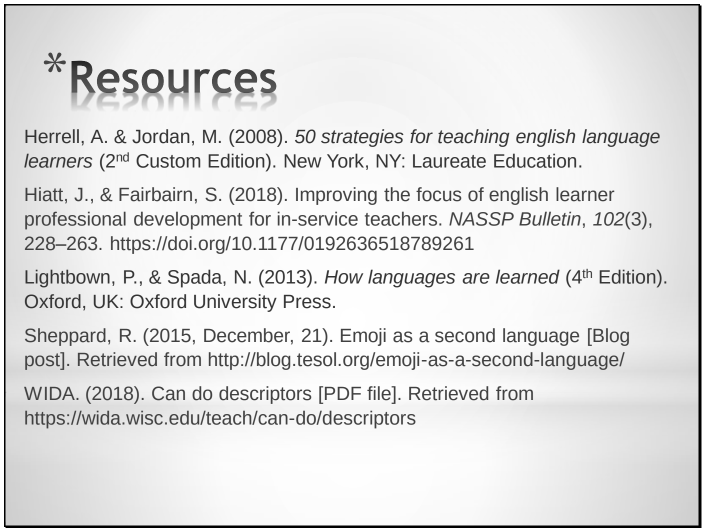
Slide 15

The facilitator will provide paper copies for teachers to read and discuss.

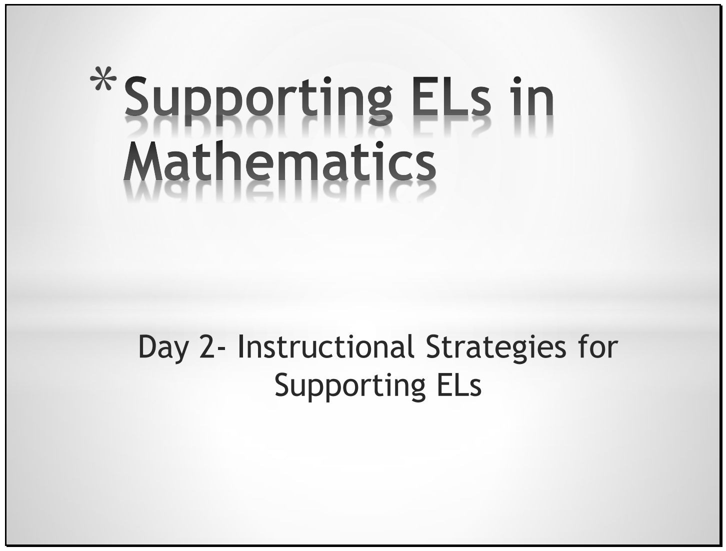
Slide 16


*Resources
Burstein, J., Shore, J., Sabatini, J., Moulder, B., Lentini, J., Biggers, K., & Holtzman, S. (2014). From teacher professional development to the classroom: How nlp technology can enhance teachers' linguistic awareness to support curriculum development for english language learners. *Journal of Educational Computing Research*, *51*(1), 119–144.
Echevarría, J., Vogt, M., & Short, D.(2008). Making content comprehensible for English learners: The SIOP model. Boston: Pearson.

Slide 17

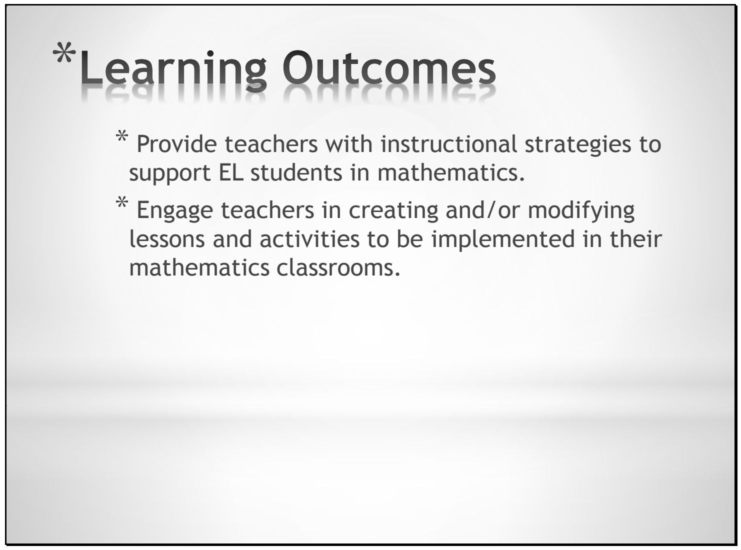

*Resources
Herrell, A. & Jordan, M. (2008). *50 strategies for teaching english language learners* (2nd Custom Edition). New York, NY: Laureate Education.
Hiatt, J., & Fairbairn, S. (2018). Improving the focus of english learner professional development for in-service teachers. *NASSP Bulletin*, *102*(3), 228–263. https://doi.org/10.1177/0192636518789261
Lightbown, P., & Spada, N. (2013). *How languages are learned* (4th Edition). Oxford, UK: Oxford University Press.
Sheppard, R. (2015, December, 21). Emoji as a second language [Blog post]. Retrieved from http://blog.tesol.org/emoji-as-a-second-language/
WIDA. (2018). Can do descriptors [PDF file]. Retrieved from https://wida.wisc.edu/teach/can-do/descriptors

Slide 1



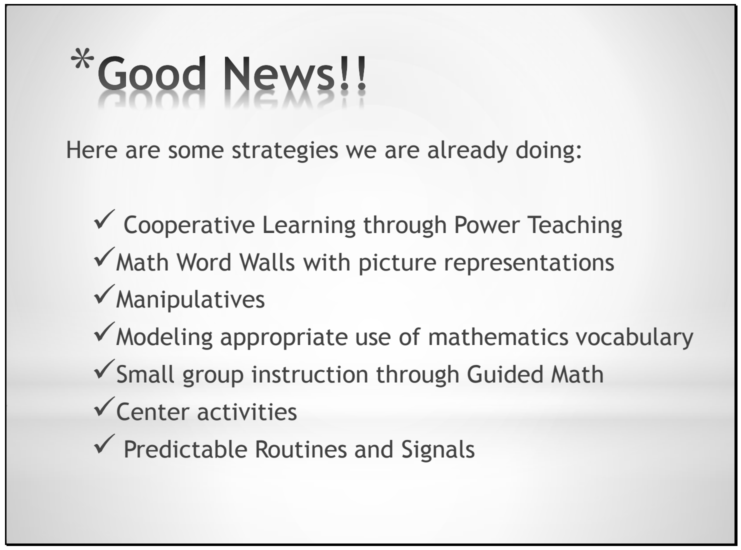
Modeled Talk is a strategy which will be discussed in detail during this session. The facilitator should be modeling this strategy throughout the presentation.

Slide 2



The facilitator will go over the learning outcomes for the session.

Slide 3

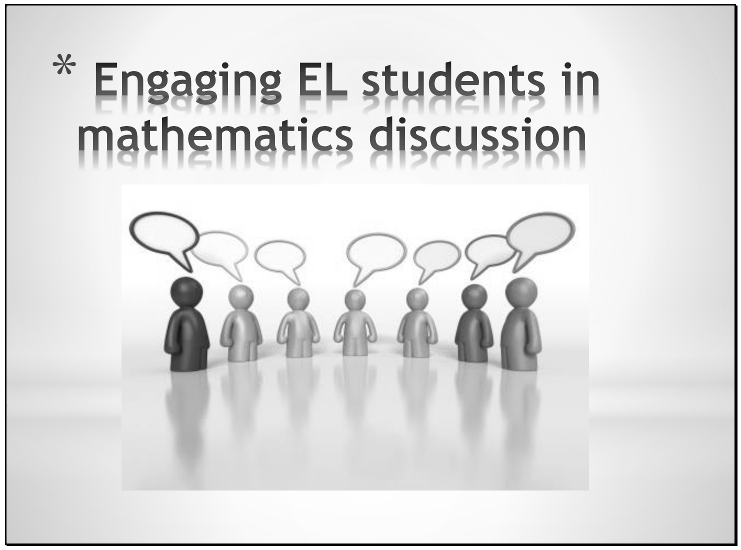


Facilitator will share that some of the instructional strategies that are already being implemented at the elementary level are beneficial to EL students. Most of these instructional strategies are parts of initiatives that have been implemented and supported by our administration over the past few years. These strategies were also observed being used by the participants in the study.

Slide 4

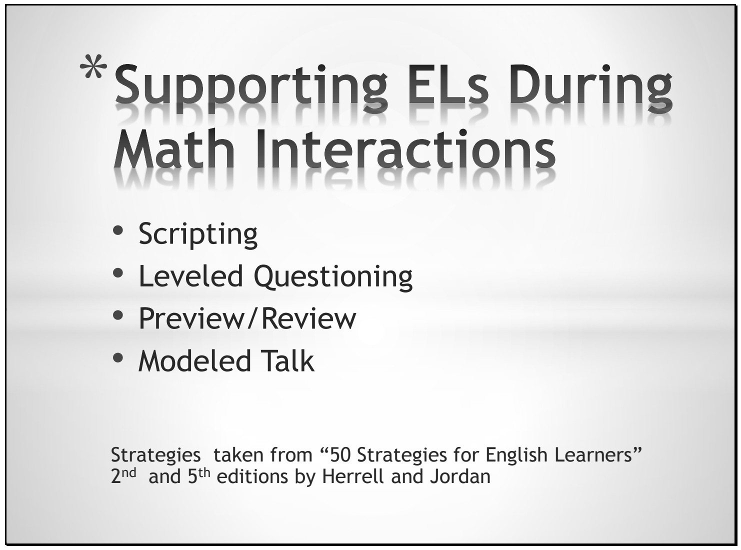
The facilitator will explain that no one strategy works for every student. The goal of this professional development is to provide teachers with multiple strategies that they can draw on to help their EL students in mathematics. It is important that teachers use their knowledge of the strengths and needs of their students to identify and implement the most appropriate strategies for each particular child.

Slide 5



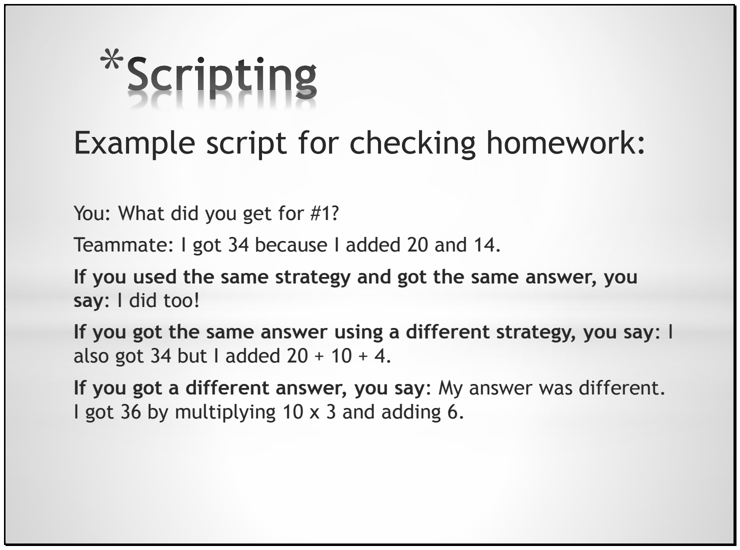
The facilitator will share that a study conducted by Banes, Ambrose, Bayley, Restani, and Martin (2018) showed that EL students are capable of engaging in rigorous mathematics discussions. Banes et al. also found that even EL students with very limited language proficiency may benefit from these discussions. District officials have reported that elementary teachers are consistently implementing mathematics discussions, however they were not convinced that EL students were actively engaging in these discussions. It is important that teachers have strategies for supporting EL students during these interactions in order for them to be able to actively engage in mathematics discussions.

Slide 6



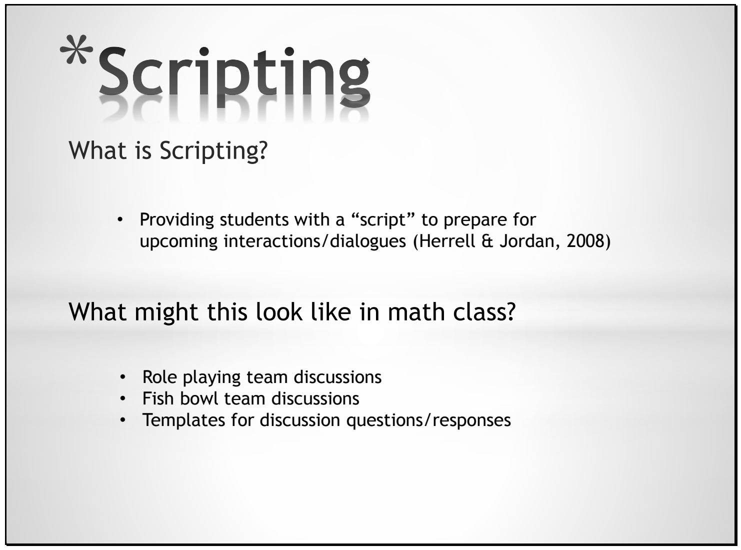
According to Shea, Sandholtz, and Shanahan (2018), teachers need professional development on how to integrate language and content learning in order to improve content-area literacy and academic vocabulary.The facilitator will introduce the following strategies as ways to support EL students during mathematics interactions. These strategies are modeled after those presented by Herrell and Jordan (2008; 2016) in their text "50 Strategies for Teaching English Language Learners". All of the these strategies help to reduce the anxiety for EL students while building confidence in their language skills, allowing them to more fully engage in learning.

Slide 7



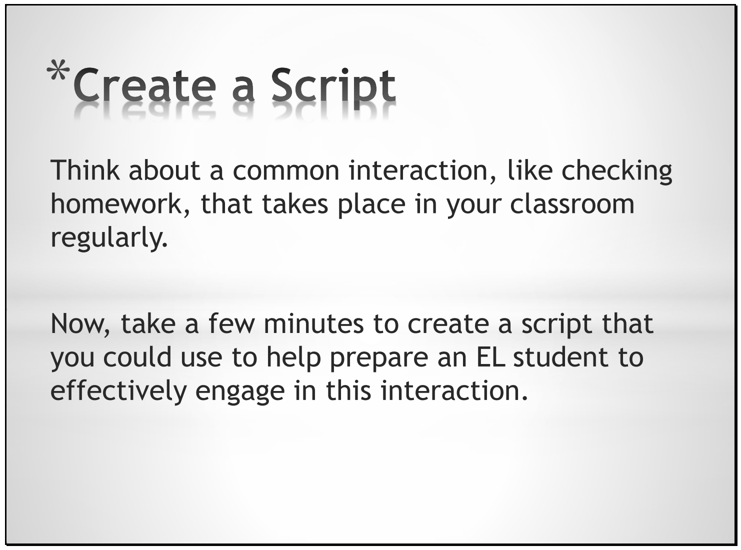
The facilitator will remind teachers that in some cases, using a script will require that the student have some reading skills. The script will need to be written in appropriate language and complexity based on the student's language proficiency. However, if the teacher takes time to model the script with the student individually or in small group, this can be done through role playing rather than reading (Herrell & Jordan, 2009). Scripts can be modified to work for both primary and intermediate students for basically any social interaction.

Slide 8



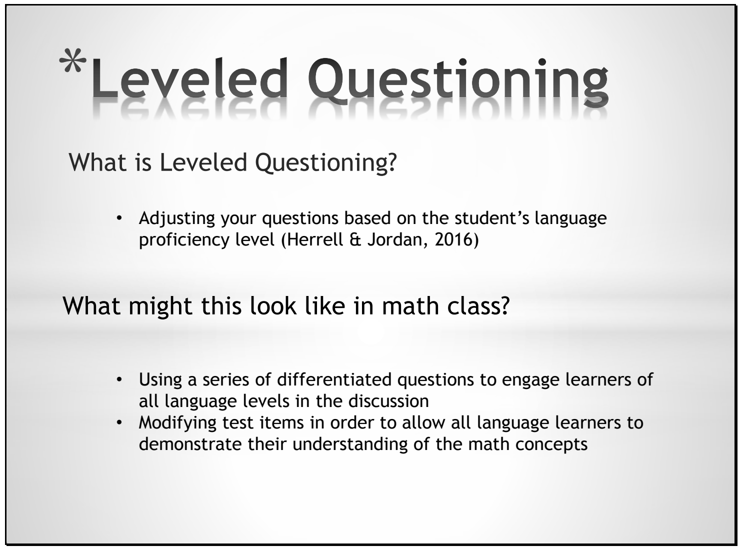
The facilitator will explain that scripting is providing example dialogues or “scripts” for students to practice before an interaction (Herrell & Jordan, 2008). These scripts are not necessarily meant to be memorized or read word for word, rather the goal is to provide examples for appropriate language for an upcoming interaction. It can also be helpful to include alternate responses. The facilitator will provide an overview of what this might look like in math class through role playing, fish bowl discussions, and providing templates/cues.

Slide 9



The facilitator will lead teachers in creating a short script that they could use to support an EL student in a common classroom interaction. The facilitator will then have a few teachers share their scripts.

Slide 10



The facilitator will provide an overview of leveled questioning, as shared in Herrell and Jordan (2016). Teachers will need to refer to their learning in the previous session on language proficiency data and Can Do Descriptors in order to apply this strategy. The facilitator will remind teachers that there will be a session devoted to assessing EL students in mathematics on Day 3, during which Leveled Questioning will be revisited.

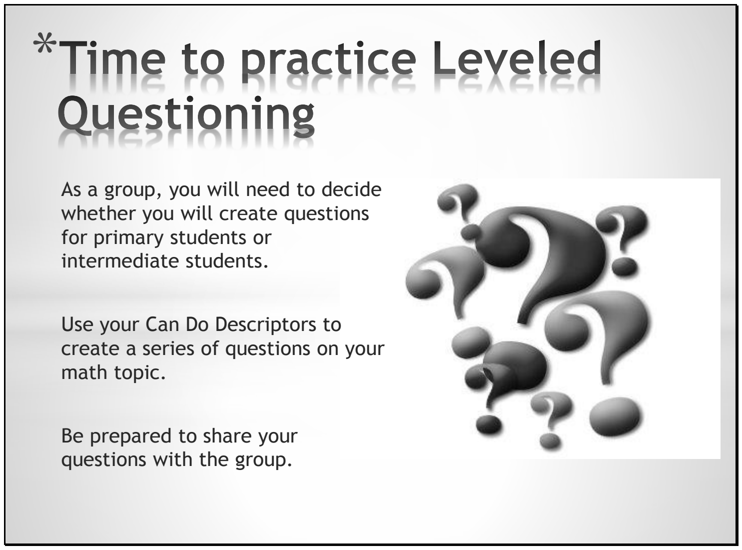
Slide 11

*Leveled Questioning

ELP Level	Primary	Intermediate
1- Entering	Did you get a sum of 10? (Thumbs up/down)	Can you show me a shape that is a quadrilateral? (point or draw)
2- Emerging	What did you do with 6 and 4 to make 10?	How many sides does a quadrilateral have?
3- Developing	How did you make a sum of 10?	How do you know that this shape is a quadrilateral?
4- Expanding	Tell me the steps you used to make 10?	How did you decide which shapes are quadrilaterals and which shapes are not?
5- Bridging	How do you know that 6 + 5 does not make 10?	If this shape is a rectangle, then it is also a quadrilateral. Why?
6- Reaching	How do you know when two numbers make 10? How do you know when they do not make 10?	Explain why all parallelograms are quadrilaterals but not all quadrilaterals are parallelograms.

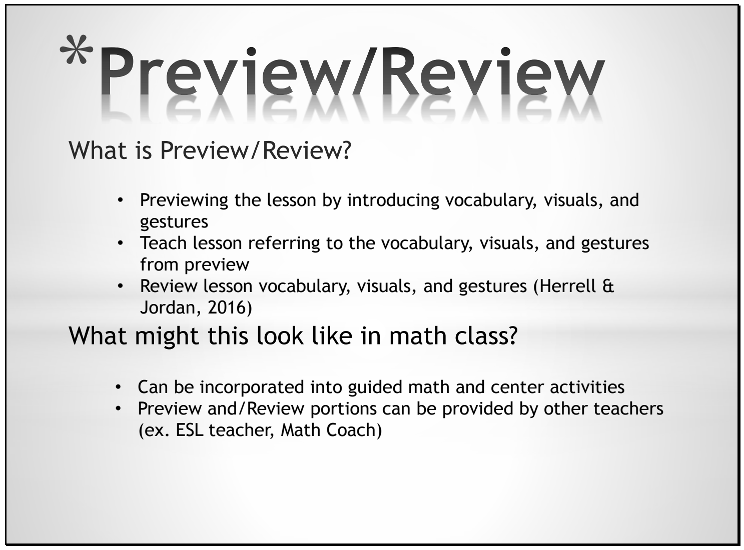
The facilitator will refer teachers back to the information they received in a previous session about English Language Proficiency levels and Can Do Descriptors. These example questions were developed based on the information provided in those documents and the Leveled Questioning Strategy described by Herrell and Jordan (2016).

Slide 12



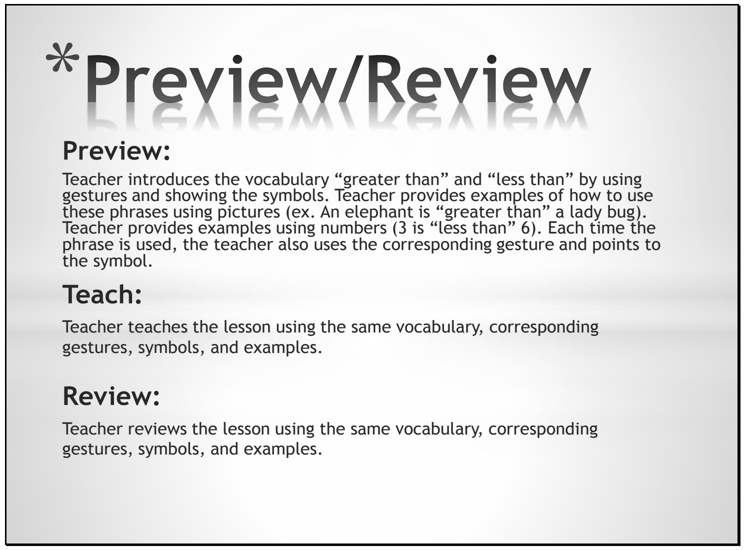
The facilitator will guide the group in completing this activity within their teams. Each teacher team will be given a general mathematics topic such as addition or quadrilaterals. When teams have had time to create a series of questions, the facilitator will provide time for teams to share with the group.

Slide 13



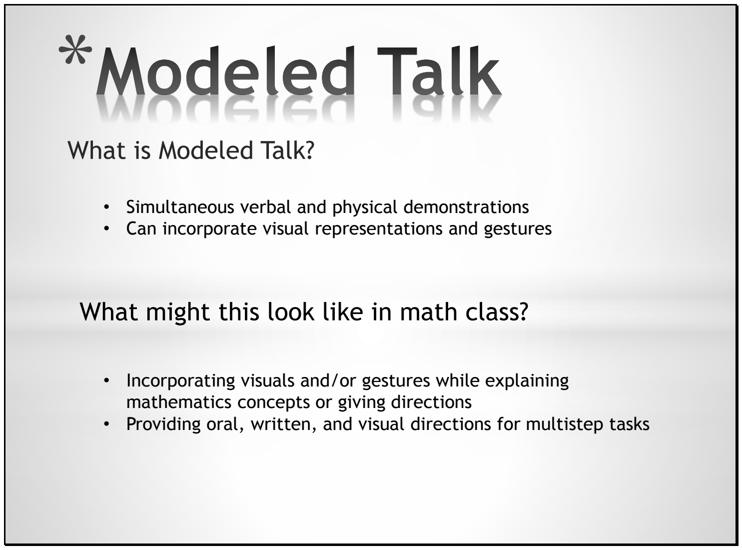
The facilitator will describe Preview/Review (Herrell & Jordan, 2016). The facilitator will acknowledge the challenge of time and resources that may be a factor for some teachers when implementing this strategy. This strategy can be adapted and incorporated into guided math and center activities that are already being used by some teachers. Also, as a part of shared responsibility, the preview and review portions can be provided by other teachers such as ESL teachers or Math coaches. This would require significant planning to ensure that the instruction is presented in a consistent way. An added benefit of this strategy is that it provides EL students with multiple exposures to the same content and vocabulary (Herrell & Jordan, 2016).

Slide 14



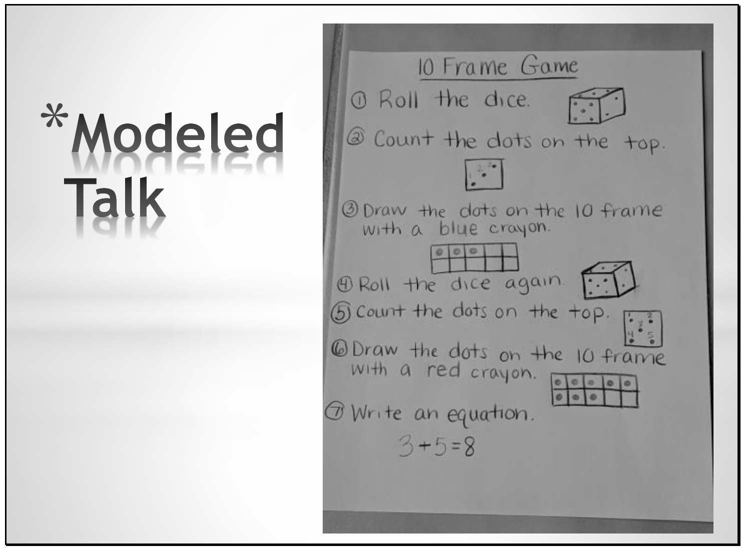
The facilitator will share this example of Preview/Review. The facilitator will have teacher teams discuss some ways this strategy could be used to support students at their school. The facilitator will have teacher teams share with the group.

Slide 15



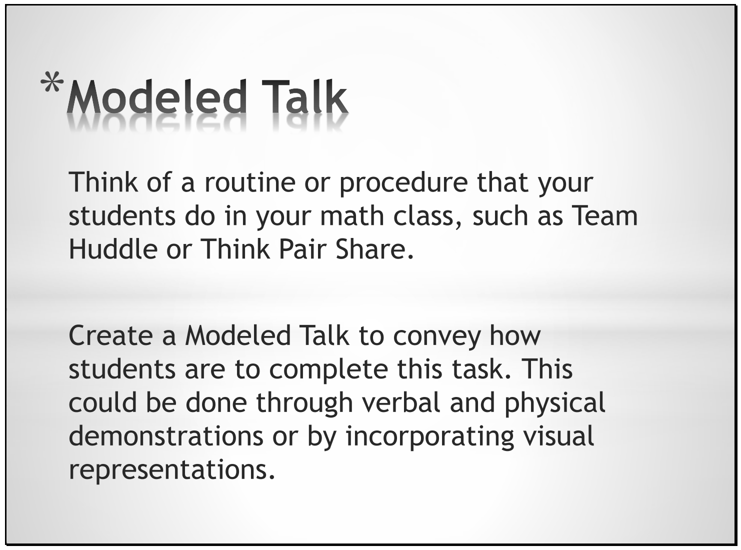
The facilitator will provide an overview of Modeled Talk, as presented by Herrell and Jordan (2016). Modeled talk is when teachers incorporate specific gestures or visual representations to provide EL students with specific directives (Herrell & Jordan, 2016). Herrell and Jordan (2016) recommend teachers practice their modeled talk in front of a mirror to ensure that your gestures and motions are communicating the message clearly to your students. The facilitator will ask teachers to point out any Modeled Talk that they have noticed the facilitator using throughout the session.

Slide 16



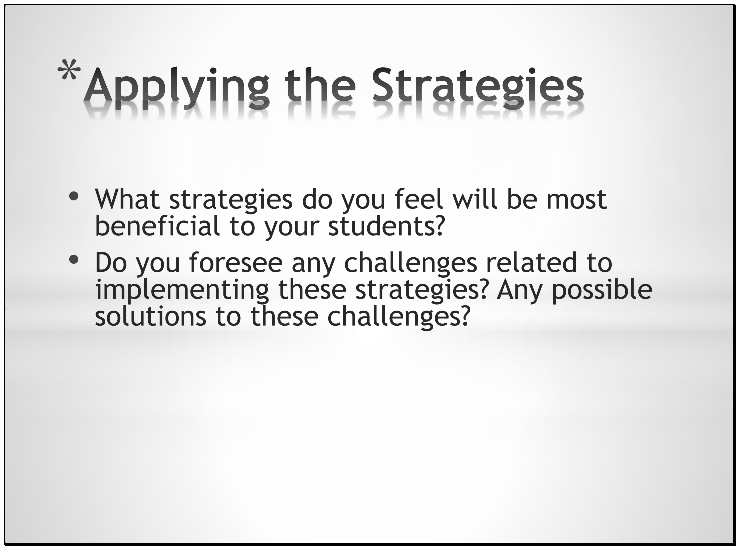
The facilitator will share this example of how Modeled Talk can be used for multiple step directions when incorporating a visual representation.

Slide 17



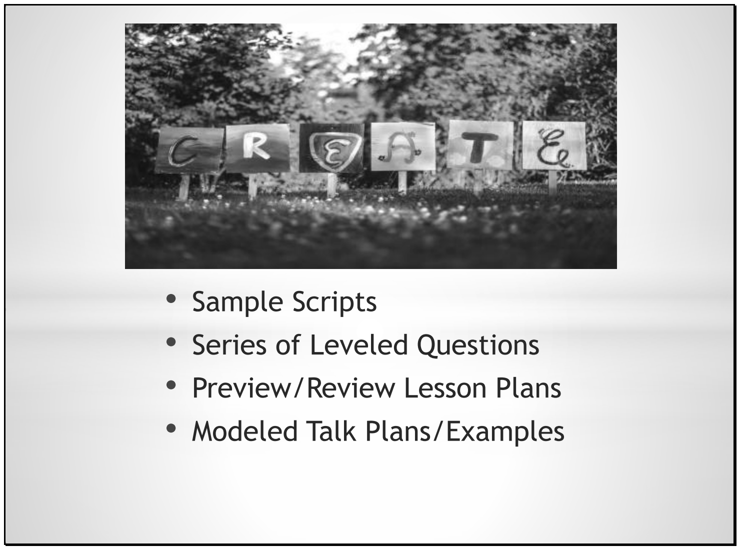
The facilitator will lead teachers in developing a Modeled Talk example for one of their classroom routines. Teachers will be able to work individually or collectively with their team. The facilitator will have some teachers share their Modeled Talk examples with the whole group.

Slide 18



This reflective activity will allow teachers an opportunity to think about how these strategies can be applied to their own classrooms. Teachers will have an opportunity to reflect individually and with their PLC group. Groups will then have an opportunity to share out. This activity will also serve as a troubleshooting session. As groups identify potential challenges, possible solutions will also be shared. The facilitator will be able to use this information to provide support in the future related to the identified challenges.

Slide 19

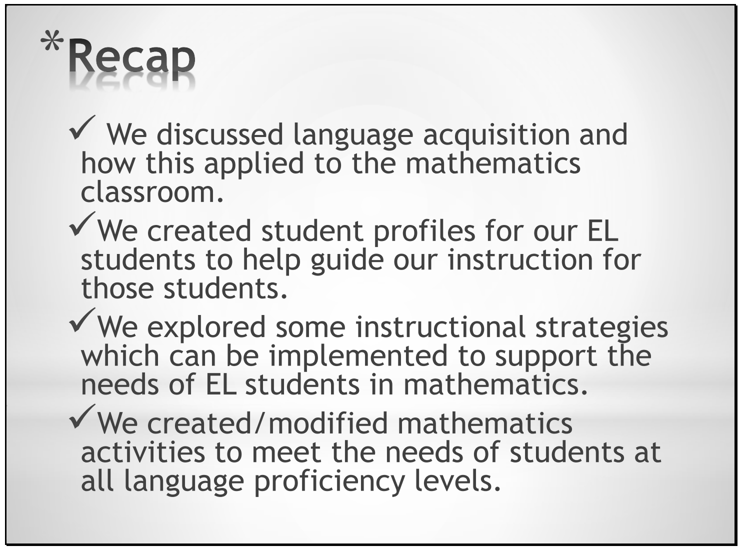


Finding time to create and modify resources to support EL students in mathematics is always a challenge. This is an opportunity for teachers to create scripts, leveled questions, preview/review lessons plans, and modeled talk examples to be used in their classrooms. The participants in the study emphasized the need for professional development to be practical and to be able to apply it directly to their classrooms. This will also allow the facilitator to provide any individualized support to teachers who may have questions or concerns.

Slide 20

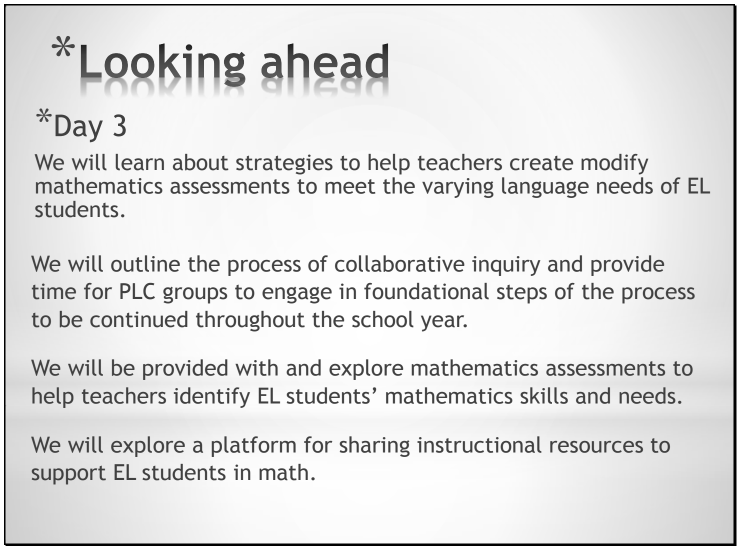
The facilitator will ask a few teachers to share the resources they created with the whole group. The facilitator will encourage teachers to bring any resources they created with them to Day 3.

Slide 21



The facilitator will give a brief summary of the activities covered in the professional development on Day 2.

Slide 22

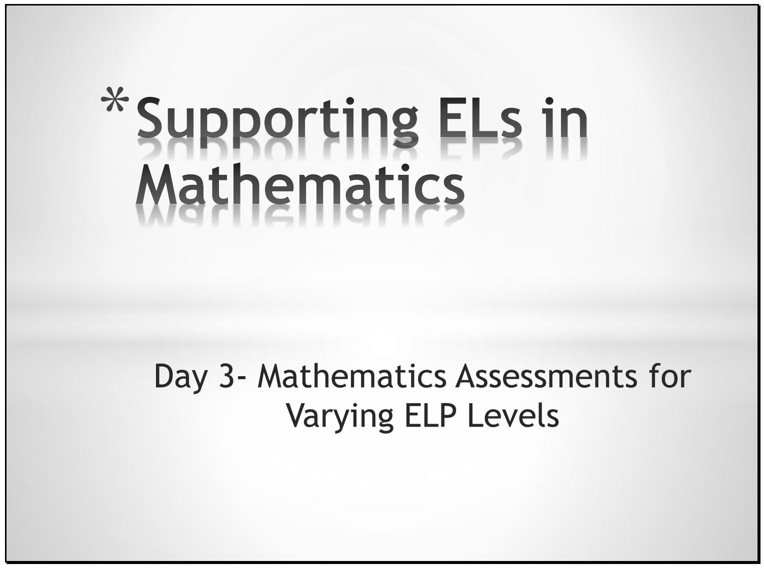


The facilitator will provide a brief overview of the topics and activities to be covered on Day 3 of the training.

Slide 23

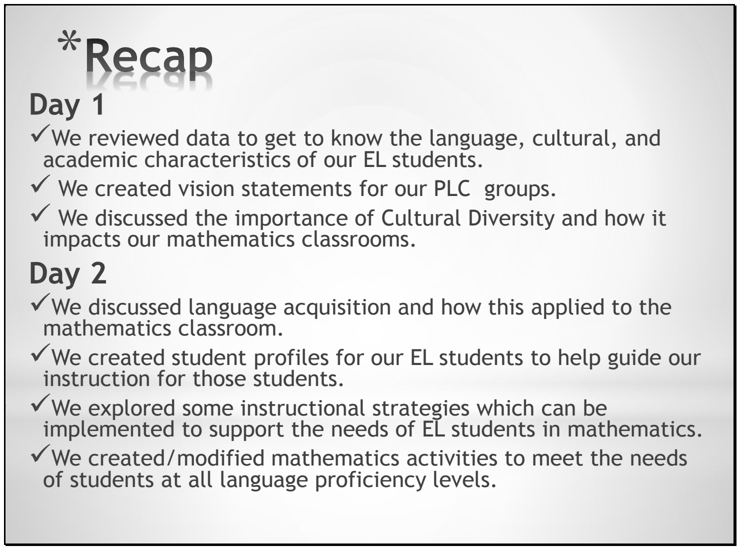

*References
Banes, L., Ambrose, R., Bayley, R., Restani, R., & Martin, H.(2018). Mathematical classroom discussion as an equitable practice: Effects on elementary english learners' performance. *Journal of Language, Identity & Education*, *17*(6), 416–433.
Herrell, A. & Jordan, M. (2008). *50 strategies for teaching english language learners* (2nd Custom Edition). New York, NY: Laureate Education.
Herrell, A. & Jordan, M. (2016). *50 strategies for teaching english language learners* (5th Edition). Boston, MA: Pearson.
Shea, L. M., Sandholtz, J. H., & Shanahan, T. B. (2018). We Are All Talking: A Whole-School Approach to Professional Development for Teachers of English Learners. *Professional Development in Education*, *44*(2), 190–208.

Slide 1



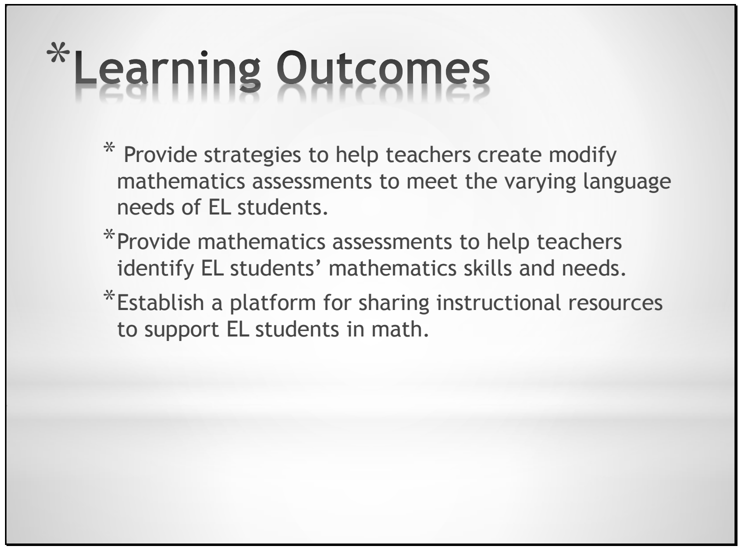
*Supporting ELs in Mathematics
Day 3- Mathematics Assessments for Varying ELP Levels

Slide 2



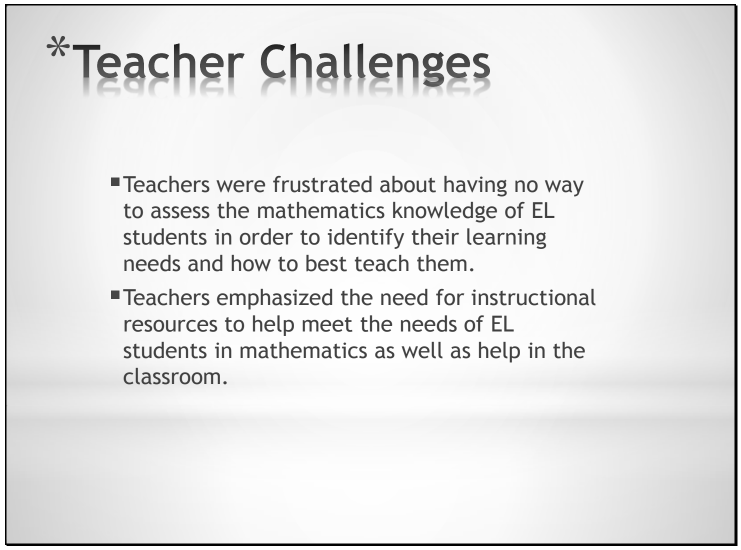
The facilitator will recap Day 1 and Day 2 of the professional development.

Slide 3



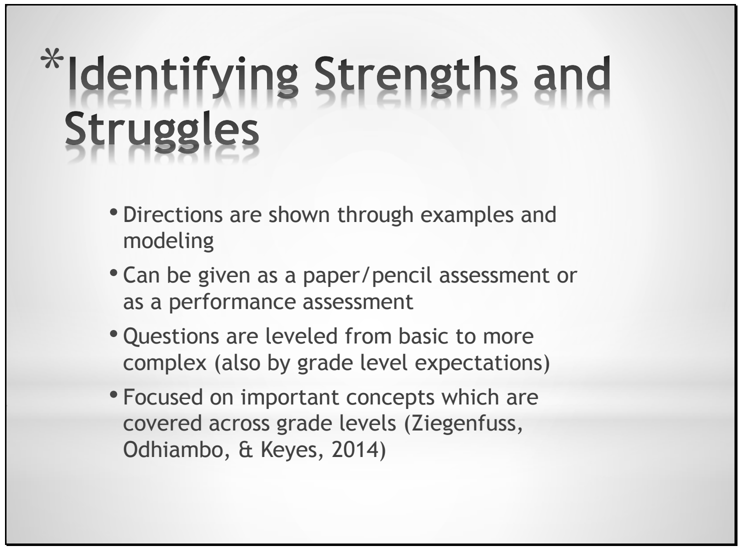
The facilitator will go over the learning outcomes for the session.

Slide 4



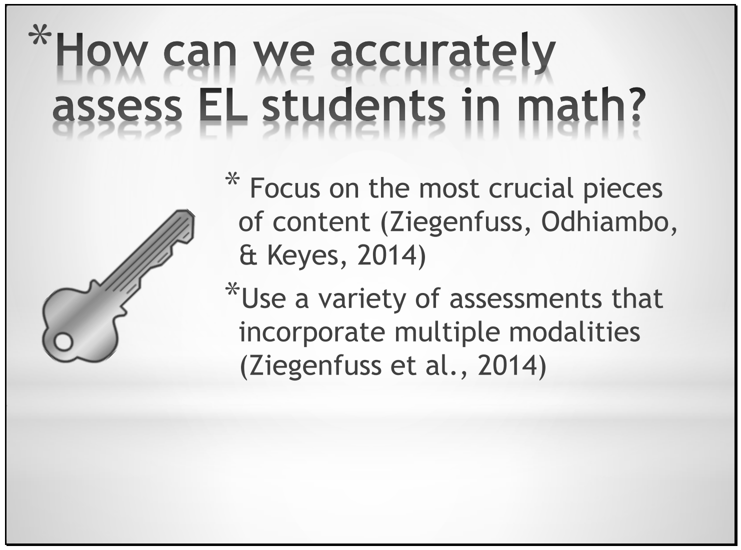
The facilitator will remind teachers about the doctoral study that was discussed on Day 1. Two of the major findings from this study will be addressed in this session. Two of the challenges reported by teachers were a need for effective mathematics assessments for EL students and a need for instructional resources. Today, I will be sharing a mathematics assessment, we will be discussing some formative assessment strategies, and we will explore a platform for sharing resources.

Slide 5



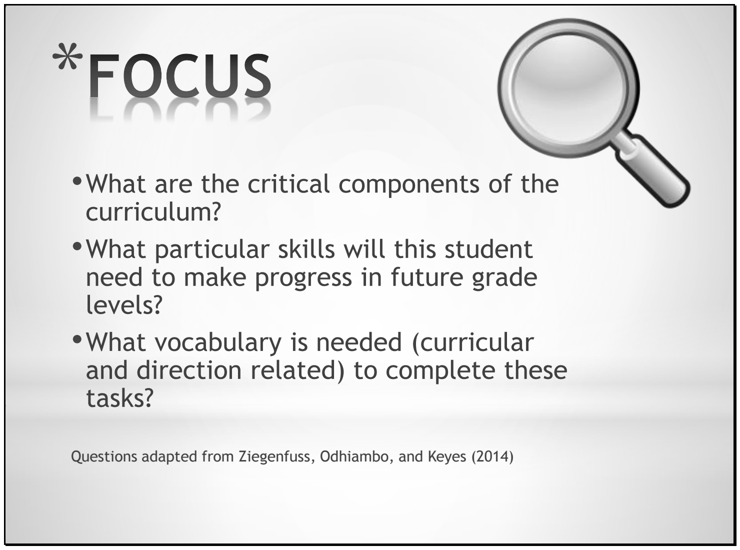
The facilitator will provide copies of math assessments for Grades K-2 and Grades 3-5. These assessments were created to address the need for an effective assessment to identify the strengths and struggles of EL students, specifically Newcomers. The facilitator will share the points above that were considered during the development of these assessments. Teachers will have time to review and/or complete the tests themselves. This will help them to see how the directions are shown through modeling and how the questions build in difficulty. Teachers will also receive a digital copy of these assessments through the district email.

Slide 6



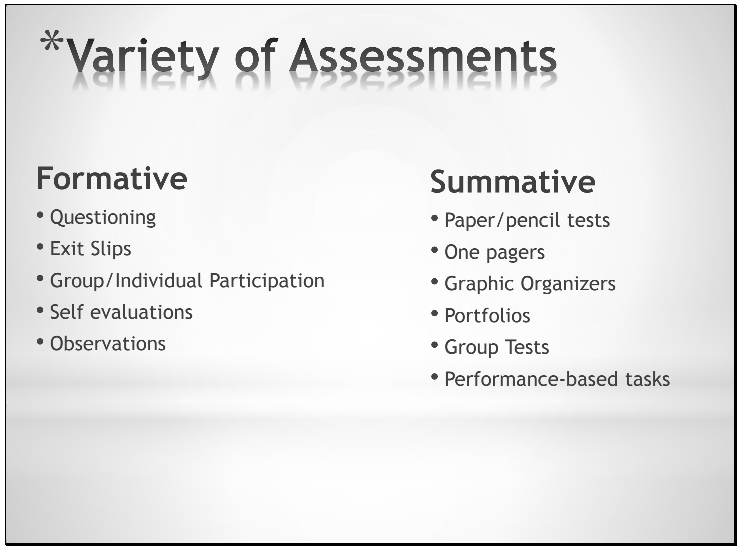
The facilitator will introduce the key points listed above to accurately assessing EL students in mathematics. Current researchers have emphasized the need to improve teachers' knowledge of assessing EL students through professional development (Hiatt & Fairbairn, 2018; Kim, Erekson, Bunten, & Hinchey, 2014). Teachers need professional development on formative and summative assessment strategies and how to modify assessments for EL students (Kim et al., 2014).

Slide 7



The facilitator will discuss the importance of providing EL students with access to rigorous grade level content (Ziegenfuss, Odhambo, & Keyes, 2014). In order for this to be beneficial and not overwhelming, teachers must focus on the most important parts of the curriculum for those students (Ziegenfuss et al., 2014). Before assessing an EL student, consider the above questions.

Slide 8



The facilitator will briefly go over the list of formative and summative assessments and ask teachers to add any others that they feel are relevant. The facilitator will tell teachers that they will not being going over every one of these assessment strategies as many of them are already being used regularly. However, teachers will be encouraged to ask questions about any of these strategies that are not covered. Also, assessments can be modified using the Can Do Descriptors (discussed on Day 2).

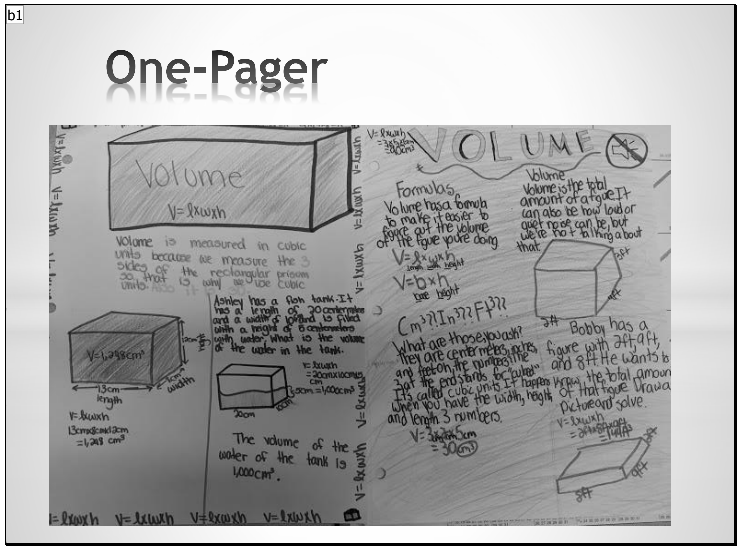
Slide 9

*Leveled Questioning

ELP Level	Primary	Intermediate
1- Entering	Did you get a sum of 10? (Thumbs up/down)	Can you show me a shape that is a quadrilateral? (point or draw)
2- Emerging	What did you do with 6 and 4 to make 10?	How many sides does a quadrilateral have?
3- Developing	How did you make a sum of 10?	How do you know that this shape is a quadrilateral?
4- Expanding	Tell me the steps you used to make 10?	How did you decide which shapes are quadrilaterals and which shapes are not?
5- Bridging	How do you know that 6 + 5 does not make 10?	If this shape is a rectangle, then it is also a quadrilateral. Why?
6- Reaching	How do you know when two numbers make 10? How do you know when they do not make 10?	Explain why all parallelograms are quadrilaterals but not all quadrilaterals are parallelograms.

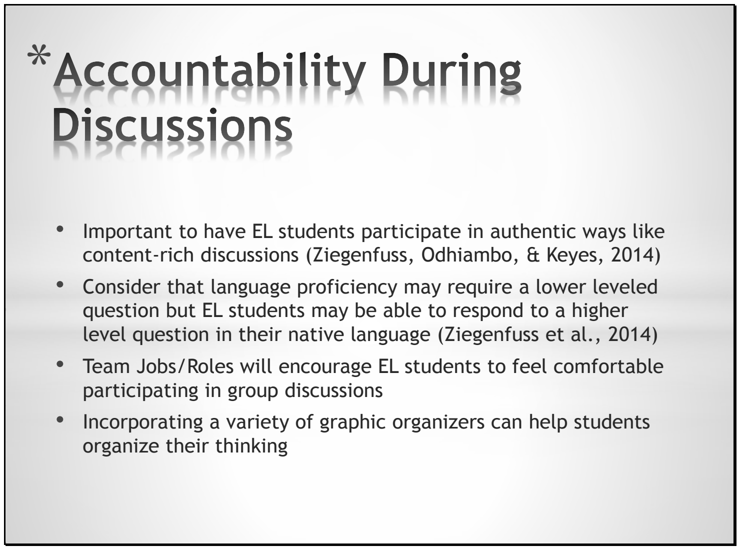
The facilitator will remind teachers of the discussion about Leveled Questioning from Day 2. This slide shows the example questions that were developed based on the information provided in the Can Do Descriptors and the Leveled Questioning Strategy described by Herrell and Jordan (2016). Leveled questioning can also be used when creating a pencil/paper test.

Slide 10



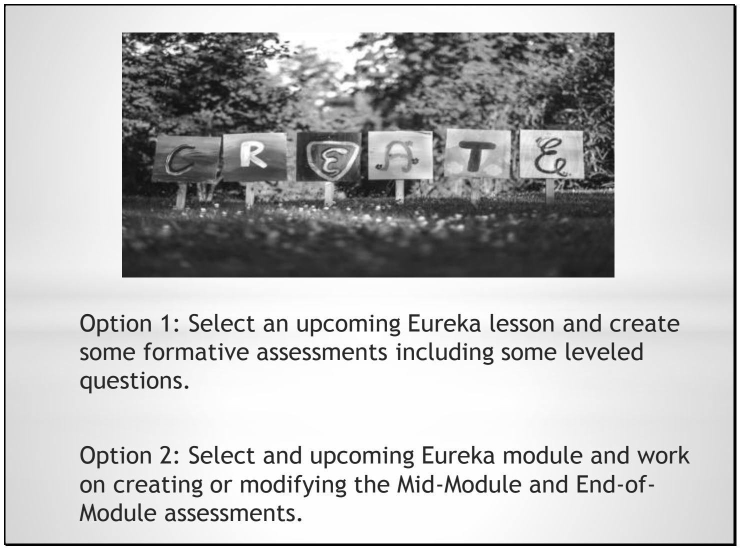
The facilitator will share these student examples of “one-pagers”. A “one-pager” is an activity or assessment where a teacher provides a list of specific criteria for a given topic (Fletcher, 2018). Students are encouraged to use their creativity to display their knowledge of the given topic while making sure to include all of the necessary criteria (Fletcher, 2018).

Slide 11



The facilitator will emphasize the importance of engaging EL students in authentic mathematics learning experiences including discussions (Ziegenfuss et al., 2014). The facilitator will remind teachers that an EL student may need a lower leveled question in order to respond in English, often times these students are capable of answering a much higher leveled question if they are able to do so in their native language (Ziegenfuss et al., 2014). The facilitator will share that most teachers are already assigning team jobs or roles. Fortunately, this is helpful for EL students as it can help them become more comfortable participating in group discussions by taking on their assigned role. It can also be helpful to provide graphic organizers for EL students to organize their thinking.

Slide 12



The facilitator will go over the two options for this activity. Teachers will be given time to create and/or modify assessments to meet the needs of their EL students.

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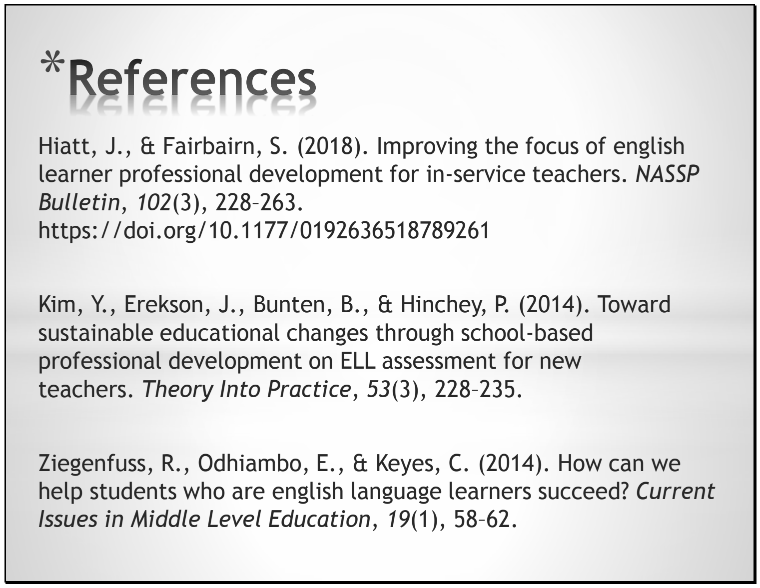
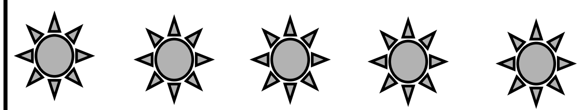
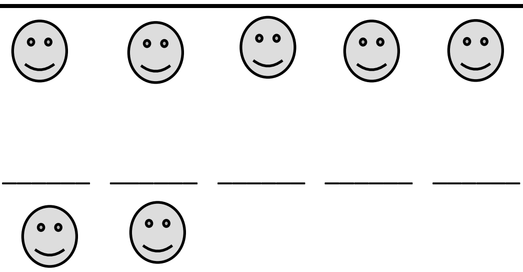
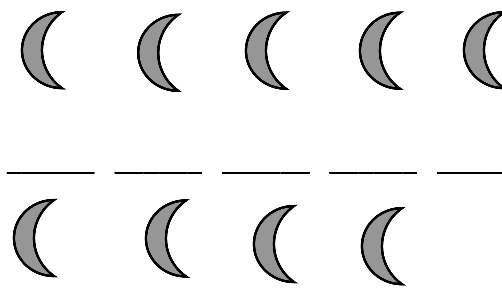
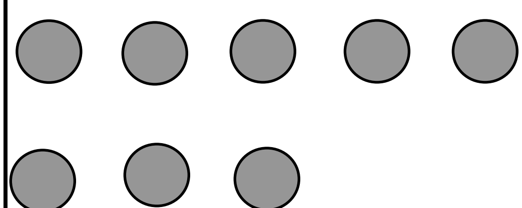

*References
Hiatt, J., & Fairbairn, S. (2018). Improving the focus of english learner professional development for in-service teachers. *NASSP Bulletin*, *102*(3), 228–263. https://doi.org/10.1177/0192636518789261
Kim, Y., Erekson, J., Bunten, B., & Hinchey, P. (2014). Toward sustainable educational changes through school-based professional development on ELL assessment for new teachers. *Theory Into Practice*, *53*(3), 228–235.
Ziegenfuss, R., Odhiambo, E., & Keyes, C. (2014). How can we help students who are english language learners succeed? *Current Issues in Middle Level Education*, *19*(1), 58–62.

K-2 Mathematics Assessment for EL Students

 1 2 ____ ____	 ____ ____ ____ ____ ____
 ____ ____ ____ ____ ____ ____ ____	 ____ ____ ____ ____ ____ ____ ____ ____ ____
8 	3
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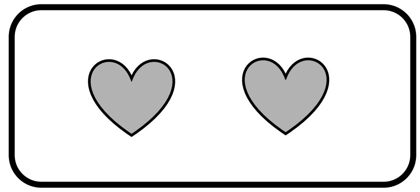

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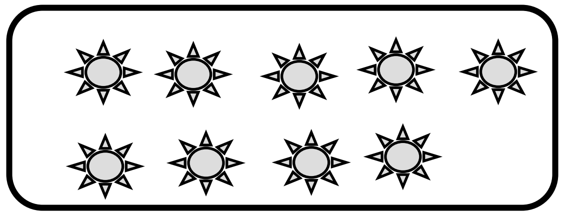

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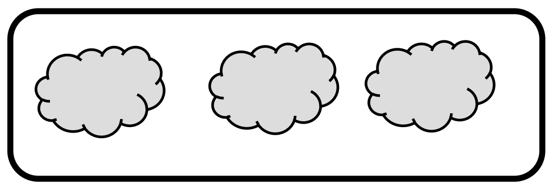

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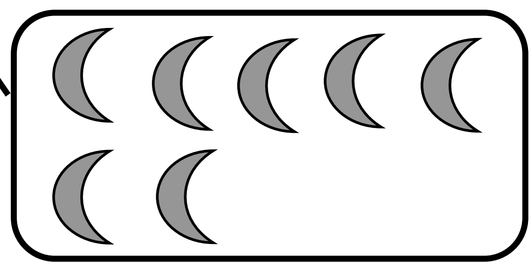

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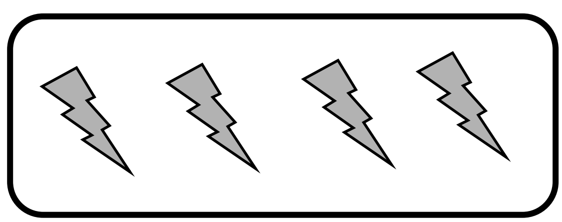

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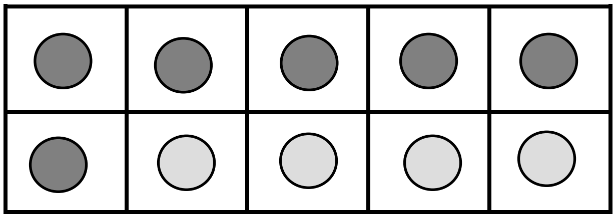
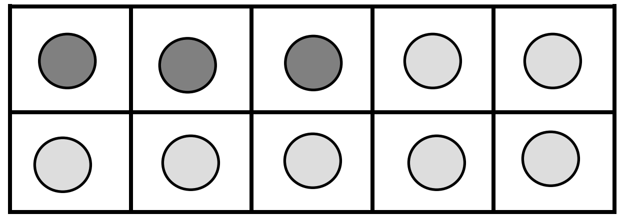
91								99	

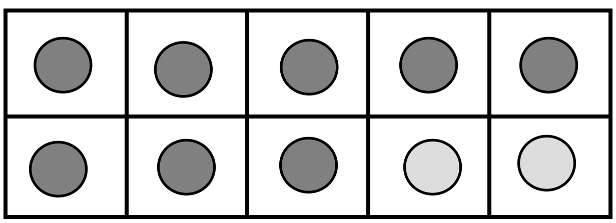
10	20	30							276



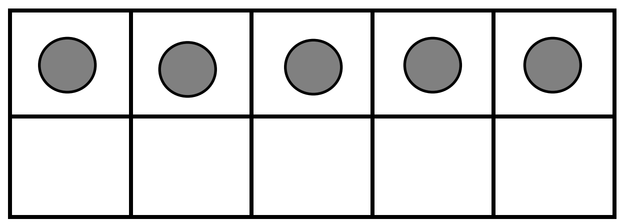
6 + 4 = 10



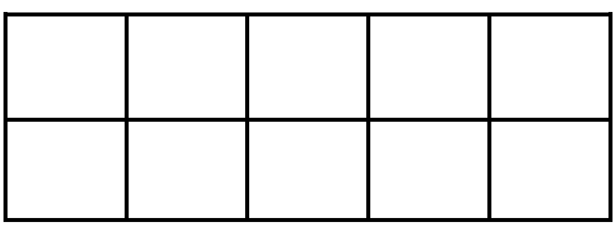
3 + ____ = 10



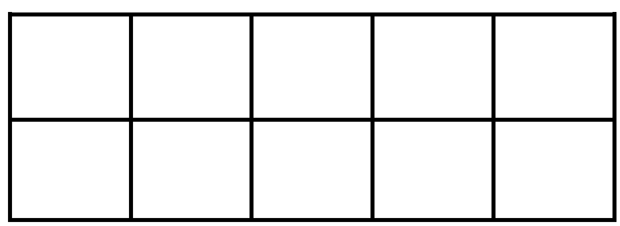
____ + ____ = ____



5 + ____ = ____



1 + 9 = 10

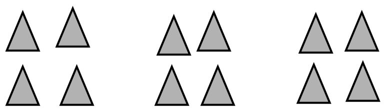
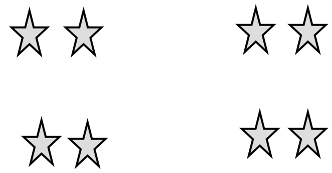
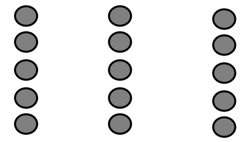
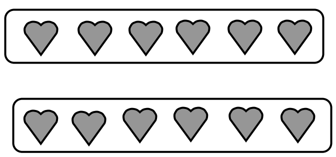
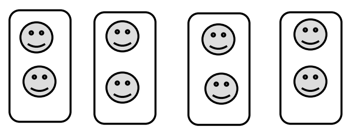
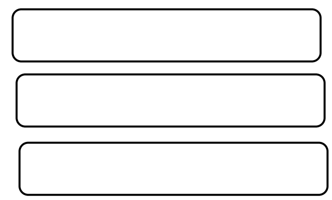


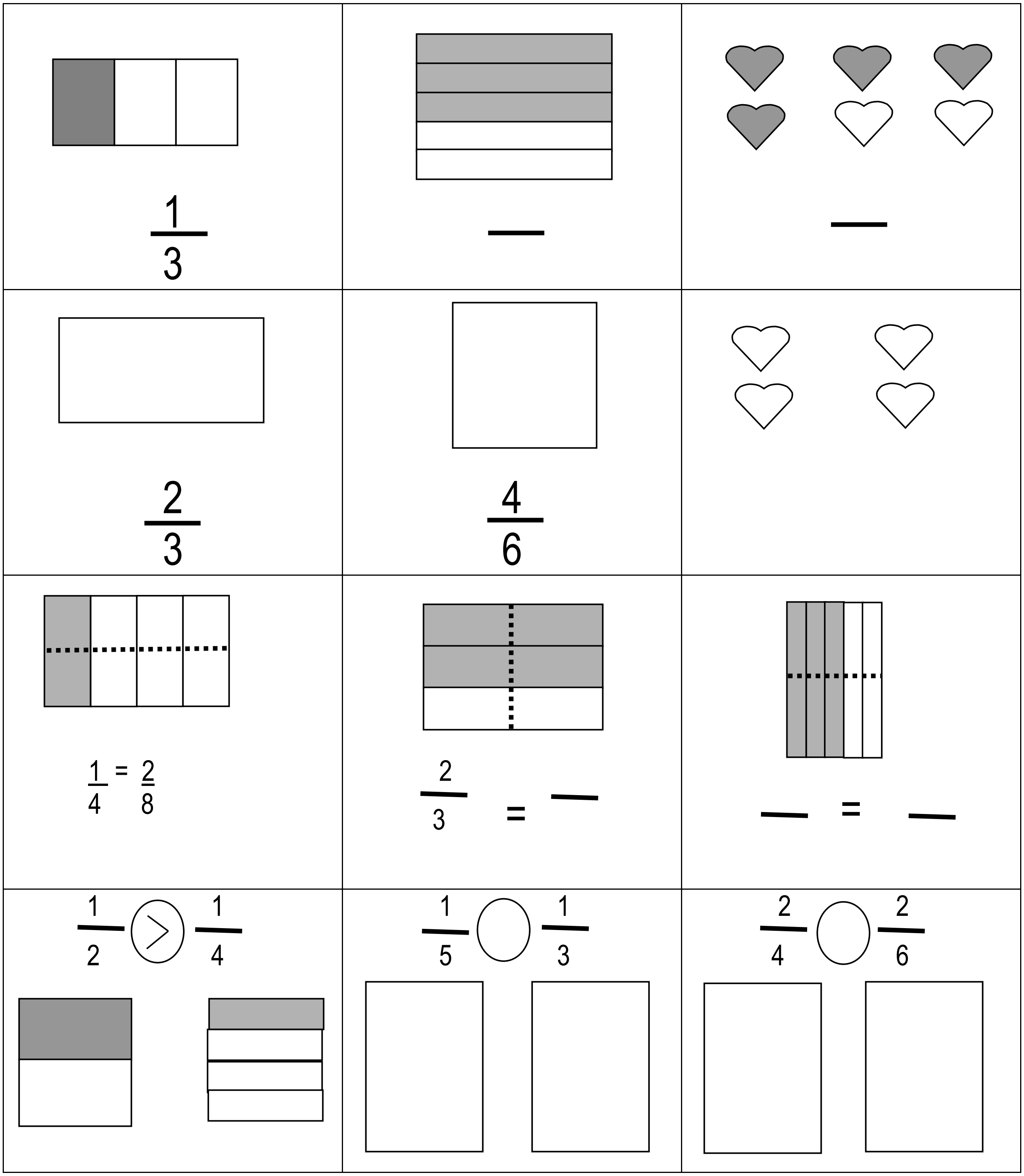
____+ ____ = 10

12 + 0 = ____	12+ 1 = ____
14 + 1 = ____	16 + 0 = ____
11 + 2 = ____	15 + 2 = ____
29 + 1 = ____	39 + 2 = ____
12 - 0 = ____	12 - 1 = ____
15 -1 = ____	20 - 0 = ____
12 - 2 = ____	18 - 2 = ____
30 - 1 = ____	31 - 2 = ____

$\begin{array}{r} 23 \\ +\ 15 \\ \hline \end{array}$	$\begin{array}{r} 38 \\ +\ 41 \\ \hline \end{array}$	$\begin{array}{r} 55 \\ +\ 37 \\ \hline \end{array}$
$\begin{array}{r} 136 \\ +\ 223 \\ \hline \end{array}$	$\begin{array}{r} 425 \\ +\ 361 \\ \hline \end{array}$	$\begin{array}{r} 785 \\ +\ 163 \\ \hline \end{array}$
$\begin{array}{r} 28 \\ -\ 15 \\ \hline \end{array}$	$\begin{array}{r} 86 \\ -\ 41 \\ \hline \end{array}$	$\begin{array}{r} 95 \\ -\ 37 \\ \hline \end{array}$
$\begin{array}{r} 468 \\ -\ 142 \\ \hline \end{array}$	$\begin{array}{r} 824 \\ -\ 256 \\ \hline \end{array}$	$\begin{array}{r} 705 \\ -\ 128 \\ \hline \end{array}$

4,285 + 1,313	27,528 + 11,653	304,918 + 269,468
5,685 - 2,413	46,328 - 21,653	300,325 - 164,416
6.52 + 2.39	8.8 + 4.36	2.065 + 0.860
14.62 - 5.86	6.247 - 0.859	7.005 - 2.486

4 x 3 = 12 3 x 4 = 12 4 + 4 + 4 = 12 	___ x ___ = ___ ___ x ___ = ___ ___ + ___ + ___ + ___ = ___ 	___ x ___ = ___ ___ x ___ = ___ ___ + ___ + ___ = ___ 
6 x 2 = 12 2 x 6 = 12 12 ÷ 2 = 6 12 ÷ 6 = 2 	___ x ___ = ___ ___ x ___ = ___ ___ ÷ ___ = ___ ___ ÷ ___ = ___ 	3 x 6 = 18 ___ x ___ = ___ 18 ÷ 3 = 6 ___ ÷ ___ = ___ 
$\begin{array}{r} 34 \\ \underline{\times\ 4} \end{array}$	$\begin{array}{r} 426 \\ \underline{\times\ 6} \end{array}$	$\begin{array}{r} 2{,}408 \\ \underline{\times\ 25} \end{array}$
$\begin{array}{r} 1.68 \\ \underline{\times\ 43} \end{array}$	$6\overline{)384}$	$12\overline{)519}$


1/3
2/3
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=
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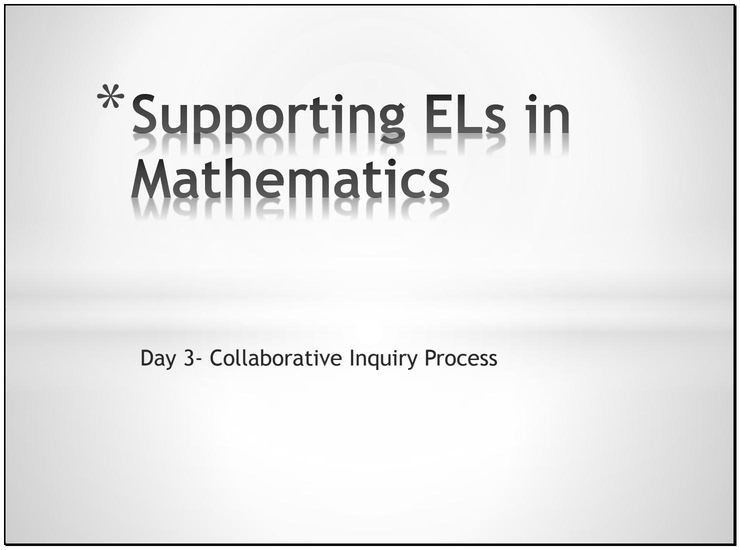
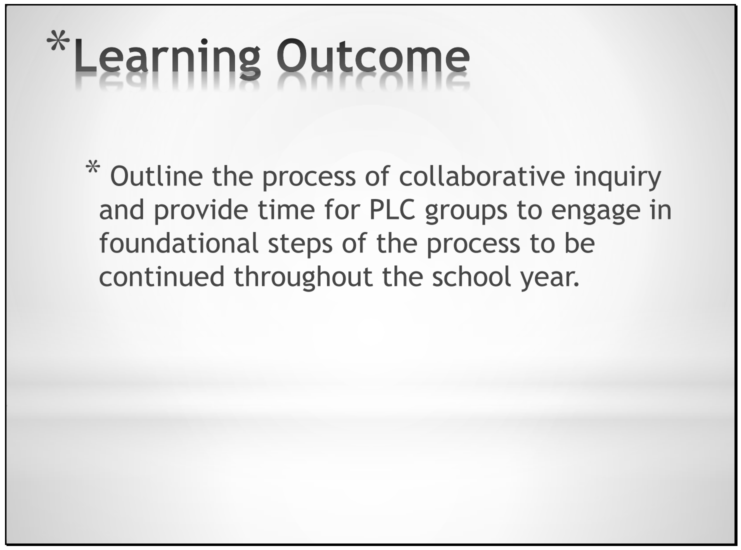
2/6

Slide 1

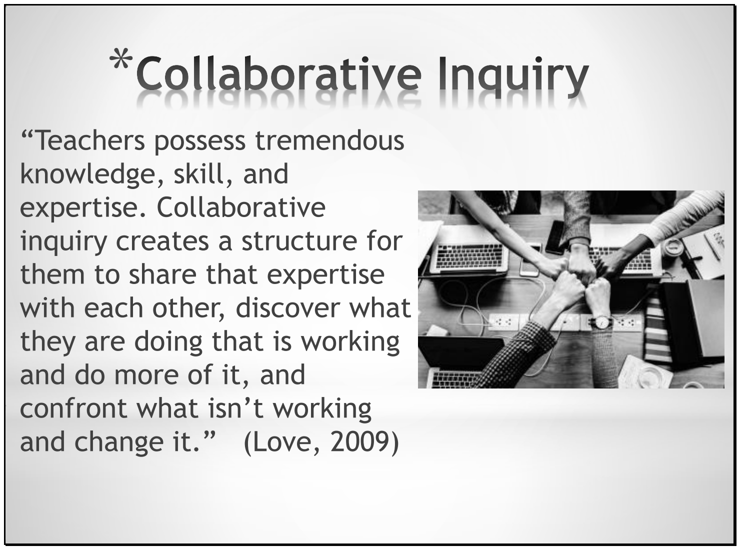

*Supporting ELs in Mathematics
Day 3- Collaborative Inquiry Process

Slide 2



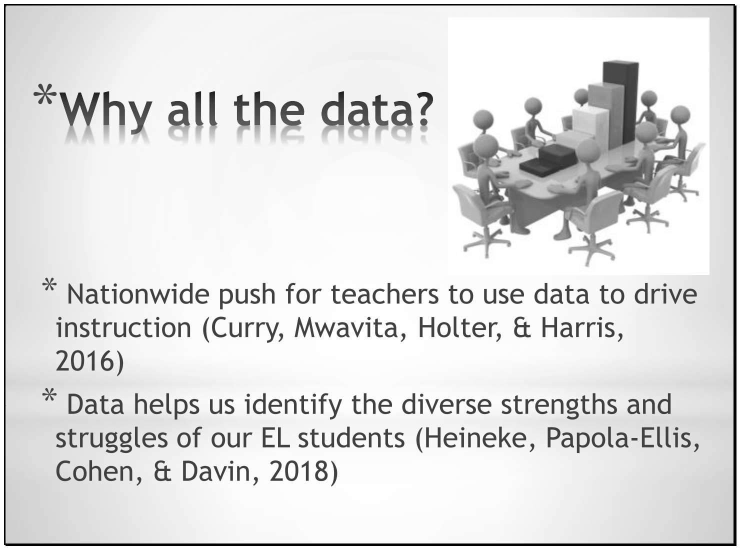
The facilitator will go over the learning outcome for the session.

Slide 3



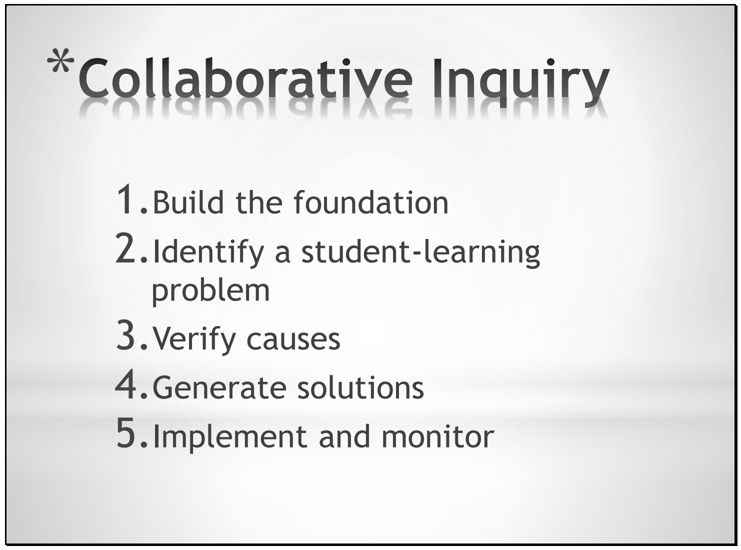
The facilitator will introduce the session by reading this quote.

Slide 4



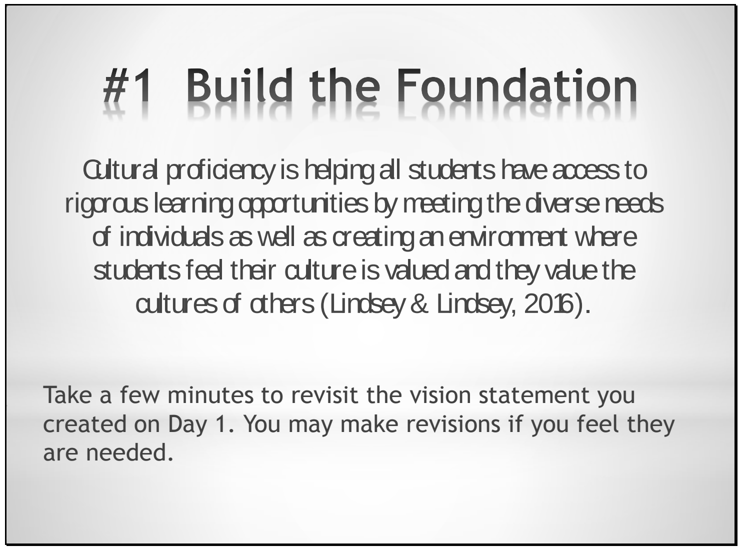
The facilitator will give a rationale for why data analysis is such an important part of this professional development. According to Curry, Mwavita, Holter, and Harris (2016), there has been a nationwide push for teachers to use data to drive instruction over the past several years. Curry et al. emphasized the importance of supporting teachers in learning and developing these skills as well as providing time for ongoing discussions with colleagues about student data. Data analysis helps us to identify the diverse strengths and struggles of our EL students (Heineke et al., 2018).

Slide 5



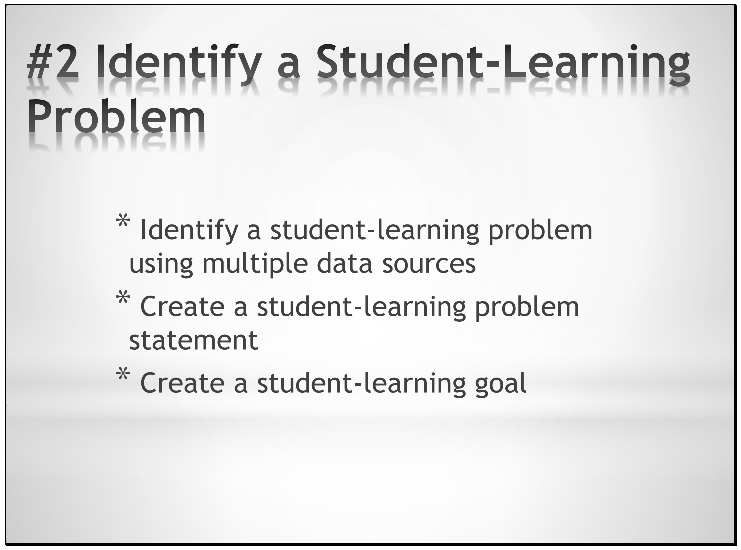
The facilitator will use the following slides to give a detailed overview of the collaborative inquiry process (Love, 2009). The teacher teams have already engaged in step 1 of the process on Day 1 when they discussed cultural proficiency and created vision statements.

Slide 6



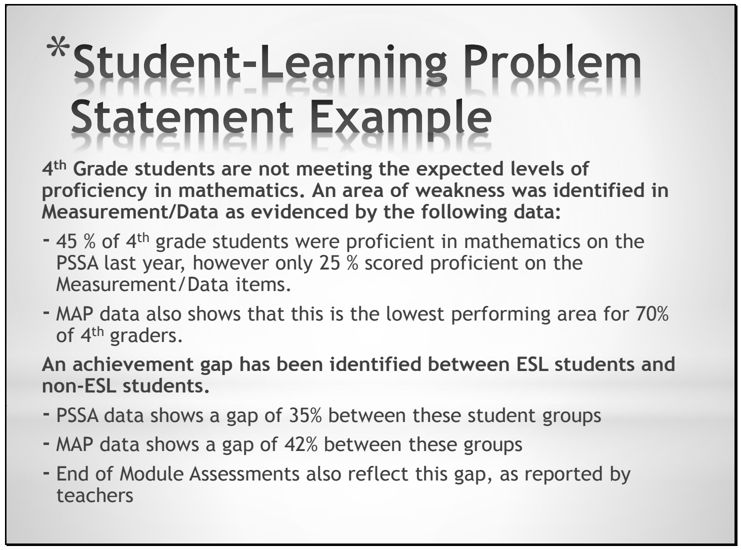
The facilitator will briefly review cultural proficiency (Lindsey & Lindsey, 2016) and the purpose of a vision statement (Love, 2009) from Day 1. Teacher teams will then have time to revisit and/or revise their mission statements.

Slide 7



The facilitator will review the process of identifying a student learning problem (Love, 2009). The first step is drilling down multiple data sources, one at a time, to gain as much information as possible to identify the student-learning problem (Love, 2009). Data analysis should include the following levels of data: aggregated, disaggregated, content areas, test items, and student work (Love, 2009). Since it is difficult to solve a problem if you are not sure what the problem is, it is very important to clearly define the student-learning problem (Love, 2009). The problem statement should include what the problem is, who it affects, and any achievement gaps that have been identified (Love, 2009). Along with this, comes the student-learning goal which must also be clear and measureable (Love, 2009).

Slide 8

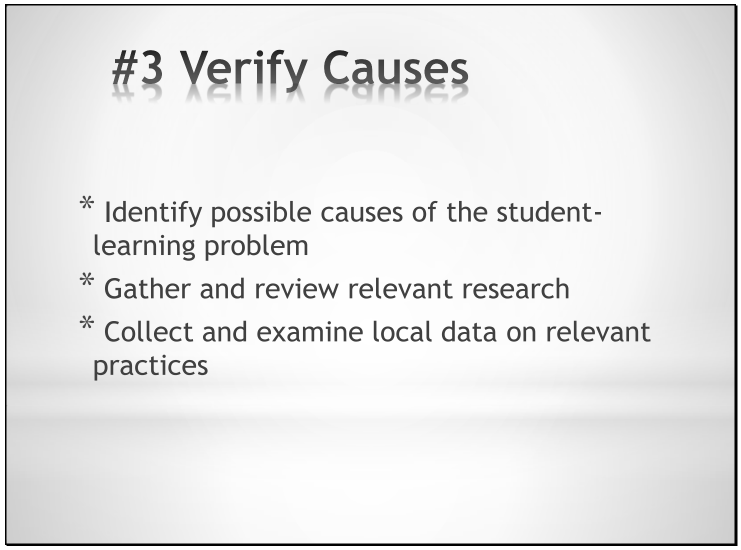


The facilitator will review this example of a Student-Learning Problem Statement and answer any questions about this process.

Slide 9

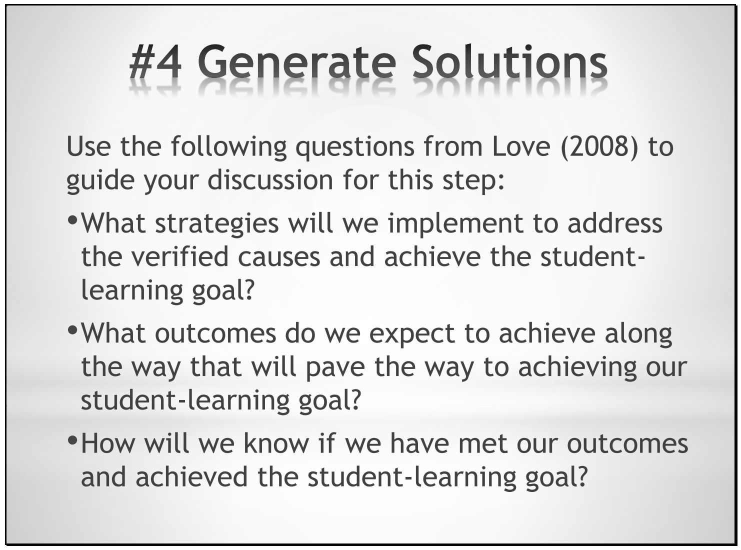
The facilitator will go over the elements of a SMART Goal (Love, 2009). The facilitator will have teacher teams create a SMART goal to go with the Student-Learning Problem example on the previous slide. The facilitator will need to put the previous slide back up for groups to reference during this activity. Then, the facilitator will ask the teacher teams to share their SMART goals with the group.

Slide 10



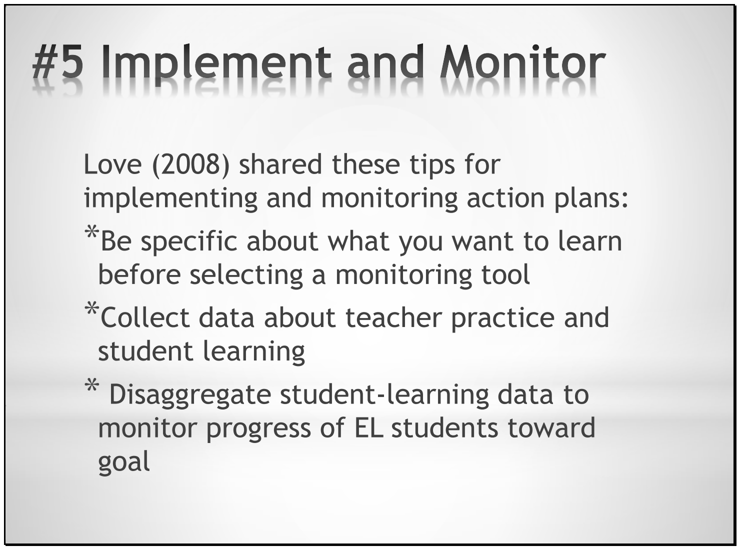
The facilitator will explain the process of verifying causes, gathering related research, and collecting local data on classroom practices as described in Love (2009).

Slide 11



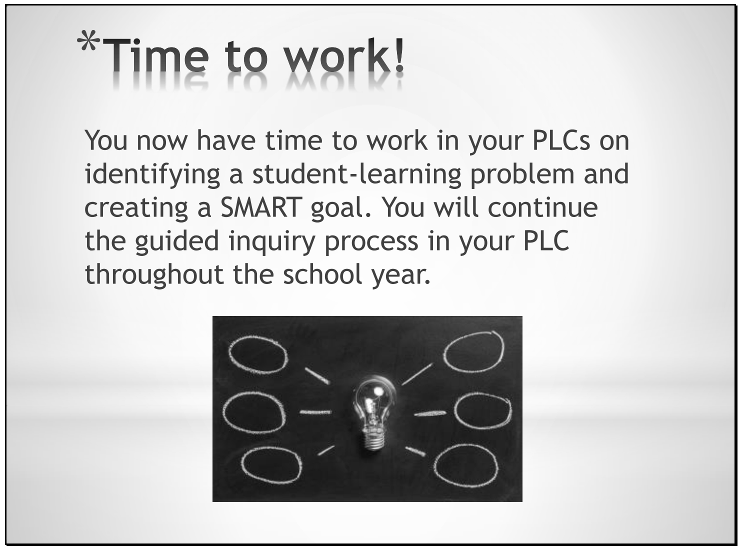
The facilitator will discuss the process of generating solutions as described in Love (2009), through these guiding questions.

Slide 12



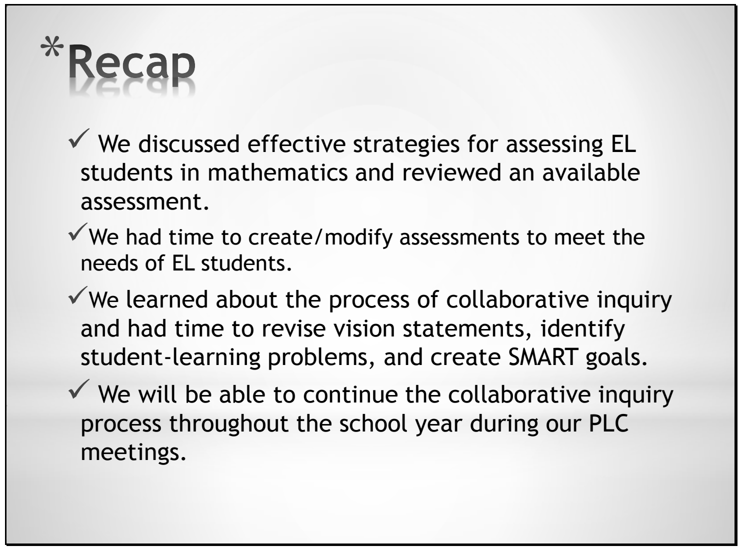
The facilitator will share tips for implementing and monitoring action plans (Love, 2009).

Slide 13

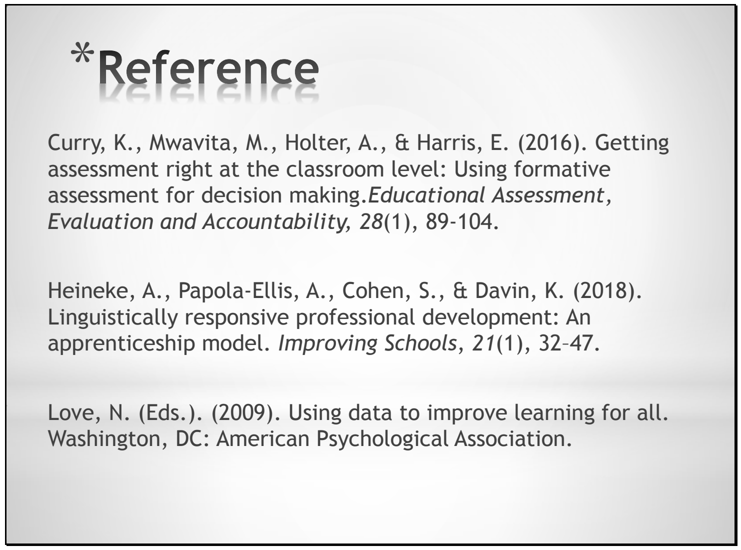


The facilitator will prove time for teachers to meet with their PLC groups to set the foundation for their collaborative inquiry which will continue throughout the school year. The facilitator will circulate and guide groups in this process when needed.

Slide 14


*Recap
✓ We discussed effective strategies for assessing EL students in mathematics and reviewed an available assessment.
✓We had time to create/modify assessments to meet the needs of EL students.
✓We learned about the process of collaborative inquiry and had time to revise vision statements, identify student-learning problems, and create SMART goals.
✓ We will be able to continue the collaborative inquiry process throughout the school year during our PLC meetings.

Slide 15


*Reference
Curry, K., Mwavita, M., Holter, A., & Harris, E. (2016). Getting assessment right at the classroom level: Using formative assessment for decision making.*Educational Assessment, Evaluation and Accountability, 28*(1), 89-104.
Heineke, A., Papola-Ellis, A., Cohen, S., & Davin, K. (2018). Linguistically responsive professional development: An apprenticeship model. *Improving Schools*, *21*(1), 32–47.
Love, N. (Eds.). (2009). Using data to improve learning for all. Washington, DC: American Psychological Association.

“Supporting ELs in Mathematics” Formative Evaluation Form

Date ____________________ Facilitator/Instructor
____

Session Name
____

Please respond by circling the number that best describes your opinion of the professional development training.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The learning outcomes for the professional development were clearly communicated.	**1**	**2**	**3**	**4**	**5**
The activities and resources were relevant to achieving the learning outcomes.	**1**	**2**	**3**	**4**	**5**
The information presented was clear and easy to understand.	**1**	**2**	**3**	**4**	**5**
The pacing of the presentation and activities was appropriate.	**1**	**2**	**3**	**4**	**5**
The information and resources shared are applicable to my teaching situation.	**1**	**2**	**3**	**4**	**5**
I am satisfied overall with my experience with this professional development training.	**1**	**2**	**3**	**4**	**5**

How do you plan to apply what you have learned in your classroom?
____
____
____

Recommendations for future trainings:
____
____
____

“Supporting ELs in Mathematics” Summative Evaluation Form

Date ____________________

Please respond by circling the number that best describes your opinion of how the professional development training effected your knowledge and instructional practices.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The initial trainings prepared me to use collaborative inquiry to improve the learning in my classroom.	**1**	**2**	**3**	**4**	**5**
The initial trainings provided instructional strategies that I was able to apply to my classroom.	**1**	**2**	**3**	**4**	**5**
The resources I gained through this training were relevant and helpful in the classroom.	**1**	**2**	**3**	**4**	**5**
I feel that my participation in this professional development training has improved my ability to meet the needs of EL students in mathematics.	**1**	**2**	**3**	**4**	**5**

How have you applied your learning from this professional development to your classroom/students?

____

____

____

What barriers, if any, have you encountered when applying your learning?

____

____

____

Which resources from this training were most helpful?

____

____

____

Other comments:

____

____

____

Appendix B: Interview Protocol

Study: A Qualitative Case Study of the Instructional Practices for Elementary English Learner Students in Mathematics

Time of interview:

Date:

Location:

Interviewer:

Pseudonym:

Project Description: Thank you for coming today! I am currently working on my Doctoral Project Study through Walden University. The purpose of my study is to explore how effective instructional practices related to building background, student interactions, and opportunities for practice and application are currently being implemented during mathematics instruction for English Learners. Today I will be conducting an initial interview which will be followed up with an email interview at a later date. I will be audio taping the interview, as per your consent, so that I can more accurately transcribe our conversation. All information shared today will be confidential as I will not include any names in my study. I will send you a copy of the interview transcript to review to ensure I accurately recorded today's interview.

Questions:

Please give a brief overview of your teaching experience and your current teaching situation. (How long have you been teaching? What school do you work at? Grade level?)

What preparation, if any, have you had for working with English Learners?

What experience do you have working with English Learners in mathematics?

Tell me about the role building background knowledge through prior knowledge and vocabulary plays during your mathematics instruction?

What instructional practices, if any, do you use to help EL students build background knowledge?

Describe how you provide opportunities for EL students to verbally interact with you and with their peers during your mathematics instruction

How do you support your EL students when they are interacting with you or with their fellow students in the classroom?

Tell me about how opportunities for practice and application of mathematics concepts play a role during your instruction of mathematics to EL students.

In what ways, if any, do you support your EL students during opportunities for practice and application of mathematics concepts?

Describe any challenges you encounter related to providing effective instruction for ELs in mathematics.

Appendix C: Follow-Up Interview Protocol

Have you ever reached out for help/support regarding teaching mathematics to EL students? If so, tell me about whom you asked and the response you received.

How does the transiency of EL students impact your ability to provide effective instruction in mathematics?

How does student behavior of EL students impact your ability to provide effective mathematics instruction to these students?

When you have a new EL student, how do you go about finding out where they are academically and/or their language level?

Have you found that working with EL students from some backgrounds are more challenging than others? If so, why?

Do you feel that the current available assessments (Eureka, MAP, PSSA, etc.) accurately assess the mathematics skills/knowledge of your EL students? Why or why not?

Appendix D: Sheltered Instruction Observation Protocol

The Sheltered Instruction Observation Protocol (SIOP®)
(Echevarria, Vogt, & Short, 2000; 2004; 2008)

Observer(s): ______ Teacher: ______
Date: ______ School: ______
Grade: ______ Class/Topic: ______
ESL Level: ______ Lesson: Multi-day Single-day *(circle one)*

Total Points Possible: 120 (Subtract 4 points for each NA given) ______
Total Points Earned: _____ Percentage Score: _____

Directions: Circle the number that best reflects what you observe in a sheltered lesson. You may give a score from 0–4 (or NA on selected items). Cite under "Comments" specific examples of the behaviors observed.

	Highly Evident		Somewhat Evident		Not Evident	
Preparation	4	3	2	1	0	
1. **Content objectives** clearly defined, displayed, and reviewed with students	❑	❑	❑	❑	❑	
2. **Language objectives** clearly defined, displayed, and reviewed with students	❑	❑	❑	❑	❑	
3. **Content concepts** appropriate for age and educational background level of students	❑	❑	❑	❑	❑	
4. **Supplementary materials** used to a high degree, making the lesson clear and meaningful (e.g., computer programs, graphs, models, visuals)	❑	❑	❑	❑	❑	
5. **Adaptation of content** (e.g., text, assignment) to all levels of student proficiency	❑	❑	❑	❑	❑	
6. **Meaningful activities** that integrate lesson concepts (e.g., surveys, letter writing, simulations, constructing models) with language practice opportunities for reading, writing, listening, and/or speaking	❑	❑	❑	❑	❑	
Comments:						
Building Background	4	3	2	1	0	NA
7. **Concepts explicitly linked** to students' background experiences	❑	❑	❑	❑	❑	❑
8. **Links explicitly made** between past learning and new concepts	❑	❑	❑	❑	❑	
9. **Key vocabulary** emphasized (e.g., introduced, written, repeated, and highlighted for students to see)	❑	❑	❑	❑	❑	
Comments:						
Comprehensible Input	4	3	2	1	0	
10. **Speech** appropriate for students' proficiency level (e.g., slower rate, enunciation, and simple sentence structure for beginners)	❑	❑	❑	❑	❑	
11. **Clear explanation** of academic tasks	❑	❑	❑	❑	❑	
12. **A variety of techniques** used to make content concepts clear (e.g., modeling, visuals, hands-on activities, demonstrations, gestures, body language)	❑	❑	❑	❑	❑	
Comments:						
Strategies	4	3	2	1	0	
13. Ample opportunities provided for students to use **learning strategies**	❑	❑	❑	❑	❑	

	Highly Evident		Somewhat Evident		Not Evident	
	4	3	2	1	0	
14. **Scaffolding techniques** consistently used assisting and supporting student understanding (e.g., think-alouds)	❑	❑	❑	❑	❑	
15. A variety of **questions or tasks that promote higher-order thinking skills** (e.g., literal, analytical, and interpretive questions)	❑	❑	❑	❑	❑	
Comments:						
Interaction	4	3	2	1	0	
16. Frequent opportunities for **interaction** and discussion between teacher/student and among students, which encourage elaborated responses about lesson concepts	❑	❑	❑	❑	❑	
17. **Grouping configurations** support language and content objectives of the lesson	❑	❑	❑	❑	❑	
18. Sufficient **wait time for student responses** consistently provided	❑	❑	❑	❑	❑	NA
19. Ample opportunities for students to **clarify key concepts in L1** as needed with aide, peer, or L1 text	❑	❑	❑	❑	❑	❑
Comments:						
Practice/Application	4	3	2	1	0	NA
20. **Hands-on materials and/or manipulatives** provided for students to practice using new content knowledge	❑	❑	❑	❑	❑	❑
						NA
21. Activities provided for students to **apply content and language knowledge** in the classroom	❑	❑	❑	❑	❑	❑
22. Activities integrate all **language skills** (i.e., reading, writing, listening, and speaking)	❑	❑	❑	❑	❑	
Comments:						
Lesson Delivery	4	3	2	1	0	
23. **Content objectives** clearly supported by lesson delivery	❑	❑	❑	❑	❑	
24. **Language objectives** clearly supported by lesson delivery	❑	❑	❑	❑	❑	
25. **Students engaged** approximately 90% to 100% of the period	❑	❑	❑	❑	❑	
26. **Pacing** of the lesson appropriate to students' ability level	❑	❑	❑	❑	❑	
Comments:						
Review/Assessment	4	3	2	1	0	
27. Comprehensive **review of key vocabulary**	❑	❑	❑	❑	❑	
28. Comprehensive **review of key content concepts**	❑	❑	❑	❑	❑	
29. Regular **feedback** provided to students on their output (e.g., language, content, work)	❑	❑	❑	❑	❑	
30. **Assessment of student comprehension and learning** of all lesson objectives (e.g., spot checking, group response) throughout the lesson	❑	❑	❑	❑	❑	
Comments:						

Appendix E: Action Sequence

Action Sequence

AMAO 3 ACTION SEQUENCE

Directions: If the entity failed to meet the target for AMAO 3, an Action Sequence must be developed to address the problem.

STEP 1: What is the problem?		**STEP 2: What will you do?**
Area of Concern:	**Underlying Root Cause:**	**Research Based Strategies/Best Practices:**
1. Math PSSA and Keystone	1. There are no math concepts in the ESL curriculum because ELs are never pulled from math. 2. There are no math interventions currently in place. 3. There has been an increase in rigor with PA Core, Keystones, and new district math curriculum.	1. Content teachers will integrate math vocabulary. 2. ELs with a lower language proficiency level will use DreamBox Math to learn foundational math skills on their curriculum level. 3. Content teachers will use power teaching to increase ELs' participation in class.

STEP 3: How will you get there?

What Needs to Be Done: *Describe "What needs to be done" to implement this research based strategy/best practice.*	By Whom?	By When?	What Resources?
1. Need to meet during PLCs to discuss math content vocabulary.	Math Supervisor, Math Coaches, ESL Supervisor, ESL Teachers	June 2017	Eureka (math curriculum), SAS Overlay, Assessment Anchors and Eligible Content Glossary
2. Need to develop time for students to use DreamBox for recommended times.	Content Teachers, ESL Teachers, Math Coaches	October 2016	Zearn, ST Math, School 21, and DreamBox
3. Need to evaluate ELs' participation in math lessons (groups).	Math Content Teachers, Math Coaches	June 2017	Power Teaching Rubric

STEP 4: How will you know you are doing what you planned?	**Step 5: What will you look for to determine if it is working?**
Indicators of Implementation	Indicators of Effectiveness
-Collect PLC notes to check progress of creating grade level content vocabulary. -Students in selected buildings who are struggling significantly with math and/or new to the country will use the recommendation from DreamBox to use the program at least (30-60 minutes for K-2nd grade) and (60-90 minutes for 3rd-12th grade). Teachers are encouraged to have the students use it daily based on students' level of need to support grade level curriculum. Teachers will log in at least weekly (Mondays) to check student participation and progress. Teachers will print standards at least monthly for student data report to check growth with the math content. -Collect Walk Through Forms from informal observations to look for EL participation in	-Use MAP scores to track student growth in math. -Look at the areas (skills) to see where students are excelling and areas that still need to be addressed. Assign a focus on DreamBox, if necessary. -The forms should show all ELs are participating.

STEP 1: What is the problem?	STEP 2: What will you do?

Action Sequence	PROFESSIONAL DEVELOPMENT
power teaching lessons.	

***National Clearinghouse for English Language Acquisition main site.* *http://www.ncela.gwu.edu/*
Directions: List the Professional Development needed to implement the planned Action Sequences.

STEP 6: *What professional development is needed for implementation?*			
Date/Time *When?*	**Topic/Focus/Purpose**	**Facilitator/Provider** *By whom?*	**What changes in practice do you expect to see as a result of the Professional Development?**
PLC – 2016-17 School Year 8:15 – 8:40	Create grade level vocabulary lists	Math Content Teachers Math Coaches ESL Teacher	Team will create a list of vocabulary words for each unit of the math curriculum. Team can use Eureka and Assessment Anchors and Eligible Content Glossary from PDE.
September 30	ESL Capacity – Building Series	Intermediate Unit 12	To support leadership; increase the instructional effectiveness of the ESL program.

STEP 6: *What professional development is needed for implementation?*			
Date/Time *When?*	**Topic/Focus/Purpose**	**Facilitator/Provider** *By whom?*	**What changes in practice do you expect to see as a result of the Professional Development?**
PLC – October 8:15 – 8:40	Discuss Math Overlay	ESL Teachers	ESL Teachers can help content teachers learn how to differentiate lesson plans based on language proficiency levels.
PLC – October 8:15 – 8:40	Implement computer strategies (School 21, DreamBox, Zearn included with Eureka curriculum)	ESL Teachers Math Content Teachers Math Coaches	Content teachers would have ELs use the computer programs in class during a designated time.
October 13-14, 2016	WIDA National Conference	WIDA Conference Planning Team	To better understand how to help ELs in math and to provide support to help teachers differentiate their lesson plans.

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WALDEN UNIVERSITY
1001 FLEET STREET
BALTIMORE, MD 21202

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