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The Efficacy of Sheltered Instruction Observation Protocol (SIOP) in Mathematics Instruction on English Language Learner Students

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COLLEGE OF EDUCATION

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Jose Vidot

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Abstract

Studies by the National Association for Educational Progress found that English Language Learner (ELL) students perform poorly compared to other students on standardized mathematics exams. The research problem addressed how Sheltered Instruction Observation Protocol (SIOP) affected the instructional practices of high school mathematics teachers. The purpose of this evaluative case study approach was to explore the extent to which the implementation of SIOP influenced mathematics instruction in a mid-sized rural high school. The conceptual framework for this study was formed by combining Krashen's i+1 nativist theory for language acquisition through comprehensible input, Long's interactionist theory for acquisition of knowledge and Bandura's teacher efficacy theory. A concurrent mixed method design was selected to draw together inferences from both qualitative and quantitative data. NVivo software was used to combine a line by line analysis of interviews with an analysis of the components on the SIOP observation checklist. Interview findings suggest that teachers expressed a favorable response to SIOP since implementation. Classroom observations confirmed the efficacy of SIOP implementation. An analysis of covariance was used to evaluate mathematics achievement data from the Measurement of Academic Progress. Quantitative findings indicated no significant increase in mean scores after the first year of SIOP implementation. The results of this study could enhance the capacity of mathematics teachers to adjust instruction appropriate for their second-language development needs. Implications for positive social change include removing language barriers so that more ELL students may continue taking advanced mathematics courses and enter rewarding math-related careers.

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Section 1: Introduction to Study

Employers in the United States are experiencing difficulty in sustaining a high-quality workforce (National Mathematics Advisory Panel, 2008). The jobs most in demand require engineering, mathematics, and science skills that are aligned with technological innovations of the 21st century. Hispanic children are a driving force in the growth in school population in the United States, accounting for roughly one in every four children under the age of 10 (U.S. Census Bureau, 2010). A large percentage of students lack the mathematics and science skills needed to qualify for the high technology jobs. The task of providing rigorous mathematics instruction is complicated when the majority of the student body has a limited comprehension of the English language.

The Sheltered Instruction Observation Protocol (SIOP) is purported to be an effective way to provide the instruction of important content knowledge while implementing strategies to facilitate the acquisition of the English language (Echevarria, Short, & Vogt, 2008). Lee (2005) found that many Hispanic students with limited exposure to the mainstream acquire cultural norms and practices in their homes that do not always align with those of the school. The concurrent mixed-methods design, using an evaluative case study approach of the SIOP instructional model in the study high school, provided information on the extent that SIOP implementation impacted the efficacy of mathematics instruction.

When instructional strategies bridge the gap between student experiences and the new content, teachers can have a significant impact on students learning and achievement (Driscoll, 2005). This study examined teacher perceptions of SIOP and the efficacy of

SIOP instruction to mathematics achievement. The efficacy of SIOP in mathematics instruction is relevant to educator leadership in K-12 schools in that it provided information of how the leadership decision to implement the SIOP instructional model influenced the mathematics achievement of students in a school where the majority of the students have limited English proficiency.

Background of Study

In the 21st century, educational policies and mandates serve to sustain the role of the school in a free and democratic society, and influence school advocacy for academic and social success for an increasingly diverse population of students. Title I of the No Child Left Behind Act (NCLB) of 2001 was developed so that school systems would target funding to students with linguistic challenges, lower socioeconomic status, and underperformance on standardized assessments.

The state of Washington responded to the call for accountability from the NCLB Act (2001) by mandating that all students pass the state assessments in writing, mathematics, reading, and science. The Washington State School District (pseudonym) responded to the call for accountability by instituting the Sheltered Instruction Operation Protocol (SIOP) instructional model and monitoring student progress through the Measurement of Academic Progress (MAP) standardized assessment. The SIOP model was developed at the Center for Research and Diversity in Education with funding by the U.S. Department of Education. The SIOP model is an observation protocol for ensuring effective and consistent sheltered instruction. Students at the Washington State School District were tested on the MAP three times a year in order to provide data for instruction.

In 2009, the American Reinvestment and Recovery Act (ARRA) was enacted to provide additional support for schools and school districts with high percentages of poor children who need help in meeting the rigorous state academic standards. The combination of NCLB and ARRA has brought about a renewed emphasis on accountability between the federal, state, and local governments to demonstrate higher student achievement results (U.S. Department of Education, 2010d). However, the achievement results are not increasing fast enough.

The results of the spring 2010 assessment of academic achievement for the state revealed that under 42% of the students in the 10th grade met or surpassed the standard in mathematics (Office of Superintendent of Public Instruction, 2010 [OSPI]). When the state achievement data were disaggregated by language proficiency, the results revealed that less than 9.3% of students classified as limited English proficient students passed or surpassed the standard in mathematics. The results were even more disheartening in the Washington State high school, where less than 2.6% of the limited English students in the high school met or surpassed the state standard in mathematics. Bruton and Robles-Piña (2009) posited that the achievement between White non-Hispanic and minority students is a major concern for educators, parents, and society because "many minority students often dropout of school unable to read or do basic math" (p. 41). Since 100% of the limited English students at the study high school speak Spanish as their primary language and almost 94% of the student body is Hispanic, the emphasis was on the achievement of students identified as English language learner (ELL).

An example of the impact of limited English proficiency on academic achievement can be found in a national study conducted by the Pew Hispanic Center

(Lopez, 2009). Lopez found an achievement gap between Hispanic school aged students who are immigrants and those Hispanic school aged students who are native born. Lopez concluded that the lack of academic achievement among Hispanic students between the ages of 16 and 24 was a reflection of their mixed feelings about their academic success. In addition to these mixed feelings, the PEW survey showed that 58% of the respondents believed that limited English skills are a major reason why these students do not perform as well as other student groups. Other factors may contribute to the lack of achievement among students with limited English proficiency.

Bruton and Robles-Piña (2009), for example, reported that the attitude of the teacher towards the student may also impact student achievement. Bruton and Robles-Piña identified a 2004 study where nine preservice teachers volunteered to have qualitative data collected from them in the form of interviews, field notes, journals, and observations as they worked with ELL students. According to Bruton and Robles-Pina, "Participants commented frequently on deficiencies they saw in the children; they noted deficiencies in their student's culture, language, intelligence, and families" (p. 45). Former Secretary of Education Richard Riley appointed a panel of researchers and policy analysts to study the achievement gap and drop out problem among Hispanic students (Bruton & Robles-Pina, 2009, pp. 43-44). The panel found that many educators believe that Hispanic students do not value school, nor do they desire to learn English.

However, a number of studies have refuted these findings. In a meta-review of the research on deficit thinking, Bruton and Robles-Pina found differences in teacher ratings of White and Hispanic students, as well as an effect of ethnic background on the level of acculturation of Hispanic students. One hundred fifty students in fifth grade, of which 63

were Hispanic, were assessed by teachers using the Behavior Characteristics of Superior Students Assessment (BCSSA) to determine the presence of leadership, motivation, learning, and creativity within students. The study showed that teacher perception of the student to simultaneously acquire the traits of the new culture while preserving their predominant culture significantly impacted the student ratings on the BCSSA.

The Education Commission of the States (2004) reported the results from a number of studies conducted by groups that included among them the Education Trust, the Pew Hispanic Center, the Thomas Rivera Policy Institute, and the National Center for Education Statistics. The studies revealed that Hispanic and other minority students did value education and had a positive attitude towards the importance of taking advanced mathematics classes. Although a positive attitude towards taking advanced math is important, the students must be able to perform.

Another source of information related to the academic achievement of students in the United States is the National Assessment of Educational Progress (NAEP). The NAEP is mandated by Congress "in order to inform the public about the academic achievement of elementary and secondary students in reading, mathematics, science, writing and other subjects" (United States Department of Education, 2009b, p.1). The NAEP mathematics assessment measures students' knowledge and skills in five curriculum strands that include algebraic sense, numerical analysis, discrete mathematics, geometry, and measurement. The results from NAEP indicated how students' performance in mathematics has progressed compared to performance on prior year assessments over a period of time.

According to the commissioner of National Center of Education Statistics (2009), the NAEP data in mathematics for Grades four and eight showed that the achievement gap between White and Hispanic students from 2007 to 2009 averaged 21 points higher for White fourth graders than Hispanic fourth graders. Similarly, the achievement gap from 2007 to 2009 averaged 26 points higher for White eighth graders than Hispanic eighth graders. The achievement gap in mathematics portion of the NAEP between Hispanic and White eighth grade students in Washington State was 32 points in 2009. Students eligible for free lunch averaged 24 points lower than students not eligible for free lunch and 11 points lower than students who are eligible for federal free or reduced-price lunch (U.S. Department of Education, 2010). These data indicate the urgent need to improve academic achievement among Hispanic students coming from low socio-economic backgrounds.

The reason why such a large percentage of Hispanic students underachieve in mathematics is very difficult to ascribe to any one variable. However, limited proficiency with the English language has consistently been identified as a major factor contributing to a lack of understanding of the content students are supposed to learn. Instructional strategies that address the lack of English proficiency and simultaneously emphasize academic content have shown to have positive results among ELL students (Echevarria, Short, & Vogt, 2008). Another factor affecting student achievement is the teacher ability to address student deficiencies or gaps in learning. The efficacy of the teacher in teaching students has shown to correlate positively with student achievement. McGee (2004), Collier (2005), and Murphy (2005) found that effective teachers take personal responsibility for student learning, have the capacity and training to teach classrooms

with diverse learners, and exhibit confidence in affecting student learning. These teachers tend to treat students as partners in learning and persist in assisting student learning.

The Washington State School District has identified limited English proficiency and teacher lack of capacity to address these needs as obstacles to student achievement. The question of why this issue is important is supported by the research. School systems with large numbers of limited English student populations must institute instructional models that have been successful with these students. Bruton and Robles-Pina (2009) reported that the panel appointed by former U.S. secretary of education, Richard W. Riley, recommended that schools provide high level opportunities and practices in mathematics instruction that challenge Hispanic students and recognizes the importance of race, language, and culture. However, leadership has not always used empirical evidence to support decisions that directly impact the student ability to succeed in the classroom. The following example illustrates a policy decision intended to increase student participation in advanced classes, but failed to address the learning needs of the students.

In the 2008 Performance and Accountability Report submitted by the U.S. Department of Education (2009), 14.6% of the student population of the United States was Hispanic. In the same study, 14% of all Advanced Placement (AP) examinees were also Hispanic students. The Hispanic statistics showed a 0.6% difference between the entire population and the representative sample of AP examinees, while White students comprised 64% of the entire school population and 61.7% of the AP examinees. These data show that Hispanic students proportionately participated in advanced classes when compared with their White counterparts. However, the following study shows that

increasing student enrollment in advanced classes can lead to higher rates of underachievement.

The Brown Center on American Education Policy reported the total enrollment of eight grade students in advanced algebra classes increased from 26.7% in 2000 to 36.6% in 2005 (Loveless, 2008). The total enrollment in advanced classes included 8% of low achieving students in 2000 increasing to 28.6% of low achieving students in 2005. The percentage of high achieving students enrolled in the advanced algebra classes dropped from 27% in 2000 to 20% in 2005. The percentage changes indicate over 120,000 low achieving eighth-grade students were represented in advanced algebra classes. Over 77% of the students placed in advanced math but not achieving were likely to come from poor families and to be African American or Hispanic. The Brown Center study showed that over 30% of the students in regular classes were eligible for the federal reduced-price or free lunch program compared to 69% of the students in the advanced algebra classes. Loveless (2008) posited that "the push for universal eighth-grade algebra is based on an argument for equity, not on empirical evidence" (p. 21). Loveless continued to argue that a student who was pushed into an advanced math class and does not succeed in that class loses a year of instruction that would fill the gaps in basic arithmetic needed to succeed in Algebra.

Equally important is the rising tide of U.S. public school enrollment. A study conducted by U.S. Department of Education, National Center for Education Statistics (2007) showed school enrollment increase gradually through the early 2000s and is expected to reach an all-time high of 50 million in 2014. Furthermore, 10.3 million of the 49.3 million students enrolled in public K-12 schools in 2008-2009 were Hispanic (Sable

& Plotts, 2010). Accordingly, immigrants continue to migrate into the United States with limited knowledge of the English language and culture. Many of these immigrants remain in the United States to work, raise their families, and quite often have more children. As this trend continues, the percentage of ELL students in the classroom will also continue to rise (Gandara & Rumberger, 2009). Hispanic student enrollment in the Washington State high school has risen from 160 in 1998, representing 52% of the student body to 460 Hispanic students representing 97% of the student body in 2009.

During the ten year period between 1998 and 2009, the achievement gap between the Washington high school tenth grade mathematics scores on the state assessment and the average scores of all the other schools in the state has widened. Moreover, when comparing mathematics and reading achievement data in 2007 between the White students and the Hispanic students within the Washington high school, the achievement gap was as high as 55% in mathematics and 22% in reading (Office of the Superintendent of Public Instruction, 2010). Of course, not all Hispanic students struggle with the English language. However, the trend in the Washington high school indicated a large achievement gap that favored students who are proficient in the English language. Barton and Griffin (2009) concluded that it is important to provide ELL students with the support and encouragement to verbalize, read, write, and listen in the mathematics classroom. The Sheltered Instruction Observation Protocol (SIOP) model was developed so that classroom teachers would have the framework for an effective and practical model of sheltered instruction for ELLs.

The Sheltered Instruction Observation Protocol (SIOP) was initiated as an observation instrument that could be used as part of professional development for in-

service and preservice teachers. SIOP is also a tool for developing content lessons, observing, and measuring classroom and teaching effectiveness (Echevarria, Vogt, & Short, 2010). Washington High School instituted the SIOP model in the 2007 to 2008 academic school year. Preliminary data indicated that some gains in student achievement were made in all content areas. However, a formal empirical study of the efficacy of SIOP in high school mathematics instruction had not been conducted prior to this study.

Problem Statement

The general problem that this study addressed was the poor performance in high school mathematics by ELL students. Providing teachers with an instructional model that addresses content and language learning objectives was one strategy for improving student performance in mathematics. Since 2007 to 2008 academic year, the Washington high school in this study adopted the SIOP instructional model in order to provide ELL students with rigorous content and essential language objectives. The specific problem was the lack of empirical evidence regarding the efficacy of SIOP for ELL students in general high school mathematics classes. In order to determine the impact of SIOP on student performance in mathematics, it was necessary to examine (1) the consistency of teacher implementation of SIOP teaching strategies, (2) teacher attitudes about SIOP, and (3) the student achievement data since SIOP had been instituted in the Washington high school. A concurrent mixed-methods design, using an evaluative case study approach, employed quantitative and qualitative procedures that involved internal stakeholders.

Nature of the Study

This study examined the efficacy of SIOP in high school mathematics instruction using a mixed-method case study. The increased acceptance of mixing different methods

in educational research legitimized the case study approach (Creswell, 2003). More detailed explanation is found in section 3.

The four teachers implementing SIOP taught five mathematics classes every day and have been in the study high school at least two of the three years since SIOP was instituted. Three of the teachers are participants in the study since I was the fourth teacher and was excluded as a participant. The population count of ninth grade students at the high school has averaged 120 in the last three years without any significant increase in any given year. The sample consisted of 60 students identified as ELL in each of the three cohort groups of ninth grade students. The first ninth grade cohort served as the control group from the 2007-2008 school year, the second cohort was the ninth grade students from the 2008-2009 school year, and the third cohort was from the 2009-2010 school year. All students in the study high school were required to take the Northwest Education Association (NWEA) Measure of Academic Progress (MAP) assessment three times a year between 2006 and 2010. The first assessment cycle was in the fall, the second cycle in the winter, and the third cycle in the spring. Data from the NWEA MAP were collected by the Washington school district. The participating teachers were interviewed to determine their perceptions regarding the efficacy of SIOP in mathematics instruction.

Classroom observations using the SIOP checklist were used to determine the consistency of SIOP instruction. The nature of the current study utilized qualitative data from interviews and classroom observations. Archived MAP assessment data were retrieved in order to determine if the student mathematics achievement on the MAP had changed since the introduction of SIOP. Detailed references to ANCOVA data analysis

of quantitative data and the use of qualitative software to interpret interview themes were also detailed in section 3. Data collection and analysis took about six weeks. The goal of the study was accomplished by using a within method triangulation strategy, which strengthens the credibility of data collection and analysis. This approach rests on the idea that the flaw found in a one method can be balanced by the strengths of another method (Creswell, 2003).

Research Questions

The overarching question that guided this study was: How did SIOP affect the instructional practices of high school mathematics teachers? To address the focus and purpose of this study, the following research questions were developed. The first and second research questions address the attitudes of the teachers regarding the efficacy of SIOP.

RQ1: How do teachers view the efficacy of SIOP?

RQ2: How have the teachers experience, training, and background prior to SIOP influenced their attitude towards the efficacy of SIOP?

The first and second research questions were addressed through interviews with mathematics teachers in the study high school. The interview questions (Appendix A) explored major themes that delineate the attitude of teachers regarding the efficacy of SIOP. The themes included (a) perspectives toward education and social change, (b) leadership and school culture, (c) student learning and motivation, and (d) the implementation of SIOP and its effect on student performance. The responsive paradigm used during the interview process allowed for the development of other questions during and after the interview leading to additional dimensions emerging from the interviews.

Some dimensions included the perceived quality of the tasks and activities provided by the teacher, the level of rigor, and the ethos or belief about student learning of the teacher, and the teachers own experience in education. All the teacher interview questions were open-ended to allow teachers to express how they felt about the efficacy of SIOP. The third and fourth research questions addressed the consistency of implementing SIOP in the mathematics classroom.

RQ3: What SIOP components do teachers implement consistently in the mathematics classroom?

RQ4: What SIOP components are most favored by teachers?

The third and fourth research questions were addressed through the use of the SIOP observation checklist (Appendix B). The checklist contains the eight components of SIOP and the particular elements of each component. The checklist included a Likert-type survey with a 1 through 4 rating scale to determine the efficacy of each SIOP component. To further the exploration of SIOP efficacy in mathematics instruction, quantitative data from archived MAP scores were analyzed to answer the following research question:

RQ5: How has student achievement on the mathematics portion of the MAP changed during the first three years of implementation of SIOP in the study high school?

Hypothesis

H_{01}: There are no differences in achievement on the mathematics portion of the MAP among students in terms of testing with the implementation of SIOP and without the implementation of SIOP.

H_{a1}: There are differences in achievement on the mathematics portion of the MAP among students in terms of testing with the implementation of SIOP and without the implementation of SIOP.

Dependent and Independent Variables

In this study, the dependent variable was the student gains in math performance on the MAP assessment. The independent variable was the presence (or absence) of the SIOP model. Covariates included the English language literacy level of the student and the number of years individual teachers have been using SIOP. The study included three different groups of students: 9th grade students who learned mathematics without SIOP, 9th grade students who learned mathematics with partial implementation of SIOP, and 9th grade students who learned mathematics with full implementation of SIOP. Academic year 2007-2008 was the very first year that the study school district provided training in the implementation of SIOP. Full scale implementation began in the 2008-2009 school year.

Purpose of the Study

The primary purpose of this concurrent mixed methods study using an evaluative case study approach was to determine how the implementation of the SIOP model in a high school in Washington met the educational needs of mathematics students with low English skills. A review of the literature found a shortage of studies evaluating the efficacy of programs designed to increase achievement in high school mathematics for this population. A combination of qualitative and quantitative methods was used to uncover the efficacy of SIOP to enhance student achievement. Yin and Davis (2007)

recommended that researchers utilize both qualitative and quantitative evidence in order to appropriately evaluate complex reform efforts.

Quantitative assessment data of three student cohorts in the Washington high school from the 2007-2008 year, 2008-2009 year, and 2009-2010 year were compared to determine if there were any significant gains in student performance in mathematics since SIOP implementation. Controls were developed for language and time of exposure to instruction with the SIOP. MAP scores were available to measure growth, and the majority of these students had been instructed by teachers implementing SIOP. Over 93% of the students in this school qualified for free or reduced nutrition and funding under Title I of ESEA. Data were obtained through multiple qualitative sources, including transcripts of teacher interviews, observations of teachers in their natural setting (i.e., the classroom), and samples of lesson plans, Quantitative data were obtained through the review of relevant documents such as MAP results. These data were analyzed to determine how SIOP met the needs of the participants.

Conceptual Framework

The conceptual framework was formed by combining Krashen's i+1 nativist theory for language acquisition through comprehensible input, the Long interactionist theory for acquisition of knowledge through social interaction and negotiation for meaning, and Bandura's teacher self efficacy theory. Mullin and Oliver (2010) described interactionist frameworks as activities that provide the learner with opportunities to receive meaningful cognitive input and develop comprehensible output through a social orientation. Students in these settings have opportunities to develop a balance between the cognitive process and the negotiation triggered by the social interaction.

Mullin and Oliver (2010) explained that language acquisition is based on Chomsky's natural or nativist approach. Chomsky believed that humans have an innate ability to acquire language. Krashen built on this theory and developed i+1 principle. This language comprehension (level i) advances another level (level i+1) through a natural order by understanding the input at i+1 level. The teacher constantly challenges the student to move up to the next level by providing comprehensible input that leads to more complex knowledge. According to Mullin and Oliver, the content cannot be understood unless the information is understood. In the process of providing comprehensible input, teachers remain sensitive to the student's ability to comprehend the material and make adjustments as necessary.

Cho, Ahn, and Krashen (2005) conducted a study on Korean students who were learning English as a second language. The results of the study showed that when students were provided comprehensible input through a narrow range of text to read, they were able to read and enjoy the texts that were assigned. This narrow reading as input will lead to more advanced input. Cho et al. concluded that the process of moving to the next level will occur naturally as long as the input is structured to foster comprehension of the content. Teacher attitude is also important to the implementation of classroom strategies.

Bandura (1993) posited that the effects of self-efficacy are evident in the domains of selection, motivation, and cognition. The cognitive process includes the development of self concept to achieve a goal. Bandura found that people who viewed talent as something that can be acquired had an enhanced ability to attain goals, and foster efficient thinking. Bandura continued to explain that the motivational process begins with

the forethought and belief of what they can or cannot do. Bandura (1993) referred to the expectancy-value theory that states "motivation is governed by the expectation that behavior will produce certain outcomes and the value of those outcomes" (p. 128). Affective process includes the confidence to cope with any situation-the attitude that a solution to any situation is possible. Bandura stated that "teachers who lack a secure sense of instructional efficacy show weak commitment to teaching and spend less time on academic matters" (p. 134). The fourth process that defines the efficacy process is through selection of activities. The individual chooses the situation and essentially provides the means through this selection for achieving his or her goals immediately or as part of a process.

Definition of Terms

At-risk students are students with a high probability of dropping out of school due to economic, linguistic, or other mitigating factors (Croninger & Lee, 2001).

Differentiated Instruction is defined as a strategy for teaching and learning that requires to teacher to have the dexterity to adjust the curriculum and instruction so that it caters to the specific needs of the learner instead of requiring the students to make the adjustments so that they will learn the material (Dana & Yendol-Hoppey, 2009, p. 8).

English language learner (ELL) "students are students who are in the process of acquiring English and have a first language other than English" (Goldenberg, 2008, p. 10).

Professional learning community (PLC) is a professional development model that is used in professional circles in order to improve the facility of sharing and development of ideas. In education they are usually comprised of teaching and learning practitioners

reflecting on the student learning outcomes, making adjustments to instruction after a careful analysis of student response to teaching practices (Stoll & Seashore, 2007).

Sheltered Instruction is the synthesis of sound instructional methods combined with instruction that focuses on meeting the academic needs of second language learners. Sheltered instruction focuses on language function and form when discussing content concepts. Some of these functions include explaining, describing and defining interesting content (Hansen-Thomas, 2008).

Sheltered Instruction Observation Protocol (SIOP) was developed as a research observation instrument for sheltered instruction (Echevarria, Short, & Powers, 2006). The measurement instrument included a rubric that allowed sheltered instruction teachers to be evaluated along a continuum. The SIOP model provides teachers with a construct for presenting content such as mathematics to English-language-learner (ELL) students.

Situated context means the socially contextual nature of knowledge in the use of language and social interaction (Lave & Wenger, 1991; Rogoff, 1990; Walkerdine, 1982; as cited in Núñez, Edwards, & Filipe-Matos, 1999).

Transitional Bilingual Program by definition is "a system of instruction that implements two languages, one of which is English to build upon and expand language skills to enable a student to achieve competency in English" (OSPI, 2009b, p.3).

Limitations, Scope, and Delimitations

Limitations of the Study

A potential limitation to this study was the lack of experience of the teachers with the SIOP model. The research setting was one high school in the state of Washington. In addition, as is true with any educational study, there were uncontrollable external

variables such as parental or home influences, effects of mentors or significant staff to the achievement of the students, and/or the effects of after school programs offered in a school-wide effort to impact achievement. In drawing conclusions about the outcomes, it was difficult to determine cause and effect. It was possible that some of the other factors mentioned impacted student outcomes. As with all case studies, generalizability was limited. To increase generalizability, findings incorporated a framework of relevant literature and included analytic generalizations about effective practices for educating ELL students.

The reoccurring issues discussed in the literature that generated the research questions came from the discussion of improving mathematics achievement of underachieving high school students. Although the literature pointed to other possible factors for improved achievement, the study emphasized the effects of a very specific instructional model for improving student learning. Validity of this study was limited to the reliability of the instruments used.

Scope and Delimitations of Study

The unit of study was a secondary high school in the northwest United States. Hispanic students comprised 93% of the population in the high school. Moreover, the majority of students did not receive formal direct services for limited English language abilities such as ESL specific classes although a large percentage of students came from homes where Spanish was the primary language spoken. The NCES (2010) reported that 10.8 million students in the United States did not speak English at home. In the Washington school district, 93% of the 1952 students spoke Spanish at home.

The study employed a case study approach where qualitative data were collected and analyzed in combination with archived quantitative data results. The quantitative data from the study were retrieved from archived MAP scores for the students in three cohorts. Students were mixed in classes where multiple cohorts were represented in a particular classroom. The student achievement data were narrowed down to results that were representative of the majority population of students (see Table 1).

Table 1

Description of Cohorts

	Cohorts			
Current Grade	2007-2008	2008-2009	2009-2010	2010-2011
Grade 12	Grade 9	Grade 10	Grade 11	Grade 12
Grade 11	Grade 8	Grade 9	Grade 10	Grade 11
Grade 10	Grade 7	Grade 8	Grade 9	Grade 10

MAP test scores for the selected students in three cohorts was retrieved from archives and analyzed for statistically significant differences between cohorts when SIOP was not implemented and cohorts when SIOP was implemented. Culturally these students had similar experiences and came from the same socioeconomic level as the majority students in the school population.

Qualitative data were gathered from teacher interviews in order to examine the experiences and attitudes of the mathematics teachers in the school. The teachers in the study came from diverse backgrounds and experience levels. Qualitative data were also collected from the classroom observations using the SIOP checklist. These data were used to determine the consistency of SIOP implementation. The effectiveness and consistency of SIOP implementation within the context of the teacher experiences and

attitudes was evaluated. There was very little research that had produced viable empirical or other research data to provide specific quantifiable results about the effectiveness of SIOP in mainstream high school mathematics classrooms. However, this limitation was counteracted through a within method triangulation combining transcribed interviews that were deciphered from themes that emerged from response patterns, teacher lesson plans, and observations using the SIOP checklist in the classroom setting. The limitation was further counteracted by using between methods triangulation of the analysis of archived MAP data results, interview results, and classroom observation results,

Qualitative data involved interviews, analysis of lesson plans, and a SIOP classroom observation checklist. The goal of the interview was to obtain depth of understanding and insight into how the mathematics teachers of ELL students perceived the efficacy of SIOP. It was necessary to adapt or adjust the questions in the pursuit of more depth during the interview. NVivo software by QSR (2010) was utilized to code the interview responses and identify themes that emerged from the interview responses. Although student interviews may have provided information about how students perceived SIOP, the purpose of the study was to explore the instructional factors that impact the efficacy of SIOP. Therefore interviewing students would not provide information pertinent to the efficacy of SIOP implementation. Classroom observations and field notes were used to document the activities and behaviors of the teachers and students in the classroom. The information garnered from the classroom observations and teacher interviews were triangulated with the lesson plans and the archived MAP assessment results.

Classroom observations were conducted using the SIOP classroom observation checklist. The SIOP observation checklist addressed the eight components of SIOP instruction. The instrument was based on a Likert-type scale from 0 (*not clearly supported*) to 4 (*clearly supported*). The results of the checklist provided information on the frequency and effectiveness of the SIOP components throughout the lesson. One of the prescribed SIOP lesson plan templates was used as a guide to look at teacher lesson plans (Echevarria et al., 2008). The analysis of the lesson plans and the interviews was a prerequisite to the classroom observations.

Significance of the Study

Closing the achievement gap is a daunting challenge given that the prevailing achievement gap between Whites and Hispanics has remained essentially flat after 20 years of efforts to reduce the achievement gap. For example, the gap in mathematics achievement between Hispanic and White thirteen-year-olds decreased from 35 points in 1973 to 23 points in 2004 (Kewal-Ramani, Gilbertson, Fox, & Provasnik, 2007). In 2008, the achievement gap between White and Hispanic 17-year-old students in mathematics was 21 points compared to an achievement gap of 19 points in 2004. Although Hispanic student scores have increased in those 25 years from 1973 to 2008, the change has been very slow and the achievement gap has widened. In the state where the study high school is located, the achievement gap between Hispanic students and White students was 32 points (NAEP, 2009).

The standards movement is sending a message to schools nationwide that students could no longer be allowed to graduate with limited skills. Nobel Prize winning economist James Heckman wrote:

> The nation will become more just and equitable if poor children have more opportunities for success ─ but it will also become wealthier, spending less on welfare and crime prevention and drug treatment and collecting more in taxes from the workers who may not otherwise find a job. (Tough, 2008, p. 193)

Failure to prepare for this economic reality could result in a future for these students who are mired with struggle to create productive lives for themselves and their families (OSPI, 2003). In the state located in the northwest United States where the study was conducted, agriculture, high technology, and tourism are essential industries that rely on international trade and exchange. Students who want to succeed in the state located in the northwest United States need the cultural and technical sophistication to compete economically with individuals from around the world. Mathematical and science abilities will be in particular demand. Eccles (1994, as cited in Crosnoe & Huston, 2007) and Stevenson, Schiller, and Schneider (1994, as cited in Crosnoe & Huston, 2007) found that taking math courses, more than almost any other academic activity, is a powerful predictor of future educational and socioeconomic attainment.

Harris and Robinson (2007) posited that increasing the achievement levels for ethnic minorities and Whites could close the achievement gap between them and essentially reduce racial inequality in the attainment levels of education and earnings. Enhancing the achievement levels may lead to a reduction of crime, health issues, and family dysfunction among lower income and ethnic minorities. However, many of these problems continue to affect Hispanics. Levin, Belfield, Muennig, and Rouse (2007) reported that "Hispanics are victims of violent crimes at a higher rate than whites, and are incarcerated at higher rates than whites" (p. 13). Levin et al. (2007) went on to argue that

higher education attainment leads to higher incomes. Those with higher education attainment typically have better health insurance, rely less on public assistance programs such as welfare and Medicaid, and generate more economic benefit to the public sector.

Page, Petteruti, Walsh, and Zeidenberg (2007), in a research brief for the Justice Policy Institute, reported that increasing the average years of completed schooling by one year could reduce violent crimes by 30%. Furthermore, increasing the high school completion rate for males between the ages of 20 to 60 would lead to a savings of $5 billion in crime related expenses per year for the United States Justice Department. The lack of skills needed to survive in the new economy may result in the unskilled workers and their families relying more on social programs adding strain to the national economy and an over-reliance of employers on foreign workers to do the work that American workers should be able to do.

To illustrate a comparison between students in the United States and students in other countries, the researchers at NCES (2007) reported the results of the mathematics portion of the Program for International Assessment (PISA) of ninth graders and the Trends in International Mathematics and Science Study (TIMSS) of fourth and eighth graders. The studies conducted on the PISA and the TIMMS results provide data on the content knowledge and mathematical rigor capabilities of fourth-, eighth-, and ninth-grade students in the United States compared to the students in the other participating countries of the Organization for Economic Co-operation and Development countries. The results of the TIMSS (2007) indicated that the United States eighth-grade students performed at a lower rate than the eighth-graders in seven of the participating countries.

The results of the mathematics PISA (2010) showed U.S. 15 year-old students were in 25th place among the 34 OECD countries.

The Pacific Northwest has experienced a large influx of language minority students in recent years. Some districts in the state have seen their populations of students with limited English proficiency more than double in the last ten years. Schools in the rural school districts within the state are no exception to this growth. For example, in the Washington School District there were 459 ELL Hispanic students classified as Transitional Bilingual during the 1998-1999 academic year; by the 2008-2009 academic year, there were 1154 ELL Hispanic students classified as Transitional Bilingual Program. Transitional Bilingual Program by definition is "a system of instruction that implements two languages, one of which is English to build upon and expand language skills to enable a student to achieve competency in English" (OSPI, 2009b, p.3). Washington Administrative Code WAC 392-160-010, with the authority of Revised Code of Washington 28A.180.060, requires districts in the state of Washington to provide an alternative instructional program in the event that instruction in two languages is not practical.

A number of factors are affecting districts with high ELL populations. Title I legislation requires districts to demonstrate that all ELL subgroups are making adequate yearly progress (AYP) towards meeting academic standards by 2014. In addition, Title III legislation requires ELL students to demonstrate the attainment of English proficiency by meeting the Annual Measureable Achievement Objectives (AMAO). Title III, Section 3122, of the NCLB Act (U.S. Department of Education, 2010a) states that at least 80% of

the ELL students must move up at least one proficiency level per year with the percentage increasing annually.

The common thread in the literature calls for leaders to take positive action to increase the achievement levels for all students residing in the United States. Simultaneously increasing the achievement levels for African American, Hispanic, and White students could close the achievement gap between them, raise the achievement level for all students, and essentially reduce racial inequality in the attainment levels of education and earnings, which could lead to a reduction of crime, health issues, and family dysfunction among lower income and marginalized groups (Harris & Herrington, 2006).

Educators in the K-12 system benefit from this study in a number of ways. The results of the study provide evidence of a strategy that is effective in helping students overcome the language barrier that prevents them from developing the ability to comprehend academic content in a meaningful way. The study benefits students and families who are trying to improve their station in the modern economy through education and post secondary opportunities. Furthermore, society benefits from this study in an indirect manner. The information provided through this study provides a compass for teachers with the responsibility of teaching students who struggle to demonstrate achievement in mathematics. With the improved opportunities to learn, students will be able to break out of the cycle of poverty and underachievement, and become better prepared and contributing members of society.

Summary

There is a sense of urgency to decrease mathematics achievement disparities between groups of student, particularly the disparity between White and minority children. The Washington high school was comprised of a high percentage of lower income minority children with barriers in English comprehension. Furthermore, the students in the Washington high school exhibited mathematics achievement considerably lower than the state average. Although low-income and minority students in general scored lower than did White students, the mathematics achievement levels are very low for all students in the state, regardless of race and socioeconomic status. The fact that mathematics achievement is low for minority students as well as White students poses new questions and challenges for leaders and educators.

Ware and Kitsantas (2007) contended that a growing body of research in educational psychology equates a teacher's performance to the level of commitment to influence student learning in a positive way. The perception a teacher has of his or her ability to help students learn mathematics can affect the teacher's commitment to ensuring the student is learning. School leaders must be able to assess the needs of the students and teachers, determine the strategy that will shift the culture into a culture that is conducive to effective teaching and learning for all students, and implement the strategy in a manner that will not disrupt the teaching and learning process. Mathematics achievement will likely improve in classroom cultures where the teachers have developed a capacity for cultural receptivity, instructional modeling, and high expectations for all students (Jamar & Pitts, 2005).

Bruner (1999) posited that a combination of deep understanding and honesty are essential to presenting any physical phenomena in a way that is correct, exciting, and comprehensible. In a body of knowledge such as mathematics, it is important to have a background of understanding the fundamentals. The purpose of this study was to determine the efficacy of SIOP in improving the mathematics learning of underachieving high school students. In Section 2 I describe the relevant literature on the subject.

Section 2: Literature Review

The literature review presented in section 2 contains a summary of theoretical and empirical studies that provides the background necessary for understanding the key aspects of learning mathematics in the context of teaching underachieving students. The literature review includes an analysis of the historical context of mathematics education reform, the complexity of underachieving students including ELLs, and the previous studies that show promise in affecting the teaching and learning of mathematics to underachieving students. The literature review provides an insight into the attributes of the classroom teacher, outlines the characteristics of a culture for improved teaching through professional collaboration, describes the characteristics of ELL students, describes strategies that are effective when used with ELL students, and describes the elements of SIOP that are prescribed to enhance student learning.

Title Searchers, Articles, Research Documents, and Journals

The primary objective of the literature search is to explore the key concepts of the underachievement of Hispanic students; examine the underachievement of students in general; and assess the efficacy of the SIOP instructional protocol to teach ELLs, culturally and linguistically diverse students, and other underachieving students. The literature review includes a historical perspective on efforts to improve mathematics and science education in the United States, research studies and other scholarly literature on teacher learning of a new instructional strategy, professional collaboration, and the attributes of teaching and learning of ELL students. The literature on SIOP as a possible strategy for teaching underachieving students mathematics vocabulary was analyzed. The

rationale was that mathematics vocabulary is often new to everyone, regardless of prior linguistic background.

The literature review is based on online academic libraries, peer-reviewed articles, books, and dissertations. Walden University online sources included ProQuest, EBSCOhost, InfoTrac, and ProQuest Dissertations and Theses databases. Additional Internet searches were performed using commercial search engines such as Google Scholar and through direct access to U.S. government websites such as the U.S. Department of Education, the Office of Civil Rights, and the Bureau of Labor and Statistics. Searched terms included keywords such as *underachieving student, gifted education, differentiated instruction, teacher professional development, sheltered instruction, achievement gap, social justice, professional learning community, English Language Learner, language acquisition, mathematics learning, cognitive, situated learning, leadership, efficacy, Hispanic student, immigration trends, education reform, student motivation, teacher motivation, case study methodology, qualitative, quantitative, mixed method,* and *peer observation*. The literature search generated some studies that were more applicable than others. All studies were read, but only those that met the objectives of this literature search were selected and outlined their content to support this study.

Historical Perspective on the Effort to Educate Everyone in the United States

Education is a powerful instrument for social change. Education provides the tools that citizens can use to increase one's ability to earn a living through the use of his or her mind rather than through the fruits of physical labor. "Without education, children today are essentially doomed. People who are in the front lines of the war on poverty

invariably say the same thing: more than ever before, to survive and thrive in today's economy, you have to have an education" (Canada, 2008, p. 128). Canada argued that a poorly educated society has about the same chances for success as a poorly educated child.

High quality education needs to be accessible to everyone if the United States is to remain a first-rate country. Harris and Robinson (2005) purported that simultaneously increasing the achievement levels of ethnic minorities and Caucasian students could close the achievement gap between them and essentially reduce racial inequality in the attainment levels of education and earnings. Reducing the achievement gap could indirectly reduce crime, health issues, and family dysfunction among lower income individuals and ethnic minorities.

Despite the heightened awareness of a need for equitable education, inequities persist. Ziegler and Finn-Stevenson (2007) posited that homes where parents nurture their children and provide stimulating activities such as learning their numbers and reading before age 3 have been shown to set young children on a trajectory of academic achievement throughout their school years. Harvey (1999) determined from an analysis of the National Longitudinal Study of Youth that the emotional functioning of children might be affected by the parent's employment and income. The study found that children from low-income homes and whose parents worked more hours scored lower on cognitive tests than children from higher income households where the parents worked more hours.

The National Longitudinal Study of Youth (1999) is a survey of an estimated 12,600 African American, Hispanic, and economically disadvantaged White females

between the ages of 14 and 22. In 1986, 1988, 1990, 1992, the survey included evaluations of their children born after 1980. Disadvantaged White females were no longer surveyed after 1990 due to financial reasons. The study findings indicated that a lack of quality interactions between parents and their young children might affect the emotional ability of children and might result in a gap in learning that increases with time.

There are certain qualities exhibited by schools that overcome daunting challenges in their efforts to ensure that all students have the opportunity to succeed. According to McGee (2004), the qualities of successful schools are (a) strong leadership, (b) a professional development program aligned to the needs of the students, (c) ongoing curriculum development, and (d) an organizational structure conducive to sustaining professional development and curriculum development. However, policies that emphasize improving the quality of the teaching practice in the classrooms will do more to close the achievement gap for students who are prone to failure or who are more educationally at risk than just about any other reform effort (Darling-Hammond, 2008).

The Public School Science and Mathematics Agenda

The development of the public school agenda coincides with the cultural shift of the times. In the 1950s, the Soviet Union and the United States were embroiled in a cold war. The launching of Sputnik in 1957 amplified the public concern that an enemy of the United States was on their way to dominating the space program. The media reflected the concerns of the citizens of the United States that the inability to beat the Soviets in the launch of the first spaceship was due to the poorly performing schools in the United States (Rutherford, 2005).

In the 1970s, the National Science Foundation funded three studies to determine the status of mathematics and science education in the United States. The studies showed that elementary school enrollments in science classes were beginning to decline, science instruction was inadequate, and hands-on innovative science instruction was limited to about 10% of the school-age population. The studies also reported that the perceived barriers to effective science teaching had not changed since 1957, and over 50% of the students did not take science classes after Grade 10 (Helgeson, 1977). In the 1980s, U.S. President Ronald Reagan appointed a committee to determine the problem with education and to provide recommendations for action. Rutherford (2005) continued by stating that the emphasis on determining the best course of action for improving education led to the publication of *A Nation at Risk: An Imperative for Education Reform.* The report sounded the alarm by arguing that a mediocre education would lead to the demise of America as a country and as a people.

In the 1990s, following the dismal report from the Third International Mathematics and Science Study (TIMSS), the 50 governors of the states came together with U.S. President Clinton to voice a commitment to reform efforts that would help the United States be the best in mathematics and science. In a study conducted by the National Council of Education Statistics, the results of the Program for International Student Assessment (PISA) of ninth graders and the Trends in International Mathematics and Science Study (TIMSS) were analyzed (United States Department of Education, 2007). The results of the TIMMS confirmed that fourth and eighth graders in the United States seriously lagged in mathematics at the international level. Studies conducted on the PISA and the TIMSS results provided data on the content knowledge and mathematical

rigor capabilities of fourth-, eighth-, and ninth-grade students in the United States relative to the students in the participating Organization for Economic Cooperation and Development countries. The report on the results of the 2003 PISA found that "U.S. students demonstrated lower mathematical literacy than their peers in 20 of the other 28 OECD countries and 3 of the 10 non-OECD countries" (U.S. Department of Education National Center for Education Statistics, 2004, p. 13).

In 2008, then President George W. Bush appointed the National Mathematics Advisory Panel (NMAP) to determine how the United States can enhance the mathematics readiness of the average citizen. According to the NMAP, the United States will experience enormous stress in sustaining a high-quality workforce equipped with the engineering, mathematics, and science skills required to keep pace with the technological innovations of the 21st century (U.S. Department of Education, 2008). The NMAP reported that the failure of the American education system to ensure that more students are prepared for a technical workforce places the economic viability and security of the United States at risk (NMAP, 2008). This analysis raised questions about what schools can do to ensure that all students are prepared for a technologically advancing society. Ensuring that at-risk students meet or surpass the standards that provide them access to the same opportunities as their more affluent or linguistically able contemporaries is an ongoing challenge.

Education and Social Justice

The Center for American Progress (2011) reported that Secretary of Education Arne Duncan spearheaded the call for more college enrollment data as part of the Higher Education Opportunity Act. This effort was in line with the $250 million funding via the

2009 Recovery Act for states to improve their longitudinal educational data systems. These actions by the federal government mark a paradigm shift in how policymakers gauge success. High school success will now be tied to a graduates' postsecondary performance. These are positive signs of an improved education system on the horizon. Unfortunately, the achievement gap between affluent students and less affluent and minority students continues to widen.

Congress responded to the call for closing the educational achievement gap by passing legislation in 2001 to reauthorize of the Elementary and Secondary Education Act (ESEA) in 2001. Within the reauthorized bill, Title I stipulates that all children should have the opportunity to receive a high-quality education. ESEA went on to state that students should be provided with the opportunities to demonstrate proficiency on a rigorous academic exam that is aligned to a set of learning a standards determined by the state.

The National Council of Teachers of Mathematics (NCTM) posited that a just democratic and economic system cannot function when there are insufficient people with the mathematical skills and knowledge to fill crucial political, scientific, and economic roles. Title III of ESEA stipulates that language instruction must be provided for all students who demonstrate low English proficiency. The funding levels supported by the ESEA coincided with the needs of the student population.

The total funding authorized for Washington State under the ESEA in 2010 was $376 million (U.S. Department of Education, 2010). This amount represents almost one sixth of the entire Washington State budget earmarked for K-12 education. The national funding for ESEA has risen from $1.15 billion dollars in 1966 to just over $24.96 billion

dollars in 2010. The consequence for schools where students fail to achieve is the loss of federal funding for failing to close the achievement gap.

In addition, the Obama administration has authorized $4.3 billion for a Race to the Top initiative. The initiative stipulates that states could apply for a part of these funds if they remove their caps on charter schools, raise standards, provide measurable ways to gauge academic progress, replace teachers whose students continue to fail, and can show unanimous support from the majority of the school districts in the state. According to Ravitch (2010), the price for extra funding in fiscally challenging times might be too cost prohibitive if education funding were to be substantially reduced. The shift in education policy indicates that a business model of competition between teachers and schools can produce better results than the existing model of collaboration.

Research on Teacher Efficacy

Bandura (1993) identified teachers with high personal efficacy as individuals that are not afraid of a challenge, but rather view the challenge as something that can be overcome. Individuals with a highly efficacious outlook remain focused on performance and set high goals for themselves. Failure is attributed to a lack of knowledge or effort as opposed to blaming other outside influences. Efficacious teachers are committed to students and driven to teaching excellence. Ware and Kitsantas (2007) found that the efficacy characteristics possessed by the individual teacher affected their commitment to individual and collective teaching. The collective efficacy component of the study included the teacher perception of their role in making decisions and the quality of the leadership within the school. Collier (2005) defined teacher efficacy as the individual's belief that his or her efforts can make a difference. Collier contended that efficacious

teachers view their role as a teacher to be important and "examine their own performance in light of student failure and developed improved instructional strategies to meet the student needs" (p. 352). Teachers who reflect on their teaching for the purpose of improving instruction tend to be more effective with students. According to Tilema and van der Westhuizen (2006), knowledge is valued in broader audiences only when the concepts of the new knowledge has been challenged or openly debated. This idea supports the notion that concepts must be communicated in a dialogue with other teachers. This dialogue should be combined with reflection of the action or concept. The elements that impact efficacy described in this paragraph will be explored in the following sections within the literature review.

A Culture for Social Change

School leaders are accountable for making sure that schools are always improving. Lambert (1998) described leadership as something that transcends one individual or a group of individuals. Leadership "involves an energy flow or synergy generated by those that choose to lead" (p. 5). Leadership is evident when the emphasis is on everyone learning together and developing knowledge collaboratively. The commitment to students and the effort of teachers toward instructional improvement are tied directly to the extent that teachers feel empowered to help students succeed.

Ware and Kitsantas (2007) conducted a study of the U.S. Department of Education School Staffing Survey results of 1999-2000 to determine if teachers' belief in their capability to help students succeed would be a good predictor of the teachers' commitment to the profession. Ware and Kitsantas found that teachers felt "it is the responsibility of leaders to ensure that the aspirations of group members—teachers and

administrators—are met" (p. 308). Cultivating the capacity and commitment to a community of practice that enables teachers to feel capable of helping all students succeed is no easy task. School leaders are faced with what Schon (1987) called *the learning paradox.* The learning paradox indicates that a learner initially cannot understand the competence he or she is supposed to learn. The learner can learn by taking the initiative to be educated on the competence and can only be truly educated by beginning to apply the competence he or she still does not understand.

To develop the synergy for school improvement, educational research and data about the students being served must be available to support the school improvement efforts. School improvement means all students will achieve academically regardless of race, ethnicity, disability, and socioeconomic status (Dolejs, 2006). Successful schools have a culture where the staff members reflect on their preconceived notions about their students, how individual teachers process new knowledge, and how teachers monitor the newly learned information about how the students they serve learn.

The paradigm in education in the United States is moving away from teaching as the center of the pedagogical universe and moving toward student learning and development. For example, at the study high school, the SIOP model was not easily integrated into the school culture. The formation of a community of professionals with the ethos for improving teaching and learning requires the structure for communicating and sustaining the move toward improvement (Senge, Cambron-McCabe, Lucas, Dutton, & Kleiner, 2000). To facilitate the integration of SIOP, the school district administration provided the structure for an environment that allowed for communicating, sharing, and expressing ideas and beliefs. The leadership at the study school district emphasized the

importance of improved student learning and instruction by meeting the needs of the students. The structured collaborative time is an example of the demonstrated commitment to school improvement. The next section includes a discussion on the development of school culture for continuous improvement.

School Culture for Improvement

Fullan (2001) posited that "leading in a culture of change means creating a culture (not just a structure) of change" (p. 44). Fullan described effective schools as complex systems where the dynamics have been designed to allow for coherence making. Coherence making in complex systems occurs when (a) there is mutual accountability between school staff; (b) where knowledge–creation goes through a sorting process of the knowledge conveyed during knowledge sharing activities; and (c) people will motivate, stimulate, and excite each other in ways that are not apparent.

The effort to ensure that every student has the opportunity to succeed involves having (a) strong leadership, (b) a teacher professional development program aligned to the needs of the students, (c) ongoing curriculum development, and (d) an organizational structure conducive to sustaining professional development and curriculum development (McGee, 2004). The vision and implementation of a culture that is student-centered must be based on the belief that developing the capacity for teachers to meet the learning needs of their students is vital (Sergiovanni, 2005). The challenge for school leaders is to develop a school ecology that empowers the school community in transforming teaching and learning so that students most in need are achieving as well as students who have more advantages.

School improvement efforts that aim to increase the achievement levels of all students should include (a) the reorganization of curricula, (b) the implementation of new programs, and (c) access to the resources that support the learning and development of students who are most in need (Ares & Buendia, 2007). However, focus on ability and an emphasis on one subgroup are not sufficient. Wenger (2002) posited that a school culture where teaching and learning strategies are focused to address student learning must be cultivated and sustained with an attitude of reflection and readjustment that will become the ecology of the school for years to come. Such a long-term and holistic view of school improvement is essential to the development of effective student-centered programs and services that emphasize teaching and learning with high expectations for all students.

Professional Collaboration

Sustainable school reform is similar to the natural growth of any living organism ─ growth starts small then it picks up speed, then slows down until it has reached it full mature size (Senge et al., 2000). Wenger, McDermott, and Snyder (2002) posited that since knowledge has become a valuable asset, organizations must continuously seek to refine and test the knowledge for its effectiveness in meeting the goals of the organization. Wenger, McDermott, and Snyder posited that "Cultivating communities of practice in strategic ways is a practical way to manage knowledge as an asset" (p. 6).

The National Commission on Excellence in Education, through the Nation at Risk report of 1983, revealed an increased demand for high-quality teaching and increased resources as a key to attaining and sustaining the preeminence of the United States in technology innovation, commerce, and industry (Harris & Herrington, 2006). Students will achieve at higher levels when they are taught in a learning environment in which

teachers are supported and encouraged to be creative, knowledgeable, and collaborative. Effective leadership addresses the need to help teachers and other members of the school community make sense of the problems, establish coherence in the strategies used to solve the problems, and ensure that the communities within the school are growing, learning, and evolving together (Lambert et al., 2002).

A school must (a) be equipped with the capacity to interpret and use data to provide students with instruction that addresses its particular learning needs, (b) receive ongoing training and professional development materials around standards, and (c) encourage the generation of new ideas. Teachers and administrators in effective schools use collaborative structures to focus on instruction, student achievement analysis, assessment, and curriculum. These structures serve to sustain teacher effectiveness and enthusiasm about teaching all students and aid in the development of a culture where teachers have a highly evolved attitude of constantly seeking to improve on their practice (Senge, Cambron-McCabe, Lucas, Dutton, & Kleiner, 2000). In the process of sharing, informal networks are very powerful to the community of practice. Communities of practice are more "loosely connected, informal and self-managed than business units even when they are institutionalized" (Wenger, McDermott, & Snyder, 2002, p. 41).

The ideal for a successful school culture is for the school or program goals to be framed with a moral purpose and passionate belief that all children can and should learn (Muijs, Harris, Lumby, Morrison, & Sood, 2006). This moral purpose or set of values is an essential part of the equation for effective leadership. Sergiovanni (2005) identified the heart, head, and hand of leadership as those things that the school community values and sustains. This set of values will imbue the school culture when a purposeful effort to

ensure that the teaching staff is proficient and able to implement the competencies that enable them to feel capable of helping students succeed is implemented and sustained (Dolejs, 2006). Sergiovanni (2005) described purposing as the "continuous stream of action that induces clarity, consensus, and commitment regarding school purposes" (p. 143).

To achieve a community of practice where the purpose is to help all students achieve, school cultures must be changed to places where "teacher development is valued over developing efficient and effective structure" (Murphy, 2005, p. 99). Lunenburg and Ornstein (2004) defined an excellent leader as someone who has the emotional intelligence to demonstrate excellence in empathy, intuitive ability, motivating power, and integrity. Murphy (2005) defined leadership as having a sense of the direction that the organization should be headed and being able to engage the participants of the organization in the process of achieving that vision. Blankenstein (2004) described courage as the most essential virtue that a leader must possess. Leaders convey the inner beliefs and value-added behaviors that strengthen the core and provide the motivation for initiating and sustaining school improvement (Sergiovanni, 2005).

Leadership can also be the ability to organize and transform communities of practice so that an effective knowledge system is implemented and sustained. Wenger et al. (2002) described a knowledge system as "two interdependent processes by which knowledge is produced and applied" (p. 166). However, implementing communities of practice that share learning opportunities as professionals might not yield improvements in teaching. Horn and Little (2010) identified a variety of reasons such as (a) managing disagreements and differences in values, teaching styles, and philosophies; (b) inadequate

social and structural support; and (c) the multiple tasks that teachers must attend to during the course of a normal teaching day. These constraints might challenge teachers to interact with the depth and consistency needed to form new insights into instructional issues or to foment innovative teaching strategies.

There are instances where the literature attributes gains in student achievement or enhanced staff capacity as stemming from many of the dynamics found when teaching professionals collaborate. One example is from a study of a group of mathematics teachers at a Chicago area high school. The teachers at the Chicago area high school were concerned with the successful transition of ninth-grade students into high school. A successful transition from middle school to high school is an important factor in determining the prospects for high school completion or postsecondary education opportunities for students. Horn and Little (2010) contended that the quality of the discourse in problem solving cannot be attributed to the individual teacher's professional experiences or personality but rather to a manifestation of the collective efforts of the group. The mathematics teachers at the Chicago high school had developed and refined a set of ideals and conceptual tools that developed from shared professional development experiences. The teachers intensified their capability in mathematics teaching and reinforced their moral commitments to students through interactions with colleagues, professional groups, and professional development events outside of the mathematics department.

Best Practices-Examples of Efficacy at Work

The literature contains a few examples of schools with high at-risk populations that have been successful in helping students achieve. Reis and Dias (1999) found that

African American and Hispanic students from a high-poverty urban high school credited their success to the support they received from school counselors, teachers, and adults in the school community as well as ready access to opportunities for advanced classes. In Los Angeles, a group of successful high school students from homes with a mean parental income under $30,000 described several factors leading to their success. In addition to their own work efficacy, the students cited a positive outlook, encouragement from school staff, excellent instruction, peer influence, and a school culture that promoted achievement (Griffin, Allen, Kimura-Walsh, & Yamamura, 2007).

Jefferson High School in Porterville, California, implemented a rigorous International Baccalaureate program that attracted a high number of African American, Native American, and Hispanic students from lower socioeconomic and disadvantaged backgrounds. The teachers at Jefferson High School have a strong belief in the students' ability to succeed in the rigorous and highly competitive program. The students have access to support structures that encourage them socially and academically to continue their pursuit of excellence. These examples from the literature illustrate how school leadership becomes essential to sustaining a school culture where the ethos in these schools is that all students should have the access and support to achieve (Dolejs, 2006).

Instructional Strategies and Practices

The most important action that any school can take toward improved student learning is to focus on improved instructional strategies and practices (Murphy & Alexander, 2002). Neihart (2006) noted, "Considerable research tells us that developing talent is more of an uphill battle with some groups of children than with others" (p. 197). One area that has garnered support for many years is on student learning in a social

context. John-Steiner and Souberman (1978) cited Vygotsky's argument that the relation between the individual and society is dynamic. The interaction between younger learners and more experienced learners is where younger learners establish a means for remembering. Bottge, Rueda, and Skivington (2006) found that students in situated learning environments experienced enhanced creativity and the active generation of knowledge rather than the learning found in passive environments. Providing practice in recognizing and comprehending the elements of the problem in an authentic context might contribute to students' capacity to contribute to their success in everyday situations.

According to Sfard (2007) students learn through a commognitive process. Commognition in mathematics is a combination of thinking or mathematical discourse and interpersonal communication. Sfard continued to explain that a discourse is mathematical if it includes words that refer to shapes and quantities. "Learning mathematics may now be defined as individualizing mathematical discourse, that is, as the process of becoming able to have mathematical communication not only with others, but also with oneself" (Sfard, 2007, p.573). Sfard explained that traditional educators and studies on education view learning as a way of acquiring ideas or concepts as separate entities. Since the beginning of the 20th century, studies on learning in cross-cultural or mixed situations have slowly drawn researcher attention to the social and cultural aspects of learning. Sfard continued that thinking is a form of human activity that probably resulted from an arrangement or configuration of communal activity. A good example of a communal activity that transformed into thinking through the process of being able to complete tasks individually is interpersonal communication. Therefore, thinking is

defined as “the acts of informing ourselves, arguing, asking questions, and waiting for our own response” (Sfard, 2007, p. 569). Environments that promote situated learning are highly effective in motivating low-achieving students to become engaged. Bruner (1999) posited that students learn best when they perceive the material they are learning as “worth knowing” (p. 31). Dowson and McInerney (2001) conducted a study to investigate student goal setting by looking at students’ perspectives of their motivational goals through the behavioral, academic, and situated learning dimension. They found that students engaged in situated learning activities showed a higher propensity for participating and attempting rigorous mathematics.

English Language Learners

Cohen and Walton (2007) posited that a sense of social belonging in a school setting was essential to intellectual development. They go on to argue that minorities perceive colleges and workplaces as places where members of their group are under-represented. The uncertainty experienced by minority students, in addition to the psychological results of being targeted by negative stereotypes may at times result in “attributional ambiguity-a mistrust of other people’s treatment of them” (p. 83). Students must be recognized for their skills, talents, and intellectual contributions (Lotan, 2006).

Despite education reform efforts that promote schools without student tracking, immigration trends and family mobility have led to classrooms with varying academic achievement and English language proficiency levels. Classrooms with large immigrant populations without student tracking pose daunting challenges for educators. However, some immigrant and low-income Hispanic students do well in school while others do not. Conchas (2001) found that Hispanic students who received support and have established

relationships with caring adults tended to have better academic achievement than those students who did not.

Although it is evident that a major effort is needed for all students, whether the students are English speakers or not, the societal impact of the ongoing gap for English Language Learners (ELL) is large. For example, the state of California reported that 1.55 million ELL students attended public schools in 2009 (California Department of Education, 2009). The state of Washington report card showed that 93.4% of ELL 10th-grade students and 81.8% of all Hispanic 10th grade students did not meet the standard in mathematics during the 2008-2009 school year compared to the 57.4% of White, English-speaking students who did not reach the standard. In the 2009-2010 school year 90.7% of limited-English-speaking 10th graders and 80.2% Hispanic 10th grade students did not meet the standard in mathematics compared to 52.9% of White, English-speaking 10th graders who did not reach the standard (OSPI, 2010).

Goldenberg and Coleman (2010) reported that many ELLs in the United States come from communities with a preponderance of low income and education levels. This is in contrast to a country like Canada where ELLs come from affluent homes and demonstrate achievement at far higher levels, English-language learner students succeed in environments where English-language applications in specific academic subjects are stressed. This type of English emphasizes functional, syntactic, and semantic knowledge (Echevarria et al., 2006). Vygotsky contended that good instruction remains ahead of the process of learner development (Jon-Steiner & Souberman, 1978). He based this concept on the idea that every child has current developed capabilities, but the child can do more with assistance. Vygotsky referred to this stage in the process of learning as moving into

the "zone of proximal development" (Driscoll, 2005, p. 254). Vygotsky believed that growth is not a simple genetics versus environment argument but rather a continuous self conditioning process. Vygotsky posited that intellectual growth is a historical complex that occurs in stages which reflect the past incorporated into the formation of the learner's new thinking. Since ELL students have limited experiences in English, it follows from Vygotsky's theory that they can move into the zone of proximal development of the new language and content concept with assistance (Driscoll, 2005).

Barton and Griffin (2009) concluded from a study involving ELL students learning mathematics that it is vitally important to provide ELL students with the support and encouragement to verbalize, read, write and listen in the mathematics classroom. Effective classroom teachers emphasize problem solving with students by emphasizing engagement in instructional dialogue and conversation as well as through reading and writing across the curriculum. Echevarria et al. (2008) stressed the importance of using a variety of instructional techniques that help students comprehend the instruction. Some of the techniques include (a) speech appropriate to the student's English proficiency level, (b) academic tasks that are clear and concise, (c) mathematical and non-mathematical modeling, and (d) the use of hands-on activities, visuals, gestures, body language, and demonstrations, (e) opportunities for interaction and discussion, and (f) opportunities for clarification of concepts.

Student Motivation

Understanding how Hispanic youth are motivated to achieve is an important issue. According to Wilkins and Kuperminc (2010), Hispanic students as a whole have many obstacles to overcome besides lack of language proficiency in English. Wilkins and

Kuperminc found that Hispanic students have the (a) lowest high school graduation and college enrollment among all students in the school aged population, (b) the lowest socio-economic demographic in the United States, (c) a widening achievement gap, and (d) experience a higher rate of exposure to violent crimes. Wilkins and Kuperminc introduced factors outside of the school environment that may positively affect the process involved in academic motivation of Hispanic students. These factors are: (a) culture, (b) the family, (c) job opportunities, and (d) the affordability of higher education. The cultural values cited by Wilkins and Kuperminc are sense of pride and indebtedness to the family (familismo), reverence for the elders (respeto), and a focus on the goals of the community or group rather than the individual (allocentrismo). These values are very often instilled in Hispanic youth by community members and parents and provide a perspective for understanding the motivation processes. However, school based policies and intervention strategies should be developed with information resulting from an examination of the factors that affect motivation within the school setting.

When discussing motivation, a distinction must be made in goal-centered achievement motivational processes between students pursuing the intrinsic rewards of mastering a task versus students motivated by the external recognition of being able to perform a task (Elliot and Church, 2003). These approaches are known as mastery goals and performance goals respectively. Students who seek mastery are more successful than students who seek performance goals. Students pursuing performance goals are more vulnerable to a negative response to failure and tendency to avoid competition. Elliot and Church elaborated on this goal-centered theory of achievement motivation by examining the influence of defensive pessimism, or setting very low standards and expectations of a

soon to occur achievement situation. Elliot and Church argued that students select negative pessimism as a means of preventing loss of self esteem in the event that the student should fail in the achievement situation. This defensive pessimism closely aligns avoidance motivation with fear of failure and could result in positive achievement motivation results. However, students who demonstrate an approach to mastery orientation tend to pursue challenging goals and value competence and competition. Those who demonstrate an avoidance orientation tend to avoid ability assessment and competition and do not place a high value on competence. Elliot and Church define avoidance motivation as the process where the individual develops obstacles to success including withdrawal of effort so that failure will not be attributed to lack of intelligence but rather the ill conceived handicap the student had manifested. Therefore, the student places a higher premium on protecting herself or himself from the negative implications of failure rather than achievement.

In a study conducted by Witkow and Fuligni (2007), achievement goals were framed in order to distinguish between mastery goals and performance goals. The study also analyzed the differences between an approach orientation and an avoidance orientation. Students from three Los Angeles high schools were recruited to participate in the study. The students from the first high school were predominantly Hispanic and Asian and came from families that had lower to middle class educational and job backgrounds. The students from the second high school were predominantly White and Hispanic, had average achievement levels and came from families that had lower to middle class backgrounds. The students from the third high school were predominantly White and Asian, had above average achievement levels and came from families that had middle to

upper class backgrounds. No one ethnic group had an overwhelming majority in the schools selected for this study. The largest ethnic group in each school was under 50% of the entire school population. Witkow and Fuligni found that students with a mastery approach orientation believed that excellent performance on an examination was an indication that they comprehended the subject material being tested. Conversely, students with a performance approach orientation indicate that they believe a high grade on the examination implied that they did well on the examination. These conclusions indicate that high school students can find a pathway to achievement by focusing on high grades and on learning the material. Performance approach goals were exhibited in students who focused more on the desire to do better than their classmates and less on learning the material for intrinsic value. The mastery avoidance goals characteristics were most evident in Hispanic students when compared with the White and Asian students. The next section of the literature review will address specific learning strategies that have been effective when used with Hispanic and/or ELL students.

Differentiated Instruction

According to the National Mathematics Advisory Panel, the lack of student achievement in mathematics, particularly in Algebra, makes mathematics achievement at higher levels increasingly problematic for students. Students lose out on opportunities to attend post secondary educational opportunities because of poor achievement in mathematics (U.S. Department of Education, 2008), One of the most prevalent findings in recent years is that teaching strategies directly impact achievement in the mathematics classroom where the students have varying backgrounds and abilities. House (2006) found that when teachers in Japan and the United States implemented differentiated

homework and classroom strategies the algebra test scores in their classrooms increased. House also concluded that repeated implementation of active learning strategies such as discussions, developing conjectures, and relating the new mathematics to occurrences in everyday life were positively correlated to Algebra success. McTighe and Tomlinson (2006) posited that "to teach for understanding is to provide the sort of intellectual diet that yields thoughtful, capable, confident learners—and citizens"(p. 38). Central to successful teaching is the implementation of multiple elements in order to help students understand and apply the knowledge we want them to know. Effective teachers believe in helping students shape their lives as a result of the strength and understanding discovered in the knowledge presented through excellent curriculum. The implementation of multiple elements by teachers and the resulting ability to influence student learning in a meaningful way are very often elusive in classrooms where students struggle to comprehend the prescribed language in the content area being studied. It is equally as elusive for teachers who do not have the skills to deliver the content in a meaningful manner to the students with limited learning backgrounds.

Meeting the needs of students in a diverse classroom is not a trivial matter. Many teachers have struggled with the notion of providing instruction for students with varied learning backgrounds and learning needs. McTighe and Tomlinson (2006) suggest that in order acquire a deep comprehension of the material being taught, teachers must challenge students to provide explanations and evidence to justify their explanations, and provide students with counterexamples and examples. Teachers must also ask students probing and meaningful questions, and compare the material under study in an authentic context. Effective teachers accomplish the task of helping students with limited and diverse

backgrounds learn the material by employing differentiated or multiple strategies to affect student participation in the learning process. Teachers who implement differentiated techniques through individual, small-group, and whole-class instruction increase the likelihood that all students attain a deeper understanding of the content. Dana and Yendol-Hoppey (2009) define differentiated instruction as a strategy for teaching and learning that requires the teacher to have the dexterity to adjust the curriculum and instruction so that it caters to the specific needs of the learner instead of requiring the students to make the adjustments so that they will learn the required material. Students can sometimes decide to not perform when they view their task as too daunting or the material beyond their comprehension or ability. Although students may receive the encouragement to do their best in school from parents, friends and significant others, it is not reasonable to ask a person who does not understand the language to keep pace with students who comprehend the language. Mixed ability grouping is an example of a strategy used to help struggling students comprehend the content and the language of the content (Echevarria et al., 2006). These mixed ability groups will have varying threshold levels but never obvious ability level. This strategy requires the teacher to become cognizant of their individual students and to know the capabilities of their students. MAP data can be a good tool to determine the ability levels of the students (Northwest Evaluation Association, 2010).

The National Mathematics Advisory Panel (U.S. Department of Education, 2008) recommended looking at a cooperative oriented strategy for teaching. One strategy cited in the report is the Team Assisted Individualization (TAI) approach to improve student computational skills. This is a highly structured classroom strategy that places students in

mixed ability groups so that they can help each other and a reward system that is both group and individual oriented. However, student improvement of conceptual understanding and mathematics problem solving were not impacted by TAI. The panel found that when models are presented in a manner that is clear and comprehensible for the students, students in the lower third of a typical class achieved greater gains in solving word problems. The Panel continued to point out that providing students with multiple opportunities to solve problems aids in student academic achievement. The research does support the argument that instruction should be balanced with a combination of teacher directed and student centered instruction. The Panel found that students showed higher gains when they are provided with extensive feedback and were provided with opportunities to think aloud.

The findings of the Panel suggest that struggling students may benefit from explicit instruction. Furthermore, some instructional time should be dedicated to checking students foundational skill level for the mathematics they are supposed to be learning at their grade level. The researchers on the Panel caution that the report findings do not imply that all instructions should be delivered explicitly, but rather blended with differentiated techniques, discussions and other methods of garnering comprehension. Learning and teaching mathematics do not occur in a strictly intellectual context, but must also include the socially contextual nature of knowledge in the use of language and social interaction (Edwards, Felipe-Matos & Núñez, 1999). In a study analyzing mathematical learning, Gómez-Chacón (2000) demonstrated that a good student-centered math program (a) teaches students how to utilize concepts to solve problems, (b) motivates students by allowing problem-solving flexibility, and (c) provides students

with a schema for making sense of their mathematical learning. Winstead (2004) argued that mathematical knowledge retention is reinforced by "helping students think about their thinking, reflect on the knowledge they possess, and showing them how to apply specific strategies to particular situations" (p. 30).

Differentiated learning environments are enhanced when the teacher knows the backgrounds of all students in the class. This requires some background information and preliminary work where the teacher may pass out questionnaires at the beginning of the year and ask students student questions about aspirations, goals, and experiences. In the state of Washington, students monitor and develop their individual plans starting in ninth grade. Students reflect on questions about aspirations, goals, and experiences as part of the High School and Beyond graduation requirement through their senior portfolio (OSPI, 2010). By their senior year, students are required to demonstrate a clear description of their academic, career, and financial plan. Teachers can facilitate bridge building between the student background information and the new content concept by linking what is important to the student with the new content. Echevarria et al. discovered that students acquiring a new language need plenty of practice with the new language in order to help them develop new language schemata that make sense to the student. Students discussing, sharing, and explaining their work in terms of their own goals and experiences are all appropriate strategies for helping ELL students learn the content in the new language.

One challenging aspect of differentiating instruction is linked to scaffolding a cognitively rigorous concept in a manner that enhances student participation in the activity (McCosker & Diezman, 2009). McCosker and Diezman defined scaffolding as

“more than just encouraging the students' actions. It involves the teacher acting as a facilitator so the student is able to achieve more than he or she could without the scaffolding” (p. 28).The teacher must find a link to the student’s background that is consistent with the particular content being investigated in the lesson. Making connections to the student background and prior learning is very important in an environment where students come from varied backgrounds. Winstead (2004) found that teacher failure to understand the important link between the student’s background and the particular content being investigated in the lesson may result in an ineffective instructional experience for the teacher and cumbersome learning experience for the student.

Sheltered Instruction

One strategy that has shown promise among ELL students is sheltered instruction. Hansen-Thomas (2008) described sheltered instruction as the synthesis of sound instructional methods combined with instruction that focuses on meeting the academic needs of second language learners. Sheltered instruction focuses on language function and form when discussing content concepts. Some of these functions include explaining, describing and defining interesting content. Hansen-Thomas found that between 2000 and 2010, mathematics classrooms have evolved into learning environments where process learning, cooperation and discovery are valued over product-oriented and individualistic approaches. Sheltered instruction is enhanced through scaffolding of content using mathematical realia such as manipulatives, demonstrations, and investigations. Hansen-Thomas identified the following challenges facing ELLs in the classroom: (a) the speed of the spoken second language, (b) use of informal expressions

such as colloquialisms, (c) lack of exposure to academic vocabulary and (d) the use of common vocabulary that has multiple meanings, such as the math terms coordinate or plane. Teachers must also be conscious of how some words sound the same but are spelled differently such as some and sum.

Genesee, Lindholm-Leary, Saunders, and Christian (2007) found that the successful sheltered instruction occurred in environments where (a) the staff shared the ethos that all students can learn, (b) the school is safe and orderly, (c) the curriculum was meaningful and academically engaging, and clearly aligned to standards, and (d) the model for instruction is grounded in proven theory and best practices. For example, Mullin and Oliver (2010) refer to Krashen's i+1 Nativist theory that students move to a more complex level of language acquisition through comprehensible input within social exchanges in the new language. Goldenberg and Coleman (2010) suggested that good teaching for all students occurs in environments where teachers and students participate in high quality exchanges of ideas. The largest challenge facing ELLs and their teachers is that they must develop the ability to use the English language while making progress acquiring knowledge in the academic content area. The goal of sheltered instruction is to develop the ability of students to use the new language while making progress acquiring knowledge in the academic content area

SIOP

In the previous paragraph we defined sheltered instruction as a strategy that focuses on language function and form when discussing new content concepts. The Sheltered Instruction Observation Protocol (SIOP) is an observation framework for effective sheltered instruction. SIOP is used by teachers, professional development

specialists, and administrators in order to gather information about the consistency and effectiveness of the sheltered instruction.

The Sheltered Instruction Observation Protocol was a 7-year project with the goal of developing a framework for the consistent implementation of sheltered instruction. The study was conducted by the Center for Research on Education, Diversity and Excellence (CREDE), a national research center funded by the U.S. Department of Education. The research project gathered qualitative data through teacher feedback from interviews, surveys, and observations (Echevarria, et al., 2008). Creswell (2003) posited that qualitative research design can provide rich descriptions of an educational framework. After the SIOP model was developed, Echevarria et al (2008) stated that a new study through the Center for Research on Education, Diversity and Excellence (CREDE) was being implemented to determine the efficacy of the SIOP model to student achievement.

The sample in the CREDE study consisted of 346 students in grades 6 through 8 from a population of 166, 000 students distributed across 220 schools on the east coast and west coast combined. The teachers involved in delivering SIOP to the students in the project received SIOP training and "formed a learning community in order to refine the model through an examination of teaching classroom practices and student response to the SIOP lesson" (Echevarria et al., 2008, p. 45). Qualitative feedback was provided by the teachers in the form of reflections from journal entries and their own observations of the efficacy of the strategies as they aligned to the SIOP components. Student outcomes were measured quantitatively through the results of a standardized reading and writing assessment called the Illinois Measure of Annual Growth in English (IMAGE) test. Pre

and post test data of the treatment classes and the control classes were compared and analyzed.

Echevarria et al. (2006) revealed that ELL students whose teachers used SIOP showed more gains on expository writing assignments in content areas than main stream students whose teachers did not implement SIOP. The SIOP measurement instrument includes a checklist that allows sheltered instruction teachers to monitor instruction along a continuum. The SIOP model provides teachers with a construct for presenting content such as mathematics to ELL students. While the teachers make the new content understandable for students, they also help student language skills evolve through the domains of reading, writing, speaking, and listening. There is no empirical evidence that suggests the efficacy of SIOP in high school mathematics instruction.

The SIOP model is separated into eight categories and 30 objectives for lesson planning (Echevarria, et al. (2006, 2008, 2010). The categories, referred to as components in SIOP, are as follows: (a) preparation, (b) building background, (c) comprehensible input, (d) strategies, (e) interaction, (f) practice and application, (g) lesson delivery, and (h) review/assessment. The components identified in the SIOP model align very well with other successful teaching methods. For example, Driscoll (2005) described Gagne's nine transformations in the process of developing new knowledge. The first stage is referred to as getting attention. This stage along, with the second stage referred to as informing the learner of the objectives, coincides with the SIOP preparation phase. The learners have to be prepared and their attention must be garnered for what they are about to learn. The third phase in the Gagne model involves stimulating the recall of prior learning, where the learner is presented with information that will require a recollection

of prior experiences and might also entail some new information. This stage coincides with SIOP's second stage of building background. The remaining six stages of the Gagne model coincide with the final six stages of the SIOP model (Driscoll, 2005). The SIOP is about planning for a specific purpose, emphasizing teaching the academic language and content such as mathematics, and sustaining the ethos of high academic achievement for all students while developing their English proficiency (Echevarria et al., 2010).

SIOP Building Background Component

Echevarria et al. (2010) describe SIOP as an effective model that helps teachers systematically teach grade level content such as mathematics to both English language and non-English language learners, who have a limited academic literacy level. One of the key components of the SIOP model is the building background component. The SIOP building background component ensures that links are made to student prior learning and experiences while emphasizing new vocabulary in writing.

In the study school district building background is important because many of the English language learners (ELLs) have limited exposure to the English language, American culture and the education system in the United States. Good teaching practice requires teachers to activate prior learning in order to determine where the students' gaps exist and to heighten student enthusiasm for the learning experience. Young (2002) stated that "the more personally relevant the experience the more likely the student's minds and emotions will be engaged" (pp. 43-44). Teachers using SIOP need to go further in stressing mathematics vocabulary. Teachers should teach students how to utilize context clues, illustrations, and syntax related in form and meaning to a word in another language. Students require extensive practice speaking and writing the new mathematics

vocabulary with accuracy. Practice and reinforcement are more effective through multiple modalities including kinesthetic, verbal, and oral modalities. Kasmer and Kim (2009) described mathematics classrooms where predictions were used to build bridges with prior learning. Predictions are effective for building a bridge between what the student knows and what they need to learn. Students who were taught in environments where teachers posed prediction questions as relevant introductory material were more engaged in active and meaningful learning of mathematics. The prediction questions summoned student prior knowledge and connected prior concepts with new ones which is consistent with the SIOP.

SIOP Comprehensible Input Component

Lee (2005) stipulates that ELLs must develop literacy and language skills in the context area in order to keep from falling behind students who speak and comprehend English used in the academic subject area. The National Council of Teachers of Mathematics (2008) in a report titled Principles and Standards called for a core foundation of mathematics that is to be learned by all students. Students with special educational needs such as ELL students must have the opportunities and support required to attain the mathematical knowledge that is important and necessary. According to Francis and Vaughn (2009) there is a lack of research addressing the needs of older ELLs. ELL students require effective interventions and instructional strategies addressing new vocabulary and comprehension of written text. Echevarria et al. (2008) pointed out that “for English learners to understand instruction it is imperative that a teacher implements techniques to improve comprehensibility” (p. 49). Echevarria et al. (2008) found that in order to attain comprehensible input through SIOP, explanations of

academic tasks must be clear and concise and that speech is used according to the student proficiency level. Additional methods used to provide comprehensible input include modeling, visuals aids, hands-on activities, demonstrations, gestures, and body language.

SIOP Strategies Component

The strategies component of SIOP emphasizes the cognitive skills needed by the learner in order to comprehend the content concepts (Echevarria et al., 2010). Some examples of learning strategies recommended for SIOP include making conjectures, predicting, self-questioning, monitoring, self-assessing, evaluating, taking notes, and organizing information. Echevarria et al. also recommends that teachers can stimulate the use of learner strategies by asking higher order questions, using scaffolding techniques, and allowing ample time for students to think. The use of higher order thinking questions can be introduced through scaffolding of instruction. McCosker and Diezman (2009) described scaffolding as a chance for students to hone their abilities to make sense of the mathematics in a manner that enhances their efficacy towards mathematics. The mathematics efficacy can be manifested through their self confidence and their independence in tackling mathematical tasks. Examples of scaffolding include practice, partner or small group cooperation, graphic organizers, vocabulary, partially completed text. Some other examples of scaffolding that emphasized verbal instruction include thinking out loud, paraphrasing, and referencing of contextualized text (Echevarria et al., 2008).

SIOP Interaction Component

Francis and Vaughn (2009) posited that students are expected to interact at high cognitive levels, read complicated material, and communicate complex topic both in

speech and in writing. Francis and Vaughn found that "many ELL students are in mainstream classrooms where teachers are unaware of ways of adjusting instruction appropriately for their second-language development needs" (p. 290). Vygotsky argued that learning cannot be separated between the individual and learning where social interaction is facilitated (John-Steiner & Souberman, 1978). Bottge, Rueda, and Skivington (2006) posited that students in environments where learning is promoted through the social interactions between learners experience creative thought and knowledge development at a pace faster than learners in passive environments. The SIOP interaction component incorporates a myriad of methods for students to apply English in their interactions with classmates and the teacher (Echevarria et al., 2010). According to Echevarria et al. evidence of opportunities for interaction in the SIOP model includes small group discussions for clarification, wait time for response, and resources that will aide in clarification of new concepts. Some examples of resources may include text, internet, and materials written in the first language (Echevarria et al., 2008).

Practice and Application

ELL students need more time to practice and apply the key concepts of the lesson (Coleman & Goldberg, 2010; Echevarria, et. al, 2010). Providing ELL students with additional time allows them to process information between primary language and the second language. Teachers should not rely exclusively on work sheets for applied practice. The use of worksheets requires a high level of English proficiency and very little interaction and feedback from other students and the teacher. Instead, ELL students respond well to manipulatives and hands-on activities that allow the student to practice new knowledge. The National Mathematics Advisory Panel (2008) reported that students

underperforming in mathematics, including ELL students, respond well to instruction that provides students with opportunities for practice and application in the use of real world contexts This is also true for students learning mathematics in specific domains such as fraction computation, solving basic equations and representation of functions.

Teachers must provide activities that are relevant to the student and provides opportunities to practice the new content (Echevarria et al., 2008; 2010). Task expectations should be communicated in a clear and explicit manner to ensure that students participate completely in the assigned mathematical investigation (McCosker & Diezman, 2009). Hands-on activities should be structured to motivate, engage, and bring out the excitement in the learning experience. Some examples of hands-on activities include simulations, in-class demonstrations, models, problems with anecdotes, and open discussions on personal experiences relevant to the discussion. Examples of manipulatives include realia, visuals, body movement, gestures and expressions, high frequency vocabulary, and personalized language (Flynn & Hill, 2006).

ELL students flourish in environments where activities allow them to test the acquired content while applying the second language to the new content (Echevarria et al., 2008; 2010). Echevarria et al. continued by stating that classroom activities in the SIOP classroom should integrate reading, writing, speaking, and listening skills as the students are learning the new content skills and concepts At the high school level, this can take the form of modeling formulas of on the board. For example, Echevarria et al. (2010) proposed that teachers use mathematics bingo to teach geometric area, surface area, and volume. The teacher will write on the board or projector 10-20 formulas that represent geometric area, surface area, and volume. The students will pair up and

describe the meaning of each formula. For example area of a rectangle is length times width (A = L x W). The students then cut up index cards into smaller 3 x 3 sections where they write each of the formulas. The teacher then distributes a game sheet to each student with section locations, reaches into a bowl and has the student match the formula to the description.

Assessment and Review

Assessment in SIOP is ongoing before, during, and after the lesson (Echevarria et al., 2010).. Flynn and Hill (2006) found that ELL students learn best when the objectives for learning are clearly stated. ELL learners are bombarded with incoming stimuli as they are trying a new language as well as new content. In order to enhance student efficacy to learn the new content, teachers must reinforce the relationship between effort and achievement. Lack of confidence or self esteem can lower a student's ability to obtain a new language. Flynn and Hill recommend that students monitor their own progress. This can be accomplished by having the students develop a chart that tracks their individual effort and progress of their achievement. Echevarria et al. recommends that review in SIOP include a summary of the main ideas, the vocabulary, and regular feedback on how students applied the language and feedback on the quality and accuracy of the work they produce. Assessment includes constant monitoring of how well the student learned the new content through formative assessment techniques such as group reply to questions and quizzes.

Literature Review on Methodologies

The two major methods of conducting research are quantitative and qualitative. Quantitative research tends to be deductive, but it can also be inductive. Quantitative

research is inclined to be rigorous; adhering to objectivity and strict statistical analysis. In qualitative research, reality is based on perceptions. The researcher seeks to develop new ideas from the present method through an inductive approach. Rigor in qualitative research is established by ensuring that the researcher separates any personal or professional beliefs that have become unshakeable (Simon, 2006). Denzin (2010) found that "there are no ironclad criteria regulating the production of knowledge or the validation of inquiry findings" (p. 424). According to Creswell (2007) studies using mixed, multiple, and emergent methods are everywhere today, in handbooks, readers, and texts. "Creswell (2003) concluded that in most cases, mixing quantitative and qualitative methodologies is not a realistic design. Creswell believed that "it is better to conceptualize it as a method rather than a methodology" (Simon, 2006, p. 57).

Literature Related to Case Study Approach

Case studies are common in education and especially suitable for learning about little known or poorly understood situations (Jensen & Rogers, 2001; Rowley, 2002). A case study refers to descriptive research based on a real-life situation, problem, or incident and situations calling for planning, decision making, or action with boundaries established by the researcher (Simon, 2006, p. 48). Case studies describe the details that provoke a discussion of the essential components impacting the study. According to Hatch (2002) the investigation of a bounded phenomenon in a contextualized setting can be conducted using a case study. Merriam (2002) argued that "readers can learn vicariously from an encounter with the case through the researcher's narrative description" (p. 179).

Merriam (2002) provided an example of a case study regarding the role that schools play in the assimilation of immigrant children. In this case study the researchers analyzed how a school transmitted values, customs, and beliefs of society in the United States to immigrant children. The researcher used formal and informal interviews and observations. Additional information was collected from school publications such as curriculum guide, code of conduct, and student schedules.

Flores and Roberts (2008) reported on a case study that was conducted at three large urban high schools. The purpose of the study was to determine the unique characteristics and practices that led each school to better than average mathematics achievement. Flores and Roberts used quantitative measures to select the schools based on their mathematics achievement results and their demographics. After conducting interviews of the mathematics teachers, principals, and department chairs in each of the three high schools, the researchers concluded that leadership came from within the teaching staff at these three schools, teachers worked collaboratively to ensure the same concepts are covered and to share strategies and the culture was respected and no excuses were made for the students

Literature Related to Differing Methodologies

According to Rubin and Rubin (2005) positivists social researchers look for precise rules that they claim organize social behaviors. Examples of this type of research are found in studies where the problem is measured with statistical precision. Post positivists generally select an experimental research method because internal validity is very strong due to the random sampling of the participants. However, the researcher is

limited in that no generalizations can be made beyond the results of the experiment (Simon, 2006).

The literature contains examples of larger studies on the effects of an instructional model on English language learner students using a quantitative design. A study conducted by Johns (2002) on higher order thinking skills development of English language learner students used a pretest post-test control design to determine the impact English language learner strategies can have on the regular classroom using a quasi experimental design. Quasi experimental designs are used when a true experimental design is not available. Quasi experimental design is similar to the experimental design. The researcher is able to manipulate of one or more independent variable and measure one dependent variable.

Quasi experimental designs could be used when the data are archived and categorized into cohorts. Sometimes the qualitative methodology triangulated within method can be combined with the quantitative data from the quasi-experimental data for a between method triangulation. For example, Allen, Hsieh, and Nguyen (2006) conducted a study that measured the attitudes of middle school mathematics students after completing a web-based practicum and assessment. There were 74 seventh grade students participating in the study. Allen et al. compared the difference in attitude towards mathematics between students using the web-based design and the students who did not. A chi-square analysis was used to compare homework and practice assignments, surveys and questionnaires, and interviews of 12 randomly selected students. The findings were that students who experienced web-based practice and assessment had a

more positive attitude towards mathematics when compared with the students who only used the paper and pencil assessment and practice system.

Another research method considered for this study was causal comparative. The researcher in the causal comparative research views the characteristics of a problem as the result of past factors. The researcher examines "those past factors to discover the causes, critical relationships, and meanings suggested by the characteristics; usually two or more groups are compared using these criteria" (Simon, 2006, p. 44).

Brewer and Landers (2005) conducted a causal comparative study to analyze a Talent Search (TS) program at the University of Tennessee, Knoxville (UTK). Talent Search targets lower income minority students in grades 7 to 12. The program provides participants with academic and career support in the form of counseling, literature, workshops, activities, skills development, and job shadowing in order to help them make appropriate decisions about post secondary education. A sample of 100 TS students was selected annually between 1980 and 1989. The control group was formed by selecting 100 students who were qualified to be in TS but decided against joining the program.

The analysis for statistical significance compared the enrolment frequencies of TS participants with the frequencies of the control group utilizing a chi-test of independent samples. "The results clearly assert the potential of educational opportunity programs to have a significant impact on the lives of low-income, first-generation college students (Brewer & Landers, 2005, p. 205)."The results of the study indicated that the TS program appeared to make a difference for disadvantaged students.

Summary

In the Blueprint for reform (U.S. Department of Education, 2010c) President Barack Obama stated that ten nations have passed the United States in college completion. President Obama has provided a vision that by the year 2020 the United States will once again lead the world in college completion. This call for action builds on the following key priorities: (a) ensure that every classroom has a highly effective teacher and that every school has a highly effective leader; (b) provide information to educators and parents that will enhance student learning; (c) design rigorous standards that prepare students for career and college and (d) provide intensive support and effective interventions to improve the overall education in schools with the highest failure rate.

Teachers in many classrooms in the United States are as diverse as the students they are responsible for educating. Some teachers come from the conventional graduate and undergraduate teacher education programs. However, some teachers come from unconventional routes with varying degrees of rigor. In addition, teachers have been hired to teach in hard to fill positions without any formal pedagogical preparation. Darling-Hammond and Baratz-Snowden (2007) found that at least 15 percent of teachers new to the profession entered teaching through an unconventional route. This diversity challenges communities and school systems that are working towards meeting the educational needs of all students.

Effective teachers use many different strategies and techniques to determine what students know and how they learn. Activities in effective classroom environments are organized so that students can advance from their prior knowledge to where they need to be. Darling-Hammond and Baratz-Snowden stated that successful teachers “adapt the

curriculum to different students' needs ─ for example, making content more accessible for students who are still learning English" (p. 112). Students in classroom environments where they have opportunities to debate, listen, evaluate, discuss and read information are more engaged in the learning process than students in classrooms where teachers lecture from a podium. Constant feedback and self-reflection on how well they are learning is an essential aspect of the learning process.

There is a need for more research that emphasizes effective teaching for diverse and underachieving learners is obvious. There is a particular shortage of research on the efficacy of SIOP as an instructional protocol for teaching ELL students high school mathematics. Studies that emphasize improving the quality of the teaching practice in the classrooms will do more to close the achievement gap for students who are prone to failure or who are more educationally at risk than just about any other reform effort (Darling-Hammond, 2008). In Section 3 I will describe the method of the research used to determine the efficacy of SIOP in mathematics instruction.

Section 3: Research Method

A high percentage of high school students in the United States perform poorly on mathematics achievement tests. Low performance on state and local assessments is especially the case for ELL student. This concurrent mixed-methods design used an evaluative case study approach mixing qualitative and quantitative data in order to explore the efficacy of SIOP in high school mathematics instruction. The qualitative data for this study were obtained from a combination of in-depth interviews, classroom observations, and teacher lesson plans. Quantitative data were retrieved from the archived results of the NWEA MAP mathematics assessment.

Section 3 outlines the design method that was employed in this research study, on the efficacy of SIOP in mathematics instruction to ELL students. The setting and sample sub section includes the method used for sampling, a description of the participants, the sample size, the instruments used to gather data, processes for validity and reliability, data analysis, and methods for protection of confidentiality. The results of the study will support and facilitate studies on how teacher efficacy to implement a new instructional model impacts the learning of ELL students in a high school mainstream mathematics classroom. The results will also support the effects of teacher implementation of a new instructional model on student efficacy in the mathematics classroom.

Research Design and Approach

The intent of the mixed-methods study was to examine where the SIOP instructional model was implemented to teach high school mathematics. The analysis and description of what teachers were doing to make SIOP work for high school ELLs learning mathematics was more suitable for an in-depth study of a case (Echevarria et al.,

2008). Phenomenology, grounded theory, ethnography, or biography research traditions would not provide the type of insight I sought. Furthermore, grounded theory is more suited in order to develop a particular theory. This study triangulated qualitative data from interviews, classroom observations, and quantitative data from the archived assessment results of the NWEA MAP for three cohorts. Yin and Davis (2007) posited that comprehensive reform requires a combination of qualitative and quantitative data. The phenomenon under investigation was the efficacy of SIOP in high school mathematics instruction.

Quantitative data from the NWEA MAP for students in three cohorts (ninth grade during 2007-2008, 2008-2009, and 2009-2010) were retrieved from the NWEA database and analyzed. The selection of these data from these cohorts of students was appropriate because these students had varied exposure to learning mathematics in a classroom taught by a teacher implementing SIOP. Every student in the study school is required to take the NWEA MAP three times a year: September, January, and May.

The evaluative case study examined the processes of implementation as well the perceptions of the teachers responsible for implementing the model. Yin and Kelly (2007) argued that "exploratory work can be expected to be more expansive and speculative than confirmatory trials, in which confidence may be expressed as effect sizes or probability estimates" (p. 134). In this case study, a concurrent mixed method design drew together inferences from both the qualitative and quantitative data at the end of the study (Creswell, 2003). Yin (2008) posited that a case study is strong when a full variety of evidence such as observations, interviews, and documents are available for analysis. The qualitative data in the study came from interviews, lesson plans and observations.

The quantitative data were retrieved from archives. A quasi experimental or observational approach to the quantitative data was used to determine if there were any significant changes in test scores since the year that SIOP was adopted (Yin & Kelly, 2008). The quantitative data results were triangulated with the observations and interview results to ensure validity. The lesson plans were triangulated within methods using the observations and interviews to ensure validity of qualitative method.

Setting and Sample

The Washington high school in this study had an enrollment of 481 students and is located in a school district with 1872 students. In the 2009-2010 school year, 92.5% of the students at the Washington high school were Hispanic and 93.1% of the school district students were Hispanic. White students made up 6.7% of the student body in Washington high school and 6.1% of the students in the school district were White. In 2009-2010, 93.7% of all students in Washington high school received a free or reduced lunch, 37.6% were transitional bilingual, and 24.6% were migrant (Office of the Superintendent of Public Instruction [OSPI], 2010). In 2008-2009, a little over 11% of the students in Grade 10 scored at or above proficient on the mathematics portion of the state assessment. Seventy-one percent (71.7%) of the student scored at a level 1 considered well below standard. In 2009-2010, a little over 32.8% of the students in grade ten scored at or above proficient on the mathematics portion of the state assessment and 41.2% of the students in Grade 10 scored at a level 1 considered well below standard.

The school district had 112 teachers with an average of 8.5 years experience. The Washington high school had 35 classroom teachers. The teacher overall career experience average was 8.9 years. In 2009-2010, 51.4% of the teachers had at least a master's degree.

Core academic classes were taught by 23 teachers. The percent of teachers defined as highly qualified by the NCLB act was 89.6%. There was one Hispanic teacher on the high school staff. White teachers comprised 98% of the high school staff.

The school provides free or reduced lunches for over 93% of the students. Despite the evidence of poverty, the community supported and completed the construction of a new high school in 2006. The community depends on farming and reflects a predominantly Hispanic culture that is evident in the high percentage of Hispanics in all mathematics classes. The community is situated between two moderately sized cities to the north and west, approximately 50 miles apart. The rationale for selecting this site is that only 32.9% of the 10th grade students in the study high school passed the spring 2009-2010 mathematics portion of the Washington State assessment. According to OSPI (2010b), the Washington high school is in year eight of monitoring Adequate Yearly Progress (AYP) performance goals. AYP is a required statewide accountability system for schools receiving Title 1 funding under the NCLB act. In Washington State, the AYP requires each school and district to demonstrate academic progress as measured through the results of the annual state assessment in mathematics and reading. The AYP has "the safe harbor provision" that stipulates a school that has one or more subgroups not making the goals may demonstrate adequate progress if the percentage of students not making progress decline by 10% in each student category. High schools have the extra provision of reporting the "on time" graduation rate. After two consecutive years of not making AYP, the school enters into step 1 of the consequences for not making AYP. Step 5 would be designated to schools that are in year 6 of not making adequate progress. Some consequences of being in step 5 include (a) reorganize school staffs including

replacement; (b) hire an outside agency to manage the school; (c) if the state agrees, undergo a state takeover; or (d) restructure the school program. The study school is currently in step 5.

The teachers at this Washington high school were expected to participate in this study because they have provided instruction using SIOP at the study high school and have participated in professional development for SIOP. Furthermore, these teachers have taught the students in the Washington high school for at least two years. I am also a member of the teaching staff. I have 24 years of experience in public education in five school districts, and have completed three years in the Washington high school.

The first teacher has 18 years of experience, all of which occurred in the Washington high school. The second teacher is National Board Certified and has 3 years of experience in another district and four years of experience in the Washington high school. The third teacher has two years of experience, all of which occurred in the Washington high school.

Student placement in mathematics is based on ability levels and not grade level as determined by the MAP and teacher recommendations. There are no ELL-exclusive mathematics classes, although the majority of the population speaks Spanish at home. It is a regular occurrence in the high school to hear conversations in Spanish among students during lunch, athletic competitions, and between periods. The school is on a six-period day with each class period running for 58 minutes. All students currently in Grade 12 are the students from the 2007-2008 ninth-grade cohort. All students currently in Grade 11 are students from the 2008-2009 ninth-grade cohort, and students currently in Grade 10 are students from the 2009-2010 ninth-grade cohort. The first year of SIOP

implementation was 2007-2008. The primary activity during the first year of implementation was staff and coaches training. The 2008-2009 school year was the first year the district-wide expectation was to instruct students in all subject areas and all grade levels using SIOP.

The MAP assessment sample consisted of approximately 60 student scores for each of the three cohort years. The scores from sixty students in the ninth grade in 2007-2008, sixty students in the ninth grade in 2008-2009, and sixty students in the ninth grade in 2009-2010 were retrieved from the archived data file. The students from the data set scores are now in Grades 12, 11, and 10. This non-random sample is appropriate for this study because the student scores selected for the study are from students who are similar culturally and demographically to the student population. Furthermore, the students have experienced SIOP instruction and come from homes where Spanish is the primary language as evidenced in the student demographic profile. The rationale for selecting sixty student scores for each cohort year is that this number is twice the recommended number of participants for a relationship study (Creswell, 2008).

Sampling Method and Sample Size

The teachers involved in the study were interviewed to determine how they felt about the efficacy of SIOP on student achievement. The school has four prealgebra classes, five Algebra 1 classes, four Algebra 2 classes, four geometry classes, one class called Math Essentials, one precalculus class, and one calculus class. In addition to the interviews, the SIOP checklist was used to observe the three teachers. Copies of the lesson plans were requested from each of the teachers participating in the study. I was not

a part of the sample in order to ensure reliability of the interview and observation process and objectivity and consistency in the study results.

The archived MAP student data for each cohort year was identified with student ID only. Their names were concealed to protect anonymity. The sampling frame for the student data was the student scores in the Washington high school. The students comprising the sampling frame are demographically similar to the students in many other school districts in the Northwest United States. A two stage sampling procedure was used to draw every other student MAP score on the list for each cohort year selected via a systemic random sampling method. The scores for students who were below level II in English language proficiency during the spring MAP would not be included on the list. The students randomly selected from within the cohort years were sorted into a stratified random sample depending on the cohort year.

Sequential Data Collection

This concurrent mixed-methods study evaluated the efficacy of SIOP in high school mathematics instruction. Qualitative information collected from the teachers implementing SIOP was analyzed to determine the features of SIOP that teachers perceived to be most effective in addressing student needs in the mathematics classroom. Qualitative data were gathered sequentially. The interviews were scheduled and conducted first, followed by the analysis of lesson plans second and third the classroom observations. The gains in MAP scores for three years prior to the current year were also analyzed to determine if there had been a significant increase in student achievement. The first year of SIOP implementation was in 2007-2008 when the district sent staff to

training and assigned personnel as SIOP coaches. The SIOP was implemented as a district-wide instructional model since 2007-2008 to present day 2010-2011.

Context and Concurrent Strategies

In this study, qualitative data collection procedures were appropriate for describing the perceptions the math teachers experienced implementing SIOP to improve student performance in mathematics. Creswell (2007) posited that "qualitative research begins with assumptions, a worldview, the possible use of a theoretical lens and the study of research problems inquiring into the meaning that individuals or groups ascribe to social or human problem" (p. 39). Similarly, qualitative procedures are appropriate for describing observed phenomena. Teachers were observed in the classroom.

Procedures for Qualitative Data Collection

The qualitative data were collected in chronological order. The first qualitative data collection procedure involved in-depth interviews of the participant mathematics teachers. The purpose of the interviews was to describe the teachers' perceptions of the efficacy of SIOP in mathematics instruction. Rubin and Rubin (2005) described an effective interview style that makes the interviewees feel comfortable so that the researcher can obtain the needed information. The goal of the interview should be to obtain depth of understanding instead of breadth. It was necessary to adapt or adjust the questions in the pursuit of more depth during the interview. The interviews were scheduled at the teachers' convenience. A formal letter of consent explaining the interview process (see Appendix C) was hand-delivered to the teacher. Signatures were obtained upon delivery of the letter. The interviews were conducted in the span of three consecutive days, one interview per day. Each interview lasted no longer than 30 minutes

each. The location of the interviews was the Washington high school teacher classroom for privacy, comfort, and insulation from external sounds that may interfere with the recording. The interviews were recorded on an audio recorder and transcribed. Copies of the transcribed interview were e-mailed to the participating teacher interviewed. At the conclusion of the interview, the classroom observation was scheduled. At the time of scheduling the observation, a copy of the lesson plan for that class was requested verbally and made available to me at least one day prior to the observation. A follow-up note reminding the teacher of the observation date and the requested lesson plan was sent to the teacher less than 48 hours after the interview. Follow-up meetings were scheduled one week after the interview for member checking the validity of my interpretation of the interview responses.

The second qualitative procedure encompassed an analysis of lesson plans. The analysis involved a comparison of the elements found in the lesson plan and the components found on the SIOP checklist. The analysis included making comparisons between the strategies and activities identified in the literature review and the strategies implemented in the classrooms.

The third qualitative procedure involved using the SIOP checklist to observe teachers in the classroom setting (see Appendix B). I was the observer, and I arrived 5 minutes before class started and left at the culmination of the class. I was seated in a corner of the room. The rationale for sitting in the corner and arriving 5 minutes early was to minimize student or teacher being distracted by the presence of an observer. The SIOP checklist was used and observation notes were written separate of the SIOP checklist. The purpose of the observation notes was to prompt my recollection of the

observed SIOP activity or other outlier phenomena such as a unique activity or element of the lesson during the analysis phase of the study.

Procedures for Quantitative Data Collection

This Washington high school maintained a regular NWEA MAP testing schedule. Students are tested in the fall, winter, and spring each year. Archived quantitative data were retrieved and analyzed for the ninth-grade MAP scores of the current Grade 12 students, the ninth-grade MAP scores of the current Grade 11 students, and the ninth-grade MAP scores of the current Grade 10 students from September to May for each cohort. The NWEA website at NWEA.org has a data file retrieval feature that allows student archived data to be retrieved from the years since the school has been administering the MAP. A password allowing access to the student MAP data files and the data retrieval feature was provided for the researcher by the Assistant Superintendent of Instruction in the study school district. These data include the time since SIOP adoption.

Instrumentation for Qualitative Study and Material

There was a variety of instruments used for collecting and analyzing qualitative data. The instruments were (a) the interview question list (see Appendix A), (b) NVivo software by QSR (2010), (c) an audio recorder using the I phone 3G voice record feature, (d) the SIOP classroom observation checklist (see Appendix B). Rubin and Rubin (2005) noted that some interviewers use conversational guides or protocols to keep track of the main question and to take notes that might lead to follow-up questions. It was necessary to adapt and adjust the questions in pursuit of more depth in the responses of the interviewed teachers. The responsive interview method was followed. The interview

question list was piloted through an interview with the mathematics coach. The purpose of the pilot was to refine the interview questions before the teacher interviews. The recorder was placed on the table in order to allow for minimal interference and clear voice recording. The software was used to organize the transcribed interview into themes and salient features that emanated from the interviews.

Classroom observations were conducted using the SIOP classroom observation checklist developed and refined by Echevarria, Vogt, and Short (1999). Pearson publishing company has the copyright on the SIOP checklist and has provided permission to use the checklist and publish the results found using the checklist (Appendix E). The SIOP observation checklist addresses the eight components of SIOP instruction, which are:

- Preparation
- Building background
- Comprehensible input
- Interaction
- Strategies
- Lesson delivery
- Practice and application
- Review and assessment

There are 30 total elements in the SIOP checklist. The instrument is based on a Likert-type scale from 0 (*not clearly supported*) to 4 (*clearly supported*). An N/A means that this particular component of the SIOP lesson was not applicable for the particular lesson. A response of N/A requires the scorer to subtract 4 points from the denominator of the

ratio. One hundred twenty points is the maximum score possible if a participant does not check any boxes with N/A.

Instrumentation for Quantitative Study and Materials

The NWEA MAP is a computerized assessment that provides teachers and administrators with detailed information about individual students. The test adapts itself to the individual student by gradually raising the level of difficulty for each question answered. The MAP is administered in the fall, winter, and spring each year in the study high school for ex post facto analysis of student progress and to help teachers and counselors determine individual student ability levels in mathematics.

The MAP measures student progress in algebraic sense, geometric sense, measurement, number sense, probability, and statistics. Every test item on a MAP assessment corresponds to a value on Rasch Unit (RIT) conceived by Danish mathematician Georg Rasch (Northwest Evaluation Association, 2010). The purpose of the RIT score is so educators gain a deep understanding of what a student knows. The power of the assessment is that the RIT measures incorporate the level of difficulty for each test item and provide a measure of comprehension regardless of grade level. Therefore, individual student progress can be tracked from testing period to testing period and from year to year. I used the SPSS computer program from IBM for statistical analysis.

Pilot Study

A pilot study was conducted at the Washington high school as a foundation for the interview portion of the study. The mathematics coach was interviewed for the pilot study using the interview guide. The mathematics coach had 14 years of experience as a

teacher, including 4 years as a teacher in the Washington high school and 2 years of experience as a mathematics coach. The coach was a teacher on special assignment and had taught mathematics classes using SIOP. The interview question guide (see Appendix A) and interview data collection method were piloted to refine the interview questions of the study. The interview responses were transcribed and coded using NVivo software by QSR (2010) was used to group the codes into themes that emerged and to provide a picture of the efficacy of SIOP from the coach's perspective. The results of the pilot study provided information that led to the refinement of the interview questions. The mathematics coach was not part of the main study.

Data Analysis and Validation Procedure

Qualitative Data Analysis

The interviews were recorded and transcribed. At the completion of the interview process a copy of the transcripts were made available to the interviewees to serve as a member checking procedure. The transcripts were used to cluster themes into codes that were consistent with the literature review. The major themes explored included (a) perspectives toward SIOP, (b) leadership and school culture, (c) student learning and motivation, and (d) the implementation of SIOP and its effect on student performance. The responsive paradigm allowed for the development of other questions during the interview. Additional dimensions emerging from the responsive paradigm included the perceived quality of the tasks and activities provided by the teacher, the level of rigor, personal and professional experience of the teacher, and the teacher belief about student learning.

All the teacher interview questions were open ended to allow teachers to express how they felt about the efficacy of SIOP. Analysis of the interview responses also included direct quotes. The interview questions for the teachers are found in Appendix A. The codes were clustered to determine how the teachers perceive the effectiveness of the SIOP model in mathematics instruction. The major themes addressed were (a) how the teachers viewed the efficacy of SIOP, (b) how the teachers experience training and background prior to SIOP influenced their attitude towards the efficacy of SIOP, and (c) the SIOP components teachers favored and why. The interview transcripts, raw data, and audio files of the recorded interviews were stored in a secure location and will remain there for five years.

The interview response codes were cross-referenced with the classroom observation notes and the SIOP classroom observation checklist. The SIOP checklist was scored using the Likert scale. Each of the eight components was scored separately to determine the SIOP components that were emphasized in the observation. The analysis included statements reflecting the scores. The observation checklist raw data were stored in a secure location and will remain there for five years. The teacher lesson plans were reviewed by the researcher to determine if the observed lesson was consistent with the plan.

Quantitative Data Analysis

Each of the student's participating MAP scores was entered into the SPSS software to run an ANCOVA comparing three cohorts of ninth-grade students. Students currently in Grade 12 were in ninth grade in 2007-2008, students currently in Grade 11 were in ninth grade in 2008-2009, and students currently in Grade 10 were in ninth grade

during the 2009-2010 school year. The reason for running this test is to determine if the student scores have increased since the implementation of SIOP. One of the covariates was the MAP scores for students who were above Level II of language proficiency when they were in the ninth grade. The rationale for looking at Level II and above data separately is to avoid skewing the data. Level I students at the Washington high school had almost no comprehension of the English language. Furthermore, studies show that students who are at Level I at the age of 14 or older are not at their appropriate academic grade level by the time they are finished with high school (Hansen-Thomas, 2008). It was anticipated that the academic year 2007-2008 cohort should have the lowest achievement gains. The academic year 2008-2009 cohort should have higher achievement gains than the academic year 2007-2008 cohort, and the 2009-2010 cohort should have the highest achievement gains between the three cohorts. All students are MAP tested three times a year; students are tested in the fall trimester, the winter trimester, and the spring trimester.

Reliability and Validity

This study includes triangulation of multiple sources of data to develop a holistic understanding through the lesson plans, archived achievement data, recorded teacher interviews, and documented classroom observations. Yin (2008) wrote that four widely used tests: construct validity, internal validity, external validity, and reliability, determine the quality of any research.

The construct validity of the research study was achieved by analyzing student archived MAP scores. The interview questions pertaining to the students' ability to work on rigorous math as a result of SIOP was derived from the interviews. The interview

questions were designed to prompt the teacher about their beliefs in the culture for learning and the student attitudes resulting from implementing SIOP strategies within the eight domains of the SIOP model. The teacher lesson plans provided me with information about the consistency of SIOP instruction. The data were clarified through the interview process and review of interview transcripts through follow up meetings for member checking the validity of the of the interview responses. The SIOP classroom observation checklist served to provide a guide for qualitative observation and a measure of the implementation of the components of SIOP.

Internal validity was ensured by comparing the patterns of the coded interview responses, the SIOP classroom observation checklist, and the teacher lesson plans. One tactic for ensuring internal validity is pattern matching (Yin, 2008). External validity is ensured by providing rich thick description of the events reported in the interviews and observations. The interview paradigm is responsive. Therefore, the interviewer had the flexibility to ask probing and follow-up questions that provided generalizability so future readers could make case-to-case transfers particular to their situation (Merriam, 2002).

Reliability is the measure of how well research findings can be replicated (Merriam, 2002). "Reliability can be enhanced if the researcher obtains detailed field notes by employing a good-quality tape for recording and by transcribing the tape" (Creswell, 2007, p. 209). The goal of a case study approach is to understand the real-life phenomena in depth. Case studies "cope with the technically distinctive situation in which there are many more variables than distinctive data points" (Yin, 2008, p. 18). Reliability was determined by cross-referencing distinct codes assigned to the interviewee responses after the conversations have been transcribed. Data from multiple

sources were triangulated throughout the data analysis to enhance the validity and reliability of the study.

Boundaries, or delimitations, and assumptions narrow the scope of a study (Creswell, 2003). The scope of this study involved the students and mathematics teachers in a rural midsized high school. An assumption was that the teacher's responses to the interview questions were honest. Another assumption was that the teachers had no experience in SIOP prior to 2008. A possible limitation might occur when using a convenience sample in that the participants might respond to interview questions based on prior experiences.

Measures for Protection of the Participants' Rights

Role of Researcher

I was formerly a mathematics teacher for fourteen years and a school principal in other school districts for ten years. This is my third year at the study school. I am currently the mathematics department chair and the Professional Learning Team leader. I identified, recruited, and provided protections for the participants of the study. In addition, I (a) conducted, transcribed, coded, and interpreted all interviews; (b) conducted and scored classroom observations; (c) analyzed lesson plans; and (d) retrieved and analyzed archived MAP data. I have been a member of the teaching staff, but I have no direct supervisory responsibility over the teacher participants. The relationship in no way affected the validity of the data collected.

Protection of Participants

Compliance with Walden's IRB and district research guidelines was sought before data collection began. A letter of invitation to participate in the study was given to

the school (see Appendix F). A letter from the school principal was also acquired (see Appendix G) approving access to staff and student data in order to conduct the qualitative component of the study. Potential participants were solicited through a letter of consent providing them with the option of not participating or canceling their participation at anytime during the study (see Appendix C). A data usage agreement (see Appendix H) was obtained from the district of the study high school. A letter requesting permission to use the SIOP rubric was obtained from the Pearson publishing company (see Appendix E).

The identity of the participants will remain confidential. This confidentiality will be maintained by keeping all data and identities in a secure file. Each participant in each portion of the study and data collection was assured and reminded that all measures of confidentiality were being observed. Data are kept in secured files, and after 5 years all data will be destroyed. Participants were informed verbally and in writing that participation in this study involved no risk and was completely voluntary. The participants had the right to choose not to participate or to withdraw their participation at any point in this study without any negative consequences.

Summary

Section 3 included the overall procedures regarding how this study investigated some of the pertinent factors that influenced the mathematics achievement of underachieving high school students. The study included an analysis of the effectiveness of SIOP to improve student performance in mathematics. This study could create positive social change by providing educators with empirical evidence regarding a strategy designed to help underachieving students become successful students. The SIOP program could influence

the achievement gap between students who struggle to become proficient with the prescribed language used in the school setting and students who are already proficient in the language.

Section 4: Results, Analysis, and Findings

There is a problem regarding the poor performance in mathematics by ELL students in Washington State. ELLs often use different processes than their peers to arrive at answers (Hayes, 2011). According to Hayes, solving problems requires a thought process. Hayes argued that students are more focused on attaining the correct response than they are in having a deep understanding of the problem solving process. The purpose of this concurrent mixed methods design using an evaluative case study was to explore and examine the efficacy of the SIOP in high school mathematics. SIOP was designed to make content in courses more comprehensible to ELLs. Providing teachers with an instructional model, such as SIOP, that addresses content objectives (Dufour & Marzano, 2009) while simultaneously addressing language objectives (Echevarria et al., 2010) is a strategy intended to improve student performance in academic courses. Despite the promises of SIOP initiation, there was a lack of empirical evidence regarding the actual use, implementation, and efficacy of SIOP in high school mathematics. In order to determine the impact of SIOP, it was necessary to examine the teacher perception of the value of SIOP, how the teachers implement SIOP, and the relationship of SIOP to student achievement.

The findings in this section were based on data analyses related to the following research questions:

RQ1: How do teachers view the efficacy of SIOP?

RQ2: How have the teachers experience, training, and background prior to SIOP influenced their attitude towards the efficacy of SIOP?

RQ3: What SIOP components do teachers implement consistently in the mathematics classroom?

RQ4: What SIOP components are most favored by teachers?

RQ5: How has student achievement on the mathematics portion of the MAP changed during the first three years of implementation of SIOP in the study high school?

The study entailed multiple sources of data collection such as classroom observations, interviews, and the NWEA MAP test results.

Profile of Study High School

The Washington State high school in this study has a student enrollment of 481 students and is located in a school district with a total of 1872 students. In the 2010-2011 school year, 93.1% of the students at this Washington State high school were Hispanic. White non-Hispanic students made up 6.7% of the Washington State high school student body and 6.1% of the students in the entire school district are non-Hispanic White. In 2010-2011, 93.7% of all students in the Washington State high school received a free or reduced lunch, 37.6% were transitional bilingual, and 27% were migrant (Office of the Superintendent of Public Instruction [OSPI], 2011).

The studied school serves a rural community in the Pacific Northwest. The community depends on farming and reflects a predominantly Hispanic culture that is evident in the high percentage of Hispanics in all mathematics classes. The community is situated between two moderately sized cities to the north and west, approximately 50 miles apart. The rationale for selecting this site was that only 4.4% of the 10th grade students in the Washington State high school passed the spring 2008-2009 and 32.8%

passed the 2009-2010 mathematics portion of the Washington State assessment. Table 2 shows a comparison between the spring 2009 and spring 2010 mathematics state assessment scores for the Washington state high school students in grade 10.

Table 2

State Testing Washington State High School Results

Level	2008-2009	2009-2010
Exceeds standard	0.8	10.8
Meets standard	4.0	19.2
Below standard	21.8	23.1
Well below standard	69.4	43.8
No score	4.0	3.1

According to OSPI (2010b), the Washington State high school is in step 5 of needing to improve on AYP performance goals. AYP is a required statewide accountability system for schools receiving Title 1 under the NCLB act. In Washington State, the AYP requires each school and district to demonstrate academic progress as measured through the results of the annual state assessment in mathematics and reading. The AYP has the safe harbor provision that stipulates a school that has one or more subgroups not making the goals may demonstrate adequate progress if the percentage of students not making progress decline by 10% in each student category. High schools have the extra provision of reporting the on time graduation rate. After two consecutive years of not making AYP, the school enters into step 1 of the consequences for not making AYP. Step 5 would be designated to schools that are in year 6 of not making adequate progress. Some consequences of being in step 5 include (a) reorganize school staff including replacement; (b) hire an outside agency to manage the school; (c) if the state agrees, undergo a state takeover; or (d) restructure the educational program of the school.

Student placement in mathematics is based on ability levels as determined by the MAP and teacher recommendations. There are no ELL-exclusive mathematics classes, although the majority of the population speaks Spanish at home. It is a regular occurrence in the high school to hear conversations in Spanish among students during lunch, athletic competitions, and between periods. The school is on a six-period day with each class period running for 58 minutes. All students currently in Grade 12 are the students from the 2007-2008 ninth-grade cohort. All students currently in Grade 11 are students from the 2008-2009 ninth-grade cohort, and students currently in Grade 10 are students from the 2009-2010 ninth-grade cohort. The first year of SIOP implementation was 2007-2008. The primary activity during the first year of implementation was staff and coaches training. The 2008-2009 school year was the first year the district-wide expectation was to instruct students in all subject areas and all grade levels using SIOP.

The MAP assessment sample used in this study consists of 60 student scores for each of the three cohort years. The scores from sixty students in the ninth grade in 2007-2008, sixty students in the ninth grade in 2008-2009, and sixty students in the ninth grade in 2009-2010 were retrieved from the archived data file. The students from the data set scores are now in Grades 12, 11 and 10. This non-random sample was appropriate for this study because the student scores selected for the study were from students who were similar culturally and demographically to the student population. Furthermore, the students had experienced SIOP instruction and came from homes where English is not the primary language as evidenced in the student demographic profile. The rationale for selecting 60 student scores for each cohort year is that this number is twice the recommended number of participants for a relationship study (Creswell, 2008).

Profile of Participating Staff

The school district had 112 teachers with an average of 8.5 years experience. The Washington State high school in this study had 35 classroom teachers. The teacher overall career experience average was 8.9 years. In 2010 school year, 51.4% of the teachers had at least a master's degree. Core academic classes were taught by 23 teachers. The percent of teachers defined as highly qualified by the NCLB act was 89.6%. There was one Hispanic teacher on the high school staff. White non-Hispanic teachers comprised 98% of the high school staff.

Three mathematics teachers from the Washington State high school staff agreed to participate in the study. These teacher participants were interviewed and observed teaching their classes. To maintain participant anonymity, they were referred to as T1, T2, and T3. T1 was National Board Certified and had 3 years of experience in another district and 4 years of experience in the study high school. T2 had 19 years of experience, all of which occurred in the study high school. T3 had 2 years of experience in the Washington State high school and this was his first teaching position. These teachers have provided instruction using SIOP at the Washington State high school and have participated in professional development for SIOP. Table 3 lists the teachers by their gender and their experiences.

Table 3

Participating Teacher Experience with SIOP

Participants	Education experience	Gender	Experience with SIOP (years)
T1	7	M	3
T2	19	M	3
T3	2	M	2

Data Collection Procedures

Systems Used for Tracking Data

Qualitative procedures were used to collect data from interviews and classroom observations. These data were used to determine whether there was an association between the teacher implementation of SIOP strategies and (a) prior experience and training, (b) teacher perception of the efficacy of SIOP, and (c) student achievement in mathematics.

As is the case of most qualitative investigations, this study employed various strategies and methods of data analysis (Creswell, 2003). Yin (2003) identified interviews and observation as sources of evidence in qualitative data collection. For this study, the sources of evidence were documented and recorded interviews, classroom observations, and archived MAP scores. Strengths of this type of data collection are that the data can be reviewed repeatedly, exact evidence by the participants is contained, and the allowance for broad coverage of previous events (Yin, 2003). The interviews allowed for targeted and focused discussion on a specific topic within this case study. Yin explained that interviews provide insightful and perceived causal inferences and explanation. In addition, all 482 high school students' mathematics achievement data were analyzed with archived NWEA MAP scores. Quantitative procedures focused on the measurement of facts to determine a relationship among the variables of the study (Creswell, 2003). The NWEA MAP results are collected by the school district as part of its curriculum and achievement assessment.

Procedures for Qualitative Data Collection

The sequence of qualitative methods implemented to gather data followed a strict chronological protocol. The first qualitative data collection procedure involved in-depth interviews of the participant mathematics teachers. The purpose of the interviews was to describe the teachers' perceptions of the efficacy of SIOP in mathematics instruction. Rubin and Rubin (2005) described an effective interview style that makes the interviewees feel comfortable so that the researcher can obtain the needed information. The goal of the interview should be to obtain depth of understanding instead of breadth. The interview questions were adapted or adjusted in the pursuit of more depth in the responses. The interviews were scheduled at the teachers' convenience. A formal letter of consent explaining the interview process (see Appendix C) was hand-delivered to the teacher. Signatures were obtained upon delivery of the letter. The interviews were conducted in the span of three consecutive days, one interview per day. Each interview was no longer than 40 minutes each. The location of the interviews was in the teacher's classroom during prep time for privacy, comfort, and insulation from external sounds that may have interfered with the recording.

The interviews were recorded on an audio recorder and transcribed. Follow-up interviews were not necessary. Copies of the transcribed interview were e-mailed to the participating teacher interviewed. At the conclusion of the interview, the classroom observations were scheduled. A copy of the lesson plan for that class was requested verbally to be made available at least one day prior to the observation. A follow-up note reminding the teacher of the observation date and the requested lesson plan was sent to the teacher less than 48 hours after the interview. T1 and T3 responded that the lesson

plan was on the white board located in the back of the room. T2 sent the lesson via e-mail. Follow-up meetings were scheduled one week after the interview for member checking the validity of interview responses.

The second qualitative procedure was the analysis of lesson plans. The analysis encompassed a comparison of the elements found in the lesson plan and the components found on the SIOP observation checklist. The SIOP observation checklist was used as a rubric for planning lessons and to measure the extent that SIOP strategies were implemented in a particular lesson (Echevarria et al., 2010). The lesson plans were reviewed prior to the classroom observations in order to understand the strategies and activities that would occur in the lesson observed.

The third qualitative procedure was the classroom observation using the SIOP observation checklist (see Appendix B). Each teacher was observed one time for 55 consecutive minutes. Each lesson taught was an Algebra class. The rationale for observing the classes in this way was that each class would have the same curriculum content, the same amount of time allotted for the lesson, and different instructors for the same population of students. I arrived 5 minutes before class started and left at the culmination of the class. I was seated in a corner of the room. The rationale for sitting in the corner and arriving 5 minutes early was to minimize student or teacher being distracted by my presence. Observation notes were written on a separate paper and in the margins of the SIOP observation checklist. The purpose of the observation notes was to prompt my recollection of the observed SIOP activity or other outlier phenomena such as a unique activity or element of the lesson critical to the analysis of the data.

Quantitative Data Collection

The Washington State high school maintains a regular NWEA MAP testing schedule. Students are tested in the fall, winter, and spring each year. Archived quantitative data were retrieved from the NWEA database found in the NWEA website at NWEA.org. A password allowing access to the student MAP data files and the data retrieval feature was provided for the researcher by the Assistant Superintendent of Instruction in the study school district. These data include the time since SIOP adoption.

Pilot Study

A pilot study was conducted at the Washington State high school as a foundation for the proposed study. The mathematics coach was interviewed for the pilot study using the interview guide (see appendix A). The mathematics coach is nationally Board Certified, has 14 years of experience as a teacher, including 4 years as a teacher in the Washington State high school and 2 years of experience as a mathematics coach. The coach is a teacher on special assignment and has taught mathematics classes using SIOP. The interview question guide and interview data collection method were piloted to refine the interview process and question guide of the study. The interview responses were transcribed and coded. NVivo by QSR (2010) was used to group the codes into themes that emerged and to provide a picture of the efficacy of SIOP from the coach's perspective. The results of the pilot study provided information leading to the refinement of the interview questions. The pilot interview provided insight into the nature of the questions on the interview guide. For example, the original guide emphasized questions pertaining to the culture of the students. Although the culture of the students was an important consideration in the study, it was not the primary focus. The main objective for

the interview was to gather information about the attitudes and perception of the teachers towards SIOP. Therefore, the questions were adjusted to explore the perceptions of the teachers towards SIOP and questions that were not aligned to the objective of the interview were eradicated from the original question guide. The mathematics coach was not part of the main study.

Data Analysis

Qualitative Data Analysis

Yin (2003) encouraged the development of an overall explanation for any case study. To accomplish that goal, I implemented a coding process using the protocols assisted by NVivo software (QSR, 2010), an electronic coding tool for analyzing patterns in qualitative data. Three teachers participated in the classroom observations, in-depth interviews, and writing lesson plans. All interviews were transcribed and subsequently coded. Reliability was established by transcribing the interviews and returning the transcripts to check for accuracy and an opportunity to clarify any outlier that may appear in the transcript. Coding was completed consistent with transcriptions. The transcripts were read to gain a general familiarity with the perceptions of SIOP and the preferred strategies implemented by the teacher. During this process, dominant concepts, themes, and issues were noted in order to create categories that would help answer the research questions; the categories became the codes through which the transcript was interpreted and meanings were developed.

The classroom observations also provided data that were incorporated into the analysis. The contents of the Likert-type SIOP observation checklist (Appendix B), provided a list of the components of a typical lesson plan and a subset for each

component of elements that provide evidence of implementing SIOP during the lesson. Data obtained from the classroom observations, interviews, and lesson plans were systematically organized and classified into phrases, sentences, or whole paragraphs, which were linked by common themes. Units of data were subsequently deconstructed into categories that described the key characteristics of SIOP. All classroom observations, interviews, and lesson plans were placed in three categories: (a) implementation of SIOP instruction, (b) teacher attitude and perception of SIOP, and (c) student learning. These categories were examined to reveal emerging themes and all were systematically coded and compared. Categorizing and coding schemes yielded four emerging themes based on the characteristics of SIOP. The themes were (a) teacher background and experience, (b) student motivation, (c) professional development, and (d) language.

Bandura (1993) identified teachers with high personal efficacy as individuals that are not afraid of a challenge, but rather view the challenge as something that can be overcome. Individuals with a highly efficacious outlook remain focused on performance and set high goals for themselves. Failure is attributed to a lack of knowledge or effort as opposed to blaming other outside influences. Efficacious teachers are committed to students and driven to teaching excellence. Ware and Kitsantas (2007) found that teacher and collective efficacy beliefs affected their commitment to teaching (p. 308). Collier (2005) defined teacher efficacy as the individual's belief that their efforts can make a difference. Collier contends that successful teachers view their role as a teacher to be important and "examine their own performance in light of student failure and developed improved instructional strategies to meet the student needs" (p. 352). Teachers who

reflect on their teaching for the purpose of improving instruction tend to be more effective with students.

The efficacy of the teacher is an important part of teaching ELL students. Pieces were taken from the components of efficacy while developing the categories for questions in the interviews. Furthermore, the components of efficacy were compared to the implementation of SIOP during the observation and lesson planning. Emerging code and subcode schemes were derived from the following codes: (a) planning for instruction, (b) perception of effectiveness of SIOP during instruction, (c) uniqueness of SIOP as an instructional strategy, and (d) interpretation of instructional strategies as it relates to student achievement. All participants' responses under each characteristic of SIOP efficacy were summarized and placed into categories.

Category responses were grouped based on a summarization of supporting quotes and observations for each category and subcategory. Three major themes emerged in the qualitative analyses of this study: (a) implementation of SIOP instruction, (b) teacher attitude and perception of SIOP, and (c) student learning. The emerging themes in this study were developed using the following explanation. First the development of the role of instruction refers to the actual implementation of SIOP strategies cultivated and implemented by the teachers during a lesson. The teachers' interview responses regarding their background and experiences with other instructional models and professional development as well as the classroom observations were used to develop this theme. The second theme of teacher attitude was developed to examine the teacher's perception of the challenges and triumphs of SIOP. This also takes into account the teacher's background with other instructional models from the standpoint of professional

development and school leadership, and their overall success using SIOP as compared to other instructional models.

Finally, the theme of student emerged from this study with the idea that students in the study school have language and learning background deficits in mathematics. These deficits hamper student efficacy and the ability for the teacher to provide rigorous instruction. The student learning theme was developed to illustrate how well instruction affects student learning according to the components of SIOP. Teacher interview responses were also compared to observation notes in order to look for patterns in student learning. The node branches found in NVivo were as follows:

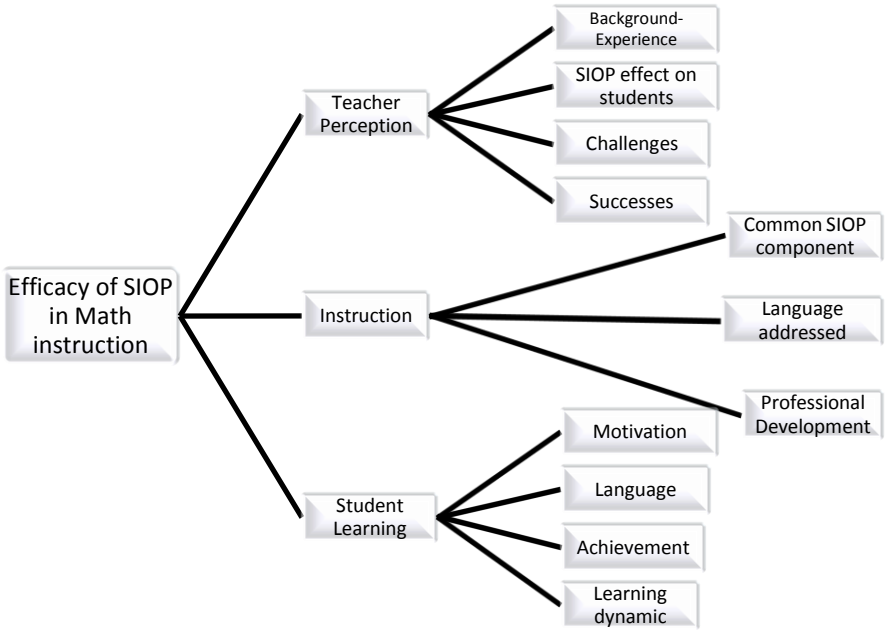

*Figure 1***.** Node Branches for qualitative analysis.

Quantitative Data Analysis

The 180 archived student NWEA MAP assessment data represented the quantitative descriptive statistical part of the study. These data were clustered into three

ninth grade student cohorts of 60 students spanning from 2007 to 2010. An ANCOVA was used to analyze student achievement archival data from a time period prior to the implementation of SIOP through the current year. SPSS Statistical Software (SPSS Inc, 2005) is the most appropriate software for implementing a statistical analysis. The analysis of the quantitative data provided an accurate measure of student achievement.

Findings

Research Question 1

Research question 1 served as a means to explore more in depth the perceptions of the teachers regarding SIOP and the impact on teaching efficacy. All participants' responses under each characteristic of SIOP efficacy were summarized and placed into categories. Category responses were grouped based on a\summarization of supporting quotes for each category and subcategory. Three themes emerged in the qualitative analyses of this study: (a) instruction, (b) teacher attitude, and (c) students.

RQ1: How do teachers view the efficacy of SIOP?

Theme 1: Instruction. The teachers generally believed that SIOP was based on sound instructional practices.

T1 stated that "it's not hard to see that SIOP encompasses the same things we have been taught from the beginning on becoming an effective teacher."

T2 stated that a strength of SIOP is that "you look at the students, what they know what you want them to know a then figure out what to do to get them there to build their background."

T3 stated that “When I write an activity or think about what I am going to do, I do not think explicitly about SIOP but rather think about what I am trying to accomplish. A lot of these strategies are consistent with SIOP.”

Theme 2: Teacher attitudes. The idea of too much of a good thing also emerged as a salient point.

T1 stated “there are times that I believe there can be too much of a good thing, there are so many activities in SIOP that sometimes teachers overuse them to a point where there is not enough fluidity and consistency.” There was a perception that SIOP offered value added strategies for student learning.

T2 stated that “we are being asked to teach to all learning styles.” He went on to portray SIOP as a positive addition “it's good that the district brings these things in, the more tools that you have at your disposal the better you are going to be. Their effectiveness depends on the situation.”

T3 believed that SIOP is an instructional model that is very effective for language and vocabulary development. He stated “If I taught in a school where language was not such an issue, I would teach in a totally different way. SIOP is more rigorous in language. Not necessarily in mathematics. But mathematics has its own language so it is helpful that way.”

Theme 3: Student learning. The Washington school district has a majority Spanish speaking population. Through SIOP, teachers use language development strategies to enhance students’ comprehension of the content that they are expected to learn.

T1 stated SIOP helps second language learners. “In this district we have a majority Spanish speaking culture. Most people speak both English and Spanish; however the majority of the kids aren't that great in either language.”

T2 stated that student learning is impacted by cultural issues. “I see the challenges are often a result of the cultural issues and not necessarily from the country they are from but the subculture that believes they are here in school only because the law requires it.” He continues by stating that “a lot of our students are extrinsically motivated and not intrinsically. Paying close attention in mathematics to a word and how it is used could be a useful application for SIOP.”

T3 also believed that students are extrinsically motivated. “Some students are extrinsically motivated. If you work to help them they will work to learn. I think a lot of times they need encouragement. My favorite saying for some of these kids is that someday you are going to be a math teacher so you better get this down.”

Research Question 2

Research question 2 served as a means to explore more in depth the experiences, training, and background prior to SIOP and the impact on teaching efficacy. All participants’ responses under each characteristic of SIOP efficacy were summarized and placed into categories. Category responses were grouped based on a summarization of supporting quotes for each category and subcategory. Three themes emerged in the qualitative analyses of this study: (a) instruction, (b) teacher attitude, and (c) students.

RQ2: How have the teachers experience, training, and background prior to SIOP influenced their attitude towards the efficacy of SIOP?

Theme 1: Instruction. Teacher background and experience had an effect on the attitudes and perceptions of the teachers towards the efficacy of SIOP.

T1 had a unique experience in the district previous to the study school district. “In my previous district for instance I worked with various groups of people but the majority of the people were from middle to upper class children. I had a freshman come to me one time when I was teaching applied math which was the lowest level of math you can teach in high school and tell that I didn't have to teach him to do math because his dad was going to give him the business. So I asked him how will you do that without math, he said that is why you hire people to do that for you.” When T1 was asked about the quality of the professional development for SIOP, he stated that “we have a lot of in district seminars taught by our own coaches. Since these in district workshops were SIOP focused we did not necessarily have people brought in from out of district.”

T2 had prior training and experience with SIOP about eight years ago. “Since our district had a heavy influx of non-English speakers I thought it would be beneficial to take the English as a second language classes. This was around 2003-2004. This is when I came across the term SIOP.” T2 also believed that many of the SIOP components align very well with the Madeline Hunter Model of Instruction. “When they brought the SIOP model into the district, I didn’t see how anything was any different. I think SIOP models are effective because I don't see how they are different from the Madeline Hunter model.”

T3 shared that he had never seen anything remotely similar to SIOP before coming to the study district. “I came into a new culture, new kids, building, program; trying to apply the components of SIOP was new.”

Theme 2: Teacher attitudes. The teachers had a very diverse background with various instructional models prior to receiving training on SIOP.

T1 commented that he had not seen SIOP before coming to the study district. T1 added that SIOP is not anything new since SIOP is big on modeling. T1 believed that SIOP is a collaboration of good teaching ethics. Teachers are committed to students and are dedicated to their own mission for students.

T2 stated "you always hear about how Asian and European high school students do really well whereas American students do rather poorly. I don't think this is a fair comparison." He continued to argue that the comparisons between our schools and other schools in the international community are not fairly evaluated. "I don't think that kids are taught poorly it's that if you compare to other places we don't. It's not fair because we try to educate everyone."

T3 stated that "the reason I teach is because I want for my kids to have the choices to do what they choose and not be stuck in a certain mold." It is a belief that students in the study school are not taught poorly. However, the teachers are challenged to teach all students regardless of background.

Theme 3: Student learning. Teacher perceptions on student learning as it relates to their prior background and training.

T1 described his perception of the students he is currently teaching as poor, hard working and close knit. "In this community that I am teaching in now, there is a very strong sense of family. The families support each other but the majority of the kids here, not all but the majority of the kids, start at the bottom rung of the ladder." One very important point that emerged was the student's willingness to do the work was affected

by the teacher's attitude toward them. "The work ethic changes from family to family. It also depends on how much the teacher is willing to love. The kids here are very receptive to that. They are very openly welcoming to that. Normally if you are sensitive to that but still holding a firm line, they are normally receptive to that and actually want to succeed for you."

T2 stated "I get a little frustrated because after teaching students who don't want to be here or do not make any effort to learn. When I sit back and reflect to when I went to school, there were kids in my class that were the same way. So I am reluctant to think in some ways that anything has really changed as far as motivation of students is concerned. I think a lot of what you see is political. Maybe business people are saying I don't want to spend my money. I believe that a lot of change that we see in education is caused by political movement".

T3 stated "I think most of the direction of a school comes from the kids that are in it. I know when I was being in high school, my perspective was different." He continued by saying "I think that teachers can affect change but if you have a good group of students who are leaders you get a better school. Teachers can be a positive role model to facilitate and if you see students with the potential to be leaders you encourage them to step up and be leaders."

Research Question 3

RQ3: What SIOP components do teachers implement consistently in the mathematics classroom?

Theme 1: Instruction based on classroom observations. T1 presented a lesson reviewing the solving of equations with variables on both sides of the equal sign. The

content objective was written on the board. The language objective was not evident; however, vocabulary words were listed. T1 made reference to student prior learning and the teacher pace of speech was understandable. The teacher checked for student understanding evidenced by the question and answer interaction between the students and the teacher. Students worked on entry task and knew they could come up to the board and work out the solution. After the teacher reviewed entry task, he modeled an equation with multiple steps. Students' comprehension was evidenced by the accuracy of responses and the language used during the time they were allowed to think aloud and work in teams. Students in class were using mathematics vocabulary consistent with the requirements for the curriculum

T2 presented a lesson on using the degree of a polynomial function to state how number of solutions for a particular function. The content objective was written on the board. The language objective was written on the board. The mathematical graphs were displayed in a handwritten format using a document camera. T2 elicited student responses in a teacher to whole class dialogue. The student's responded with mathematics vocabulary in their explanations.. T2 made reference to links to student prior learning Teacher pace of speech was comprehensible and the teacher checked for understanding by asking specific students a question and the students reply to the question. T2 assigned a team learning activity. The teacher stated "work as a team with your partner to determine as many possible characteristics as you can about the function written on the board." Students' were allowed to think aloud as they worked on the problem. The teacher facilitated learning by monitoring the conversations and guiding student teams with questions.

T3 presented a lesson on solving a system of equations. The content objective was written on the board. The language objective was written on the board. The graphs were displayed in a handwritten format on the board. The student's use of the language of mathematics was evident in their conversations with the teacher and with each other. T3 referenced links to student prior learning. The pace of T3 speech was comprehensible. T3 encouraged students to think aloud.

Theme 2: Teacher attitudes. The teachers all three classes used questioning and grouping techniques. The students were engaged and responsive to the teachers. The teachers in all three classes encouraged students to interact with each in order to solve the specific problem. SIOP component 3, comprehensible input and SIOP component 5 interactions and comprehensible input were both evident at a level 4 in all three classes.

Theme 3: Student learning. Students were engaged and active in the topic under discussion. This was evidenced by the degree of student responses to questions posed by the T1. T2 encouraged his students to complete problems on the board and explain their results to the rest of the class. Teachers T1, T2, and T3 had the students work in pairs with their classmates to discuss their findings for certain problems. T2 had the students find as many characteristics of a function as possible, T3 had the students interpret a verbal problem, structure a solution, and conjecture what would happen in the event of hypothetical data being used for the problem. T1 had the students teach each other how they would solve a particular problem. In all cases student-student and student-teacher interaction was evident. SIOP component practice and apply was at level 4.

Research Question 4

RQ4: What SIOP components are most favored by teachers?

Theme 1: Instruction. T1 indicated during the interview that the SIOP components used most were building background comprehensible input and assessment and review. During the classroom observation, T1 implemented building background and spent time having the student interpret the mathematical language into meaningful terms using a 4 square graphic organizer. Strategies evidenced during the lesson were individual, whole group and small group instruction, and cooperative learning.

T2 indicated during the interview that building background and comprehensible input was the SIOP components used most of the time. During the class, the teacher implemented the SIOP component building background by presenting equations that was part of prior learning and necessary for the lesson of the day. T2 presented the vocabulary words during instruction. An activity where the student interpreted the mathematical language into meaningful terms that was comprehensible to the students followed the introduction of the new term. Strategies evidenced during the lesson were whole group and small group instruction, and cooperative learning.

T3 indicated during the interview that the SIOP components used most were building background comprehensible input and practice and apply. During the classroom observation, T3 implemented the building background SIOP component using a closure technique. Students practiced problem solving that was partially completed with gaps in certain steps. Their entry task was to complete the blank steps based on their recollection of prior learning. The students worked in their seats and applied the ability to solve them by teaching it to their partner. Strategies evidenced during the lesson were direct instruction, whole group and small group instruction, cooperative learning, and

independent practice. The teacher employed strategies that led to student engagement on mathematical content and interaction with classmates and teacher.

Theme 2: Teacher attitudes. Teachers T1, T2, and T3 believed that SIOP was an example of good teaching. The consensus was that it was hard to determine if the SIOP model per se was responsible for the student learning; however, the teachers felt that the components in SIOP were important elements to any successful teaching model. The teachers exhibited efficacy implementing SIOP during the lesson as evidenced by the implementation of the SIOP components throughout the lesson. T1 scored a 75% on the SIOP checklist, T2 scored a 75% on the SIOP checklist, and T3 scored 96% on the SIOP checklist.

Theme 3: Student learning. Teachers T1, T2, and T3 believed that the students in the Washington high school need a model that addresses language deficiencies. Throughout the observations, students were engaged, on task, and used mathematical vocabulary consistently throughout the observed lesson. For example, in T1 observation, there was evidence of student learning through the review and assessment component and during the interaction as the students responded to the activity with accurate results and complete explanations using the mathematics vocabulary terms required for the lesson.. Teachers T2 and T3 observation demonstrated students engaged in learning as evidenced by the small group work and the practice and application of learned material.

Research Question 5

RQ5: How has student achievement on the mathematics portion of the MAP changed during the first three years of implementation of SIOP in the study high school?

The ANCOVA was used in order to remove the obscuring effects of preexisting individual differences between subjects. Simon (2006) posited that an ANCOVA test compensates when groups are selected by methods that are not random. ANCOVA tests ensure that potential complications of having subjects tested first in one condition, then in another, and then perhaps in yet another are avoided.

The archived data from the Northwest Education Association (NWEA) Measure of Academic Progress were used with the SPSS software General Linear Model (GLM) option. The dependent variable was the RIT scores and the dependent factor was the number of years SIOP has been practiced in the study high school. A covariate was identified as the student reading level. The English levels ranges were identified from level 2 signifying limited English skills requiring additional ELL instruction. The next level was level 3 that represented limited English but enough English so that the student does not require additional ELL support, and level 4 and above which indicates the student is considered proficient in English. Table 4 substantiates that there is a positive correlation between English language level and Math RIT scores.

Table 4

Correlation SIOP Experience, Language Level and Math Achievement

	1	2	3	4
1. TestRITScore				
Pearson correlation	1.000	.102	.102	.482*
Sig. (2-tailed)		.116	.116	.000
N	240.000	240	240	240
2. CohortYear				
Pearson correlation	.102	1.000	1.000*	.069
Sig. (2-tailed)	.116		.000	.288
N	240	240.000	240	240
3. SIOPYRSSCHOOL				
Pearson correlation	.102	1.000*	1.000	.069
Sig. (2-tailed)	.116	.000		.288
N	240	240	240.000	240
4. ENGLISHLEVEL				
Pearson correlation	.482*	.069	.069	1.000
Sig. (2-tailed)	.000	.288	.288	
N	240	240	240	240.000

**. Correlation is significant at the 0.01 level (2-tailed)

The null hypothesis H_{01} states that there were no differences in achievement on the mathematics portion of the MAP among students in terms of testing with the implementation of SIOP and without the implementation of SIOP. The results of the analysis of tests between subject effects in Table 5 indicate that the null hypothesis should not be rejected (p=0.18). The effects of SIOP years on Test RIT showed some growth after controlling for the covariate English language level.

Table 5

Tests of Between-Subjects Effects for the Dependent Variable TestRITScore

Source	Type III sum of squares	*df*	Mean square	*F*	Sig.	Partial eta squared
Corrected Model	17522.056[a]	4	4380.514	19.422	.000	.248
Intercept	619217.849	1	619217.849	2745.421	.000	.921
ENGLISHLEVEL	15996.510	1	15996.510	70.924	.000	.232
SIOPYRSSCHOOL	1128.723	3	376.241	1.668	.175	.021
Error	53003.240	235	225.546			
Total	1.231E7	240				
Corrected total	70525.296	239				

Summary

The study revealed conflicting results between the quantitative and qualitative results. Findings from interviews and classroom observations when considering the three emerging themes (instruction, attitude, and student learning) demonstrated that the perceptions of the teachers were supportive of SIOP as an effective instructional model. The study findings also supported the perception that SIOP is comprised of sound instructional strategies. Echevarria and Short stated that the sheltered approach to teaching draws from the techniques and processes used to teach in second language and mainstream classrooms (SIOP Institute, 2010). In Section 5, I discuss the recommendations based on the findings of the problem statement and the five research question that framed this study.

Section 5: Conclusions, Implications, and Recommendations

The purpose of this case study was to determine the efficacy of SIOP in high school math instruction. The concurrent mixed methods design using an evaluative case study was appropriate for gathering accurate data in a short period of time (Yin, 2003). A case study "occurs when, within a single case, attention is also given to a subunit or subunits" (Yin, 2003, p. 42). The unit of analysis in this case study was a single high school in northwestern United States. The participants included three mathematics teachers at the high school. The implications and significance of the study are presented, along with recommendations. A summary is also presented in the final section.

Interpretation of Findings

The conclusions of this evaluative case study are arranged by research questions and emerging themes. Three primary themes emerged from the qualitative data analyses process of investigating the efficacy of SIOP in mathematics instruction. The themes are as follows: (a) implementation of SIOP instruction, (b) teacher attitude and perception of SIOP, and (c) student learning. These final conclusions supported the findings that were identified in section 4 and the literature review in section 2. The first and second research questions revealed differences in the perceptions of the efficacy of SIOP. There was a positive relationship between teachers who have received training on instructional models for teaching mathematics to diverse students. The teacher that had the least experience was experiencing the classroom as a solo teacher for the first time. This teacher initially viewed the SIOP model as very cumbersome, time consuming, and difficult to implement. However, after one year in the classroom, the teacher felt more confident in the implementation of SIOP and saw it as a value added necessity in his classrooms.

These findings support the research of Bandura (1993), where he identified teachers with high personal efficacy as individuals who are not afraid of a challenge, but rather view the challenge as something that can be overcome. Individuals with a highly efficacious outlook remain focused on performance and set high goals for themselves. Failure is attributed to a lack of knowledge or effort as opposed to blaming other outside influences. Efficacious teachers are committed to students and driven to teaching excellence. Collier (2005) defined teacher efficacy as the individual's belief that his or her efforts can make a difference. The teacher with the most years in the teaching profession felt that SIOP was a good instructional model that contained many strategies that he had employed in the past under different teaching models. The board certified teacher believed that SIOP was an appropriate model for the student demographic he was teaching. However, he qualified that belief by making it clear that a commitment to the students he is teaching is important to success. In all three interviews, the teachers conveyed that SIOP is effective in helping their students comprehend the language of mathematics. The teachers were all committed to ensuring their students learned the mathematical content despite their language barriers and gaps in academic background.

Research Questions 3 and 4 addressed the SIOP components preferred by the teachers. The three teachers interviewed felt that the building background component was essential to teaching mathematics to all students including English Language learners. Echevarria (2008) described the SIOP building background component as a strategy that links the new knowledge to student background and experiences. Echevarria continues by stating that key vocabulary should be introduced in written format for students to see and repeated for student comprehension. Young (2002) stated that "the more personally

relevant the experience the more likely the student's minds and emotions will be engaged" (pp. 43-44). The teachers in this study found that the language needs of the students in this study required language comprehension strategies such as comprehensible input and interaction. Lee (2005) stipulated that ELLs must develop literacy and language skills in the context area in order to keep from falling behind students who speak and comprehend English used in the academic subject area. Echevarria (2008) found that in order to attain comprehensible input through SIOP, explanations of academic tasks must be clear and concise and that speech is used according to the student proficiency level. Francis and Vaughn (2009) found that "many ELL students are in mainstream classrooms where teachers are unaware of ways of adjusting instruction appropriately for their second-language development needs" (p. 290). Francis and Vaughn argued that students are expected to interact at high levels of cognitive comprehension, read from textbooks in their second language, and have conversations about concepts that are abstract.

Vygotsky argued that learning cannot be separated between the individual and learning where social interaction is facilitated (John-Steiner & Souberman, 1978). Bottge, Rueda, and Skivington (2006) posited that students in environments where learning is promoted through the social interactions between learners experience creative thought and knowledge development at a pace faster than learners in passive environments. Barton and Griffin (2009) concluded from a study involving ELL students learning mathematics that it is vitally important to provide ELL students with the support and encouragement to verbalize, read, write, and listen in the mathematics classroom. Effective classroom teachers emphasize problem solving with students by emphasizing engagement in instructional dialogue and conversation as well as through reading and

writing across the curriculum. The SIOP interaction component establishes a condition where students are encouraged to apply English in their interactions with classmates and the teacher (Echevarria et al., 2010). According to Echevarria et al, evidence of opportunities for interaction in the SIOP model includes small group discussions for clarification, wait time for response, and resources that will aide in clarification of new concepts. The three teachers using different strategies for comprehensible input include: pairs, small group, student-to-student, and student-to-teacher interaction. All three teachers identified key vocabulary words throughout the lesson. The T2 took the time to create a four square graphic organizer. This class exhibited the highest score in the SIOP elements involving student engagement on subject matter.

The fifth research question addressed the change in student achievement since the implementation of the SIOP in the Washington State High School. A quantitative analysis of archived NWEA MAP results was accessed in order to conduct an ANCOVA of student results with language and years of SIOP as the covariant. According to the results of the ANCOVA there were no significant differences in scores. In this case study, a concurrent mixed method design drew together inferences from both the qualitative and quantitative data (Creswell, 2003).

Implications for Social Change

The implications of this study were the teachers' attitudes towards the SIOP instructional model, the mathematics achievement of ELL students under this model, and the strategies that are found in the SIOP model when implemented by the teachers appear to have a positive impact on mathematics instruction of ELL students in the mainstream high school classroom. Despite education reform efforts that promote schools without

student tracking, immigration trends and family mobility have led to classrooms with a wide range of academic achievement levels and proficiency in the English language and daunting challenge for educators. Harris and Robinson (2005) purported that simultaneously increasing the achievement levels of ethnic minorities and Caucasian students could close the achievement gap between them and essentially reduce racial inequality in the attainment levels of education and earnings.

Strategies that emphasize improving the quality of the teaching practice in the classrooms will do more to close the achievement gap for students who are prone to failure or who are more educationally at risk than just about any other reform effort (Darling-Hammond, 2008). The importance of ensuring more students are competitive in mathematics is supported through the report by the National Mathematics Advisory Panel (NMAP). According to NMAP, the United States will experience enormous stress in sustaining a high-quality workforce equipped with the engineering, mathematics, and science skills required to keep pace with the technological innovations of the 21st century (U.S. Department of Education, 2008).

The problem of students with limited exposure to English learning mathematics in the classroom can be addressed using the SIOP model. The findings show that high school mathematics teachers in the high school use SIOP strategies to address language barriers. The rigor was found in the attainment of the mathematics vocabulary, which in itself is a unique language with its own vocabulary. Teachers favored comprehensible input in their practice: dissecting the language into comprehensible units for the students, building background, making links to prior learning and experiences, and practicing applications of the learned mathematical vocabulary.

In light of the findings, a closer examination is needed to determine other factors regarding how the students were able to achieve increases in mathematics obtainment. There were cases where individual students performed quite well as indicated on the MAPS and the state assessment. Despite the teacher perception that SIOP was lacking in providing students with rigorous mathematics content, the classroom observations showed signs of academic rigor. In a study conducted by the U.S. Department of State (2005), academic rigor was defined as the active exploration of research to solve complicated problems. The study found that the goal of academic rigor is to provide the learner with a profound comprehension of concepts that are consistent with college readiness standards. According to the study, rigor is evidenced when the time and opportunity are provided for the learner to navigate through sophisticated and reflective learning experiences. SIOP appears to be an effective model for making content comprehensible for English language learner students. SIOP strategies encourage reflection and constant feedback of content in the second language.

The teachers perceived the implementation of SIOP as having fostered a culture of awareness of the vocabulary used in mathematics. Emphasizing the vocabulary used in mathematics is important to the population of students studied. The students have English as a second language and struggle with the comprehension of complex vocabulary. It is difficult to distinguish whether mathematics achievement was due to the process of implementing the SIOP to foment a culture that emphasizes the importance of the language of mathematics or the technical application of SIOP as an instructional strategy. The findings of the study show that SIOP benefits students, who may not otherwise have the opportunity to learn an important content area, such as mathematics, due to language

barriers now have the means of learning it through a model that emphasizes language comprehension in the acquisition of academic content. SIOP may be implanted in the future in schools that are looking for ways to address the problem of low achievement and lack of comprehension of the English language.

Recommendations for Further Study

Although I tried to remain objective throughout the study, my own personal biases may have entered into my interpretations. I was cognizant of these biases as I observed the classes and interviewed the teachers. Teacher perceptions were an essential research question in my study. I made sure to thoroughly question teachers in this area and to document what the teachers said. A perception is something that can be elusive and my judgment could be impaired by my own biases as well. In hindsight, I may have conducted this study in a different school district, where I had no professional ties. The objectivity would be easier to attain. A further study may be comprised of multiple schools exploring whether the implementation of the SIOP model plays a role in the academic achievement of the students in the school. The study could also seek to address if the cultural aspect of SIOP implanted in the school is responsible for the significant change in achievement of mathematics.

Reflection of the Researcher's Experience

In my 24 years as an educator, I have come across a variety of instructional models and panaceas for improving student learning. I was skeptical about the effectiveness of SIOP as an instructional model designed to address the learning needs of high school students. My own experience with high school mathematics teachers is that there is a tendency to relate all matters of the subject to numerical, symbolic, graphical,

or geometric concepts. The language issue has always been more of an afterthought. My attitude was that as long as the numbers and symbols were clear, they were universal enough for the students to comprehend. In recent years, my classrooms have become more linguistically diverse. Many of the students come from places outside of the United States, have very little or diverse educational backgrounds, or they have very little time in this country. My preconceived idea was that the majority of these students were not capable of higher order learning because they do not have the language or background required to engage in the complicated mathematics required to meet the state standards.

My prior skepticism has changed. The idea that one method is the solution to all the problems may seem prudent, but in essence it is really illogical. Furthermore, the students observed in the classrooms were capable of achieving in higher order mathematical content. The premise that students are individuals and bring their own experiences and interpretations to a situation is a reality that effective educators have acknowledged for some time. The research supports the notion of teaching by helping students see the connections to their prior learning. Although the emphasis of SIOP is to address the linguistic challenges, SIOP also addresses student prior learning needs, applies rigorous mathematics content, and provides for a wealth of different assessment and instructional strategies that lay the foundation for higher learning. The key challenge for the educator is to provide for the rigorous content so that it is meaningful to the student.

The teacher participants in the study are the implementers of SIOP. Teacher efficacy in teaching students with limited English background has improved with the incorporation of second language development in math instruction using SIOP. The

experience levels of each participant were diverse as was the responses to the interview questions and the approach to teaching. However, SIOP provided each teacher with a framework that was implemented in the classroom with fidelity. There was a distinction between the preferred SIOP components of the teacher and the actual components that were implemented by the teacher. These data from the study may be impact the future instructional design and implantation in the future. The participants may alter their perception of lack of rigor found in SIOP with an emphasis in making the subject matter rigorous and relevant to the student with the implementation SIOP strategies.

Recommendations for Action

Professional development administrators and teachers need to pay attention to the results of the study. The results of my study show that SIOP has impacted teaching and learning and may have affected achievement. The information could affect the sample and the community of the school because it reinforces SIOP as an effective model for addressing language disparities in the attainment of academic content. In this era of accountability, it is vital that all students demonstrate proficiency in mathematics. A surprising finding was that the veteran teachers ascribed SIOP to sound teaching practice and welcomed the implementation of this model as a value added approach to addressing language barriers and gaps in educational background. The general consensus had been that most veteran teachers believe that their way of doing things is correct and time tested. However, the teachers at the Washington High School did not reflect this attitude. On the contrary, the teachers believed that something needed to be done to address the language barriers and that SIOP has been helpful in attaining this goal.

The results of this study have elucidated that implementation of the SIOP instructional model required the buy in of the teachers. Each teacher interviewed and observed in the study believed that SIOP had a positive impact on student learning and was therefore a viable enterprise for instruction. However, teachers perceived SIOP to lack in the rigor needed to achieve mathematics mastery. This perception led to an observation that the teachers did not perceive SIOP as a model of instruction but rather as a significant component of the curriculum. SIOP as an instructional model can provide instruction of rigorous material. The process of providing instruction of rigorous content is not the same as saying the process of providing content is rigorous. Some of the responses of the teachers led to the conclusion that they were discussing SIOP when they referred to rigor as opposed to the content as rigorous and SIOP as a means for achieving mastery of the rigorous content.

A study closely related to this evaluative case study was conducted by Flores and Roberts (2008). The purpose of their study was to determine the unique characteristics and practices that led to better than average mathematics achievement. Flores and Roberts used quantitative measures to select the schools based on their mathematics achievement results and their demographics. After conducting interviews of the mathematics teachers, principals, and department chairs in each of the three high schools, the researchers concluded that leadership came from within the teaching staff at these three schools, teachers worked collaboratively to ensure the same concepts are covered and to share strategies and the culture was respected and no excuses were made for the students.

Summary

The results of the study raised the question of what was the importance of SIOP as a model used in the culture of the school. The consensus among the mathematics teachers participating in the study showed that students are better prepared to comprehend mathematical content as a result of using SIOP. The teachers embraced SIOP as a viable model that is value added in their classroom practice. An important observation was that student achievement on the state assessment increased from 4.9% to 30%. These findings suggest that SIOP is a viable strategy that deserves further research.

References

Allen, D. G., Hsieh, Y. J., & Nguyen, D. M. (2006). The impact of web-based assessment and practice on students mathematical learning attitudes. *Journal of Computers in Mathematics and Science Teaching, 25*(3), 251-279. Retrieved from http://www.aace.org/

Apple, M. (2008). Racism, power, and contingency. *Race, Ethnicity & Education, 11*(3), 329-336. doi:10.1080/13613320802291207

Ares, N., & Buendia, E. (2007). Opportunities lost: Local translations of advocacy policy conversations. *Teachers College Record, 109*, 561-589. Retrieved from http://www.tcrecord.org/Content.asp?ContentID=12793

Aubusson, P., Steele, F., Dinham, S., & Brady, L. (2007). Action learning in teacher learning community formation: Informative or transformative? *Teacher Development*, *11*(2), 133-148. doi: 10.1080/13664530701414746

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist*, *28*(2), 117. doi:10.1207/s15326985ep2802_3

Barton, R., & Griffin, L. (2009). Improving mathematics instruction for ELL students. *NCSM of Mathematics Education Leadership, 11(1),* 21-25. Retrieved from http://www.mathedleadership.org/resources/journalsvol12.html

Blankenstein, A. M. (2004). *Failure is not an option*. San Francisco, CA: Corwin Press.

Bottge, B., Rueda, E., & Skivington, M. (2006). Situated math instruction in rich problem-solving contexts: Effects on adolescents with challenging behaviors. *Behavioral Disorders, 31*(4), 394-407. Retrieved from http://proquest.umi.com.ezp.waldenulibrary.org/pqdweb?did=1146557251&sid=2&Fmt=3&clientId=70192&RQT=309&VName=PQD

Brewer, E. W., & Landers, J. M. (2005). A longitudinal study of the Talent Search program, *Journal of Career Development, 31*(3), 195-205. doi:10.1177/089484530503100304

Bruner, J. (1999). *The process of education* (25th ed.). Cambridge, MA: Harvard University Press.

Brunner, L., & Colarelli, S. (2010). Immigration in the twenty-first century: A personnel selection approach. *Independent Review, 14* (3), 389-413. Retrieved from http://www.independent.org/publications/tir/article.asp?a=764

Bruton, A., & Robles-Piña, R. (2009). Deficit thinking and Hispanic student achievement: Scientific information resources. *Problems of Education in the 21st Century, 15*, 41-48. Retrieved from http://www.jbse.webinfo.lt/Problems_of_Education_Volumes.htm

Bureau of Labor and Statistics. (2010). *Labor force characteristics of foreign-born workers.* Retrieved July 15, 2009, from http://www.bls.gov/news.release/archives/forbrn_03192010.htm

California Department of Education. (2009). *Statewide number of enrolled ELL students.* Retrieved from http://dq.cde.ca.gov/dataquest/content.asp

Canada, G. (2008). Education and the economy. *Yearbook of the National Society for the Study of Education, 107*(2), 128-130. doi:10.1111/j.1744-7984.2008.00181.x

Carpenter, D. M., II, & Ramirez, A. (2007). More than one gap: Dropout rate gaps between and among Black, Hispanic, and White students. *Journal of Advanced Academics, 19*(1*)*, 32-64. doi:10.4219/jaa-2007-705

Center for American Progress (2011). *Promoting student success with No Child Left Behind.* Retrieved from http://www.americanprogress.org/issues/2007/04/promoting_success.html

Chesbro, P., & Boxler, N. (2010). Weaving the fabric of professional development in the 21st century using technology. *Journal of Staff Development, 31*(1), 48-53. Retrieved from http://www.learningforward.org/news/issueDetails.cfm?issueID=292

Cho, K., Ahn, K., & Krashen, S. (2005). The effects of narrow reading of authentic texts on interest and reading ability in English as a foreign language. *Reading Improvement, 42*(1), 58-64. doi:10.1207/s1532799xssr0901_2

Cohen, G. L., & Walton, G. M. (2007). The question of belonging: Race, social fit, and achievement. *Journal of Personality and Social Psychology. 92*(1), 82-96. doi:10.1037/0022-3514.93.3.415

Cole, M., John-Steiner, V., Scribner, S., & Souberman, E. (1978). *L.S. Vygotsky: Mind in society.* Cambridge, MA: Harvard University Press.

Coleman, R., & Goldenberg, C. (2010). *Promoting academic achievement among English learners: A guide to research.* Thousand Oaks, CA: Corwin Press.

Collier, M. D. (2005). An ethic for caring: The fuel for high teacher efficacy. *The Urban Review. 37*(4), 351-359. doi: 10.1007/s11256-005-0012-4

Commissioner's remarks - National Assessment of Educational Progress. (2009). Retrieved from http://www.nces.ed.gov/whatsnew/ commissioner /remarks 2009/10_14_2009.asp.

Conchas, G. Q. (2001). Structuring failure and success: Understanding the variability in Latino school engagement. *Harvard Educational Review, 71*(3), 475-504. Retrieved from http://www.hepg.org/her/abstract/122

Cooke, G., Ginsburg, A., Leinwand, S., Noell, J., & Pollock, E. (2005). *Reassessing U.S. international mathematics performance: New findings from the 2003 TIMSS and PISA*. Washington, DC: American Institutes for Research.

Creswell, J. W. (2003). *Research design: Qualitative, quantitative and mixed methods approaches* (2nd ed.). Thousand Oaks, CA: Sage.

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing from among five approaches.* Thousand Oaks, CA: Sage.

Croninger, R., & Lee, V. E. (2001). Social capital and dropping out of high school: Benefits to at-risk students of teachers' support and guidance. *Teacher's College Record, 103*(4), 548-581. doi:10.1111/0161-4681.00127

Crosnoe, R., & Huston, A. C. (2007). Socioeconomic status, schooling, and the developmental trajectories of adolescents. *Developmental Psychology, 43*, 1097-1110. doi:10.1037/0012-1649.43.5.1097

Dana, N., & Yendol-Hoppey, D. (2009). *The reflective educators guide to classroom research: Learning to teach and teaching to learn through practitioners' inquiry*. Thousand Oaks, CA: Corwin Press.

Darling-Hammond, L., & Baratz-Snowden, J (2007). A good teacher in every classroom: Preparing the highly qualified teachers our children deserve, *Educational Horizons, 85*, 111-132. Retrieved from http://eric.ed.gov/ERICWebPortal/search/detailmini.jsp?_fpb=true&_&ERICExtSearch_SearchValue_0=EJ750647&ERICExtSearch_SearchType_0=no&accno=EJ750647

Darling-Hammond, L. (2008). Securing the right to learn: Policy and practice for powerful teaching and learning. (DeWitt Wallace-Reader's Digest Distinguished Lecture). *Journal of Education*, *189*, 9-21. doi:10.3102/0013189X035007013

Denzin, N. K. (2010). Moments, mixed methods, and paradigm dialogs, *Qualitative Inquiry 16*(6), 419-427. doi:10.1177/1077800410364608

Dolejs, C. (2006). *Report on key practices and policies of consistently higher performing high schools.* Washington D.C., National High School Center, American Institutes for Research.

Dowson, M., & McInerney, D. M. (2001). Psychological parameters of students' social and work avoidance goals: A qualitative investigation. *Journal of Education Psychology, 95*, 35-41. doi:10.1037/0022-0663.93.1.35

Driscoll, M. P. (2005). *Psychology of learning (3rd Ed.).* Boston, MA: Allyn & Bacon.

Dufour, R., Eaker, R, & Dufour (2005). *On common ground: The power of professional learning communities.* Bloomington, Indiana: Solution Tree Publications.

DuFour, R. (2007). Professional learning communities: A bandwagon, an idea worth considering, or our best hope for high levels of learning*? Middle School Journal*, *39*, 4-8. Retrieved from http://www.amle.org/Publications/MiddleSchoolJournal/Articles/September2007/tabid/1493/Default.as**p**x

DuFour, R., & Marzano, R. (2009). How teachers learn: High-leverage for principal leadership. *Educational Leadership, 66(*5), 62-68. Retrieved from http://www.ascd.org/SearchResults.aspx?s=High-leverage%20for%20principal%20leadership&c=2&n=10&p=0

Echevarria, J., Short, D., & Powers, K. (2006). School reform and standards-based education: A model for English-language learners*. Journal of Education Research, 99*(4), 195-210. doi:10.3200/JOER.99.4.195-211

Echevarria, J., Short, D., & Vogt, M. (2008). Making content comprehensible for non-native speakers of English: The SIOP model. *International Journal of Learning, 14*(11), 41-49. Retrieved from http://ijl.cgpublisher.com/product/pub.30/prod.1562

Echevarria, J., Short, D., & Vogt, M. (2010). *The SIOP model for teaching mathematics to English learners.* Boston, MA: Pearson Education.

Education Commission of the States (2004). Hispanic achievement: Research sheds new Light on the Hispanic-White achievement gap. *The Progress of Education Reform 2004 6*(3). Retrieved from http://ecs.org/html/educationIssues/Progressof Reform.asp

Edwards, L., Filipe-Matos, J., & Núñez, R., (1999). Embodied cognition as grounding for situatedness and context in mathematics education, *Educational Studies in Mathematics, 39,* 45-65. Retrieved from http://www.springerlink.com/content/ m06n4 62387g820l5/

Elliot, A. J., & Church, M. A. (2003). A Motivational Analysis of Defensive Pessimism and Self-Handicapping. *Journal of Personality. 71*(3), 369–396. doi:10.1111/1467-6494.7103005

Feliciano, C. (2005). *Unequal origins: Immigrant selection and the education of the second generation.* New York, NY: LFB Scholarly Publishing.

Fink, A. (2006). *How to conduct surveys. A step-by-step guide. (3rd ed.).* Thousand Oaks, CA: Sage Publications.

Flynn, K., & Hill, J. (2006). *Classroom instruction that works with English language learners.* Alexandria, VA: Association for Supervision and Curriculum Development.

Ford, D., Grantham, T., & Whiting, G. (2008). Culturally and linguistically diverse students in gifted education: Recruitment and retention issues in eighth-grade algebra. *Exceptional Children, 74*, 289-306 Retrieved from http://cec.metapress. com/ content/ 02x4p05mw5m65752/

Francis, D. J., & Vaughn, S. (2009). Effective Practices for English Language Learners in the Middle Grades, *Journal of Research on Educational Effectiveness, 2*, 289–296. doi:10.1080/19345740903217664

Fullan, M. (2001). *Leading in a culture of change*. New York, NY: Jossey-Bass.

Gamora, A. (2007). *Standards-based reform and the poverty gap: Lessons for "No Child Left Behind.*" Washington, DC: Brookings Institute Press.

Gandara, P., & Rumberger, R. W. (2009). Immigration, language, and education: How does language policy structure opportunity? *Teachers College Record, 111*, 750-782. Retrieved from http://www.tcrecord.org/Content.asp?contentid=15343

Genesee, F., Lindholm-Leary, K., Saunders, W. M., & Christian, D. (2007). *Educating English language learners: A synthesis of research evidence.* New York, NY: Cambridge University Press.

Goldenberg, C. (2008). Teaching English language learners: What the research does—and does not say. *American Educator, 32*(2), 8-48. Retrieved from http://scholar.googleusercontent.com/scholar?q=cache:AhQcbnl1qOgJ:scholar.google.com/+Goldenberg+teaching&hl=en&as_sdt=0,48

Gómez-Chacón, I. (2000). Affective influences in the knowledge of mathematics. *Educational Studies in Mathematics, 43*(2), 149-168. doi:10.1023/A:1017518812079

Gonzales, P., Guzman, J. C., Partelow, L., Pahlke, E., Jocelyn, L., Kastberg, D., & Williams, T. (2004). *Highlights from the Trends in International Mathematics and Science Studies (TIMMS) 2003*. Washington DC: U.S. Department of Education Institute of Education Sciences.

Griffin, K. A., Allen, W. R., Kimura-Walsh, E., & Yamamura, E. K. (2007). Those who left, those who stayed: Exploring the educational opportunities of high-achieving Black and Latina/o students at magnet and non-magnet Los Angeles high schools. *Journal of Educational Studies, 42*(3), 229-247. doi: 10.1080/00131940701632662

Hansen-Thomas, H. (2008). Sheltered Instruction: Best practices for ELLs in the mainstream. *Kappa Delta Pi Record, 44*(4), 165-169. Retrieved from http://www.kdp.org/publications/archives/recordsm08.php

Harris, A., & Robinson, K. (2007). Schooling behaviors or prior skills? A cautionary tale of omitted variable bias within oppositional culture theory. *Sociology of Education, 80,* 139-157. doi: 10.1177/003804070708000203

Harris, D. N., & Herrington, C. D. (2006). Accountability, standards, and the growing achievement gap: Lessons from the past half-century. *American Journal of Education, 112,* 209-238. doi:10.1086/498995

Harvey, E. (1999). Short-term and long-term effects of early parental employment on children of the national. *Developmental Psychology, 35,* 445. doi:10.1037//0012-1649.35.2.445

Hatch, J. A. (2002). *Doing qualitative research in education settings.* New York: State University of New York Press.

Helgeson, S. L. (1977). *The status of precollege science, mathematics, and social science education: 1955-1975 (Vol. I, Science Education).* Washington, DC: National Science Foundation.

Horn, I., & Little, J. (2010). Attending to problems of practice: Routines and resources for professional learning in teachers' workplace interactions. *American Educational Research Journal, 47*, 181. doi:10.3102/0002831209345158

House, D. J. (2006). Mathematical beliefs, instructional strategies, and Algebra achievement of adolescent students in Japan: results from the 1999 TIMMS. *International Journal of Instructional Media 33*, 443-462. doi:10.3200/GNTP.167.1.31-45

Jacobson, D. (2010). Coherent instructional improvement and PLC's: Is it possible to do both? *Phi Delta Kappan, 91*(6), 38-45. Retrieved from http://www.kappanmagazine.org/content/91/6.toc

Jamar, I., & Pitts, V. (2005). High expectations: A "how" of achieving equitable mathematics classrooms, *The Negro Educational Review, 56*(2). Retrieved from http://search.ebscohost.com

Jensen, J., & Rodgers, R. (2001). Cumulating the intellectual gold of case study research. *Public Administration Review, 61*, 235-246. doi:10.1111/0033-3352.00025

John-Steiner, V., & Souberman, E. (1978). *L.S. Vygotsky: Mind in society*. London, England: Harvard University Press.

Johns, S.L. (2002). Academic achievement of English-learning Latino students in relation to higher order thinking skills instruction. Ed.D. dissertation, University of Southern California, United States -- California. Retrieved from Dissertations & Theses: Full Text.(Publication No. AAT 3094342).

Kasmer, L., & Kim, O. K. (2009). Predictions as an instructional strategy. *Mathematics Education Leadership, 11*, 33-38. Retrieved from http://www.mathedleadership .org/resources/journalsvol12.html

Kewal-Ramani, A., Gilbertson, L., Fox, M. A., & Provasnik, S. (2007). *Status and trends in the education of racial and ethnic minorities (NCES 2007-039).* Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.

Lambert, L. (1998). *Building leadership capacity in schools*. Alexandria, VA: Association for Supervision and Curriculum Development.

Lambert, L., Walker, D., Zimmerman, D. P., Cooper, J. E., Lambert, M. D., Gardner, M. E., & Szabo, M. (2002). *The constructivist leader*. New York, NY: Teachers College, Columbia University.

Lee, O. (2005). Science education with English language learners: Synthesis and research agenda. *Review of Educational Research, 75*, 491-530. doi:10.3102/00346543075004491

Levin, H., Belfield, C., Muennig, P., & Rouse, C. (2007). *The costs and benefits of an excellent education for all of America's children.* New York, NY: Teachers College, Columbia University.

Lopez, M. H. (2009). *Latinos and education: Explaining the attainment gap*. Washington, DC: Pew Hispanic Center.

Lotan, R. (2006). Teaching teachers to build equitable classrooms. *Theory Into Practice, 45*, 32-39. doi:10.1207/s15430421tip4501_5

Loveless, T. (2008). *The Brown Center report on American education: The misplaced student lost in eighth-grade algebra.* Washington D.C.: Brown Center of Education Policy at Brookings.

Lujan, N., & Day, B. (2010). Professional learning communities: Overcoming the roadblocks. *Delta Kappa Gamma Bulletin, 76*(2), 10-17. Retrieved from http://publication.dkg.org/dsweb/View/Collection-11

Lunenburg, F. C., & Ornstein, A. C. (2004). *Educational administration: Concepts and practices*. Belmont, CA: Wadsworth.

McCosker, N., & Diezman, C. (2009). Scaffolding students' thinking in mathematical investigations. *Australian Primary Mathematics Classroom, 14*(3), 27-32. Retrieved from http://eprints.qut.edu.au/28982/

McGee, G. W. (2004). Closing the achievement gap: Lessons from Illinois Golden Spike high- poverty high-performing schools. *Journal of Education for Students Placed at Risk, 9*(2), 97-125. doi:10.1207/s15327671espr0902_2

McTighe, J., & Tomlinson, C. A. (2006). *Integrating differentiated instruction & understanding by design: Connecting content and kids*. Alexandria, VA: Association for Supervision and Curriculum Development.

Merriam, S. B. (2002). *Qualitative research in practice: Examples for discussion and analysis*. San Francisco, CA: Jossey Bass Publishing.

Mizell, H. (2010). School boards should focus on learning for all. *Phi Delta Kappan, 91(6)*, 20-23. Retrieved from http://www.kappanmagazine.org/content/91/6.toc

Muijs, D., Harris, A., Lumby, J., Morrison, M., & Sood, K. (2006). Leadership and leadership development in highly effective further education providers: Is there a relationship? *Journal of Further & Higher Education, 30*, 87-106. doi:10.1080/03098770500432096

Mullin, K., & Oliver, R. (2010). A second language/dialect acquisition perspective on the Accelerated Literacy teaching sequence. *Australian Journal of Language & Literacy, 33*(3), 151-163. Retrieved from http://ro.ecu.edu.au/ecuworks/6196/

Murphy, J. (2005). *Confronting organizational and cultural barriers: Connecting teacher leadership and school improvement*. Thousand Oaks, CA: Corwin Press.

Murphy, P. K., & Alexander, P. A. (2002). *The learner-centered principles: Their value of teachers and teaching. The keys to effective schools: Educational reform as continuous improvement* (pp. 19-27). Thousand Oaks, CA: Sage.

Musanti, S., & Pence, L. (2010). Collaboration and teacher development: Unpacking resistance, constructing knowledge, and navigating identities. *Teacher Education Quarterly, 37*, 73-89. Retrieved from http://www.freepatentsonline.com/article /Teacher-Education-Quarterly/219010134.html

National Council of Teachers of Mathematics (2011). *Principles and standards for school mathematics*. Reston, VA: Author. Retrieved from http://www.nctm.org/ standards/content.aspx?id=16909

National Mathematics Advisory Panel. (2008). *Foundations for success: The final report of the National Mathematics Advisory Panel*. Washington, DC: U.S. Department of Education.

Neihart, M. (2006). Dimensions of underachievement, difficult contexts, and perceptions of self. *Roeper Review, 28*(4), 196-202. Retrieved from http://psycnet.apa.org/ psycinfo /2006-11964-001

Northwest Evaluation Association (2010). *Measure of Academic Progress*. Retrieved from www.nwea.org

Office of Superintendent of Public Instruction. (2009a). *Washington State assessment of student learning report*. Retrieved from http://reportcard.ospi.k12.wa.us

Office of Superintendent of Public Instruction (2009b). *Washington State Transitional Bilingual Instruction Program Guidelines*, Retrieved from http://www.k12.wa.us/Migrant Bilingual/BilingualProgram.aspx

Office of Superintendent of Public Instruction (2010). *Washington State Report card*. Retrieved from http://reportcard.ospi.k12.wa.us/ summary.aspx?year =2009-10

Office of Superintendent of Public Instruction (2010b). *Adequate yearly progress.* Retrieved from http://www.k12.wa.us/ESEA/AYP/default.aspx

Page, A., Petteruti, A., Walsh, N., & Zeidenberg, J. (2007). *Education and public safety policy brief.* Washington DC: Justice Policy Institute.

PISA (2011). *Strong performers and successful reformers in education: Lessons from PISA for the United States.* Retrieved from http://www.pisa.oecd.org/dataoecd/ 32/50/46623978.pdf

PLCWashington. (2010). *National School Reform Faculty Consultancy Protocol*. Retrieved from http://www.plcwashington.org/study-groups

Ravitch, D. (2010). Why public schools need democratic governance. *Phi Delta Kappan, 91*(6), 24-27. Retrieved from http://www.kappanmagazine.org/content/91/6.toc

Reis, S. M., & Díaz, E. (1999). Economically disadvantaged urban female students who achieve in schools. *Urban Review, 31*, 31-54. doi :10.1023/A:1023244315236

Reis, S., & McCoach, D. B. (2000). The underachievement of gifted students: What do we know and where. *Gifted Child Quarterly, 44*(3), 152-170. doi:10.1177/001698620004400302

Rubin, H., & Rubin, I. (2005). *Qualitative interviewing. The art of hearing data (2nd Ed),* Thousand Oaks, CA: Sage Publications.

Rutherford, F. (2005). The 2005 Paul F-Brandwein Lecture: Is our past our future? Thoughts on the next 50 years of science education reform in the light of judgments on the past 50 years. *Journal of Science Education & Technology, 14*, 367-386. doi:10.1007/s10956-005-8082-3

Sable, J., & Plotts, C. (2010). *Public elementary and secondary school student enrollment and staff counts from the common core of data: School year 2008–09 (NCES 2010-347).* U.S. Department of Education. Washington, DC: National Center for Education Statistics. Retrieved from http://nces.ed.gov/pubsearch

Sanford, B. (2004). *Teacher research for better schools*. New York, NY: Teachers College Press.

Schon, D. A. (1987). *Educating the reflective practitioner*. San Francisco, CA: Jossey-Bass.

Senge, P., Cambron-McCabe, N., Lucas, T., Dutton, J., & Kleiner, A. (2000). *A fifth discipline: Schools that learn.* New York, NY: Doubleday.

Sergiovanni, T. J. (2005). *Strengthening the heartbeat: Leading and learning together in schools.* San Francisco, CA: Wiley.

Sfard, A. (2007). When the rules of discourse change, but nobody tells you: Making sense of mathematics learning from a commognitive standpoint. *Journal of the Learning Sciences, 16*(4), 565-613. doi:10.1080/10508400701525253

Shields, C., & Mohan, E. (2008). High-quality education for all students: putting social justice at its heart. *Teacher Development, 12*(4), 289-300. doi:10.1080/13664530802579843

Shkolnik, J., Song, M., Mitchell, K., Uekawa, K., Knudson, J., & Murphy, R. (2009). *Changes in rigor, relevance, and student, learning in redesigned high schools: An evaluation for the Bill & Melinda Gates Foundation*. Washington D.C.: American Institutes for Research.

Simon, M. K. (2006). *Dissertation & scholarly research: A practical guide to start and complete your dissertation, thesis, or formal research project*. Dubuque, IA: Kendall/Hunt Publishing Company.

SIOP Institute (2010). *Improving the quality of instruction for English learners. About SIOP.* Retrieved from http://www.siopinstitute.net/about.html

Smith, M. (2000). Redefining success in mathematics teaching and learning*, Mathematics Teaching in the Middle School, 5*(6), 378. Retrieved from http://search.ebscohost.com

Sorenson, B. (2001). *Preventing early learning failure*. Alexandria, VA: Association for Supervision & Curriculum Development.

Spring, J. (2008). *The American school: From the Puritans to No Child Left Behind* (7th ed.). Boston, MA: McGraw-Hill.

Stevens, T., Olivárez, A., Jr., & Hamman, D. (2006). The role of cognition, motivation, and emotion in explaining the mathematics achievement gap between Hispanic and White Students. *Hispanic Journal of Behavioral Sciences, 28*, 161-186. doi:10.1177/0739986305286103

Stoll, L., & Seashore, K. (2007). *Professional learning communities: Divergence, detail, difficulties.* Buckingham, England: Open University Press.

Tillema, H., & Van der Westhuizen, G. J. (2006). Knowledge construction in collaborative inquiry among teachers. *Teachers and Teaching: Theory and Practice* (12)1 pp. 51-67. doi:10.1080/13450600500365403

Tough, P. (2006). *Whatever it takes: Geoffrey Canada's quest to change Harlem and America.* New York, NY: Houghton-Mifflin Publishing.

U.S. Census Bureau. (2008a). *Census 2000 gateway*. Retrieved from http://www.census.gov/main/www/cen2000.html

U.S. Census Bureau. (2008b). *Census 2000 gateway*. Retrieved from http://www.census.gov/main/www/cen2000.html

U.S. Department of Education (2009). *Performance and accountability report FY 2008*. Retrieved from http://www2.ed.gov/about/reports/annual/2008report/index.html

U.S. Department of Education (2009b). *Achievement Gaps: How Black and White Students in Public Schools Perform in Mathematics and Reading on the National Assessment of Educational Progress, Statistical Analysis Report NCES 2009-455*. Retrieved from http://nces.ed.gov/nationsreportcard/pubs/studies/2009455.asp

U.S. Department of Education (2010a). The Elementary and Secondary Education Act PL 107- 110. Retrieved from http://www2.ed.gov/policy/elsec/leg/esea02

U.S. Department of Education. (2010b). *Fiscal Year 2009-FY 2011 President's budget state tables for the U.S. Department of Education*. Retrieved from http://www2.ed.gov/policy/elsec/guid/states/index.html

U.S. Department of Education. (2010c). *Blueprint for reform: Reauthorization of the Elementary and Secondary Education Act*. Retrieved from http://www2.ed.gov/policy/elsec/leg/blueprint/publication_pg3.html#part3

U.S. Department of Education. (2010d). *Implementing the Recovery Act.* Retrieved from http://www2.ed.gov/policy/gen/leg/recovery/implement.html

U.S. Department of Education, National Center for Education Statistics (2004). *International outcomes of learning in mathematics literacy and problem solving: PISA 2003 Results from the U.S. perspective (NCES 2005-003).* Washington, DC: U.S. Government Printing Office.

U.S. Department of Education, National Center for Education Statistics (2007). *The condition of education (NCES 2007-064).* Washington, DC: U.S. Government Printing Office.

U.S. Department of Education, National Mathematics Advisory Panel (2008). *Foundations for success: The final report of the national mathematics advisory panel*. Washington DC: U.S. Government Printing Office.

U.S. Department of State (2005). *Count me in-Developing inclusive international schools: Relevance and academic rigor of content. Section 7: A-4.* Retrieved from http://www.state.gov/m/a/os/44875.htm

Vanneman, A., Hamilton, L., Baldwin Anderson, J., & Rahman, T. (2009). *Achievement gaps: How black and white students in public schools perform in mathematics and reading on the National Assessment of Educational Progress.* Washington, DC: U.S. Department of Education.

Ware, H., & Kitsantas, A. (2007). Teacher and collective efficacy beliefs as predictors of professional commitment. *Journal of Education Research, 100*, 303-309. doi:10.3200/JOER.100.5.303-310

Washington State Office of Financial Management (2010). Budget highlights 2009-2011. Retrieved from http://www.ofm.wa.gov/budget09/highlights/#education

Wenger, E., McDermott, R., & Snyder, W. M. (2002). *Cultivating communities of practice*. Cambridge, MA: Harvard Business School Press

Wilkins, N., & Kuperminc, G. P. (2010). *Family Processes Promoting Achievement Motivation and Academic Success among Latino Youth" Paper presented at the annual meeting of the SCRA Biennial Meeting, Montclair State University, Montclair, New Jersey*. Retrieved from http://www.allacademic.com/ meta/p301433_ index.html

Winstead, L. (2004). Increasing academic motivation and cognition in reading, writing, and mathematics: Meaning-making strategies. *Educational Research Quarterly, 28*(2), 30-49. Retrieved from http://eric.ed.gov/ERICWebPortal/search/detailmini .jsp?_nfpb=true&_&ERICExtSearch_SearchValue_0=EJ718129&ERICExtSearch_SearchType_0=no&accno=EJ718129

Witkow, M. R., & Fuligni, A. J. (2007). Achievement goals and daily school experiences among adolescents with Asian, Latino, and European American backgrounds. *Journal of Educational Psychology, 99*(3), 584-596. doi:10.1037/0022-0663.99.3.584

Yin, R. K., & Davis, D. (2007). Adding new dimensions to case study evaluations: The case of evaluating comprehensive reforms, *New Directions for Evaluation, 113*(4). doi:10.1002/ev.216

Yin, R. K., & Kelly, A. E. (2007). Strengthening structured abstracts for education research: The need for claim-based structured abstracts. *Educational Researcher,36* (3), 133-137. Retrieved from http://edr.sagepub.com/content /36/3/133.short

Yin, R. K. (2008). *Case study research (4th ed.)* Thousand Oaks, CA: Sage Publications.

Young, M. R. (2002). Experiential learning: Hands-on +Minds-on. *Marketing Education Review, 12,* 43-51. Retrieved from http://www.marketingeducationreview. com/asp/ptoc.asp

Ziegler, E., & Finn-Stevenson, M. (2007). From research to policy and practice: The school of the 21st century. The *American Journal of Orthopsychiatry, 77*, 175-181. doi:10.1037/0002-9432.77.2.175

Appendix A: Teacher Instruction Interview Questions

Perception of SIOP

1. Tell me something about your experience. You can go as far back as you wants. (Try to determine how have the teachers experience, training, and background prior to SIOP influenced their attitude towards the efficacy of SIOP?
2. How you view the effectiveness of SIOP? Please elaborate. (Make sure the interviewee provides depth. Add questions that will allow you to bring out the teacher's complete perceptions of SIOP. What were some of your challenges implementing SIOP?
3. What were the strengths and successes?
4. What are the challenges? (Try to find out why these are perceived as challenges. Ensure that the teacher stays with the SIOP challenges and not so much about the student)
5. What would you do different?
6. How effective is SIOP in improving the performance of your mathematics students?
7. How are you able to apply rigor in your classroom? How does SIOP impact rigor?
   Consistency using SIOP
8. What components of SIOP do you find encouraging? (Try to get the teacher to discuss their favored SIOP components. Find out why the like the SIOP component so much? How often do they implement this component?
9. What component do you find not as effective? (Find out why the teacher views the components not as effective. What has the teacher done to the SIOP component? Has the teacher modified it or does the teacher simply not use it?

   Student Learning Questions

   1. What are the greatest challenges facing your students?
   2. How are your students performing? What are the strengths; weaknesses?
   3. What motivates your students to learn?
   4. What are some strategies you implement to motivate students?
   5. How do you accommodate for English language deficiencies?
   6. How do you employ differentiated instruction?

   I will transcribe your answers and give you a copy to review before I finalize the study. Remember, I will keep your name confidential.

Appendix B: SIOP Observation Checklist

The Sheltered Instruction Observation Protocol (SIOP) (Echevarria, Vogt, & Short, 2000; 2004; 2008)										
	Observer:	Teacher:								
	Date:	School:								
	Grade:	Class/Topic: ☐ ☐								
	ESL Level:	Lesson: (check one) Multiday Single-day								
Directions: Check the box 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			
	Lesson Preparation	4	3	2		1	0			NA
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	NA
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	NA
13.	Ample opportunities provided for students to use learning strategies	☐	☐	☐		☐	☐	
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	NA

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	☐	☐	☐	☐	☐	
19.	Ample opportunities for students to clarify key concepts in L1 as needed with aide, peer, or L1 text	☐	☐	☐	☐	☐	☐
Comments:							
	Practice and Application	4	3	2	1	0	NA
20.	Hands-on materials and/or manipulatives provided for students to practice using new content knowledge	☐	☐	☐	☐	☐	☐
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	NA
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 and Assessment	4	3	2	1	0	NA

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

Appendix C: Letter of Teacher Consent

You are invited to take part in a research study of the efficacy of SIOP in teaching math: an evaluative case study. You were chosen for the study because your school is in year 4 of implementing the SIOP model. This form is part of a process called "informed consent" to allow you to understand this study before deciding whether to take part. This study is being conducted by a researcher named Jose Vidot, who is a doctoral student at Walden University.

Background Information:
The purpose of this evaluative case study is to determine the efficacy of implementing SIOP as a mathematics teaching strategy and the impact on student achievement in your high school. Since there are indications that the implementation of SIOP has a positive relationship helping students who lag in the language and background skills used in the mathematics classroom, it is imperative to determine the impact on student achievement of instructional models and the implementation of teaching strategies. The study will also report on the teacher efficacy in implementing SIOP.

Procedures:
If you agree to be in this study, you will be asked to:
• Meet with researcher to discuss the study and establish a schedule for interview
• Provide the researcher with lesson plans and samples of student work
• Complete an interview with the researcher.
• Meet with researcher to discuss data analysis.

Voluntary Nature of the Study:
Your participation in this study is voluntary. This means that everyone will respect your decision of whether or not you want to be in the study. No one at the school will treat you differently if you decide not to be in the study. If you decide to join the study now, you can still change your mind during the study. If you feel stressed during the study you may stop at any time. You may skip any questions that you feel are too personal.

Risks and Benefits of Being in the Study:
There will be minimal risk to the teacher. The teacher will only be asked to allow the researcher to observe classroom instruction using the SIOP checklist, a 20 minute interview, and to provide a sample lesson plan. This study will investigate pertinent factors that could influence mathematics achievement at the high school level. Included in this study is the analysis of SIOP strategies at the high school level in mathematics, as well as curriculum expectations and perceptions that are prevalent in the high school classrooms. Teachers will benefit from examining the findings of this study in relation to successful implementation of professional development and teacher collaboration and support, and how this may lead to positive influence on student achievement.

Compensation:
There will be no compensation for participation in the study.

Confidentiality:
Any information you provide will be kept confidential. The researcher will not use your information for any purposes outside of this research project. Also, the researcher will not include your name or anything else that could identify you in any reports of the study.

Contacts and Questions:
You may ask any questions you have now. Or if you have questions later, you may contact the researcher via phone [redacted] or e-mail jose.vidot@waldenu.edu. If you want to talk privately about your rights as a participant, you can call Dr. Leilani Endicott. She is the Walden University representative who can discuss this with you. Her phone number is 1-800-925-3368, extension 1210. Walden University's approval number for this study is IRB will enter approval number here and it expires on IRB will enter expiration date. The researcher will give you a copy of this form to keep.

Statement of Consent:
I have read the above information and I feel I understand the study well enough to make a decision about my involvement. By signing below, I am agreeing to the terms described above.

Printed Name of Participant

_____

Date of consent

_____

Participant's Written or Electronic* Signature

_____

Researcher's Written or Electronic* Signature

_____

Electronic signatures are regulated by the Uniform Electronic Transactions Act. Legally, an "electronic signature" can be the person's typed name, their e-mail address, or any other identifying marker. An electronic signature is just as valid as a written signature as long as both parties have agreed to conduct the transaction electronically.

Appendix D: Data Usage Agreement

DATA USE AGREEMENT – Principal

This Data Use Agreement ("Agreement"), effective as of 08/16/2010 ("Effective Date"), is entered into by and between Jose Vidot ("Data Recipient") and [redacted] ("Data Provider"). The purpose of this Agreement is to provide Data Rec[redacted] access to a Limited Data Set ("LDS") for use in research in accord with the HIPAA and FERPA Regulations.

1. Definitions. Unless otherwise specified in this Agreement, all capitalized terms used in this Agreement not otherwise defined have the meaning established for purposes of the "HIPAA Regulations" codified at Title 45 parts 160 through 164 of the United States Code of Federal Regulations, as amended from time to time.

2. Preparation of the LDS. Data Provider shall prepare and furnish to Data Recipient a LDS in accord with any applicable HIPAA or FERPA Regulations.

3. Data Fields in the LDS. No direct identifiers such as names may be included in the Limited Data Set (LDS). In preparing the LDS, Data Provider or shall include the **data fields specified as follows**, which are the minimum necessary to accomplish the research: grade 11 raw data test scores for: (a) individuals and classes of students on the Northwestern Education Assessment (NWEA) for the months of January 2010, May 2010, and September 2010; (b) individuals and classes of students on the spring 2010 HSPE.

4. Responsibilities of Data Recipient. Data Recipient agrees to:

a. Use or disclose the LDS only as permitted by this Agreement or as required by law;

b. Use appropriate safeguard to prevent use or disclosure of the LDS other than as permitted by this Agreement or required by law;

c. Report to Data Provider any use or disclosure of the LDS of which it becomes aware that is not permitted by this Agreement or required by law;

d. Require any of its subcontractors or agents that receive or have access to the LDS to agree to the same restrictions and conditions on the use and/or disclosure of the LDS that apply to Data Recipient under this Agreement; and

e. Not use the information in the LDS to identify or contact the individuals who are data subjects.

c. Not use the information in the LDS to identify or contact the individuals who are data subjects.

5. Permitted Uses and Disclosures of the LDS. Data Recipient may use and/or disclose the LDS for its Research activities only.

6. Term and Termination.

a. Term. The term of this Agreement shall commence as of the Effective Date and shall continue for so long as Data Recipient retains the LDS, unless sooner terminated as set forth in this Agreement.

b. Termination by Data Recipient. Data Recipient may terminate this agreement at any time by notifying the Data Provider and returning or destroying the LDS.

c. Termination by Data Provider. Data Provider may terminate this agreement at any time by providing thirty (30) days prior written notice to Data Recipient.

d. For Breach. Data Provider shall provide written notice to Data Recipient within ten (10) days of any determination that Data Recipient has breached a material term of this Agreement. Data Provider shall afford Data Recipient an opportunity to cure said alleged material breach upon mutually agreeable terms. Failure to agree on mutually agreeable terms for cure within thirty (30) days shall be grounds for the immediate termination of this Agreement by Data Provider.

e. Effect of Termination. Sections 1, 4, 5, 6(e) and 7 of this Agreement shall survive any termination of this Agreement under subsections c or d.

7. Miscellaneous.

a. Change in Law. The parties agree to negotiate in good faith to amend this Agreement to comport with changes in federal law that materially alter either or both parties' obligations under this Agreement. Provided however, that if the parties are unable to agree to mutually acceptable amendment(s) by the compliance date of the change in applicable law or regulations, either Party may terminate this Agreement as provided in section 6.

b. Construction of Terms. The terms of this Agreement shall be construed to give effect to applicable federal interpretative guidance regarding the HIPAA Regulations.

c. No Third Party Beneficiaries. Nothing in this Agreement shall confer upon ny person other than the parties and their respective successors or assigns, any rights, remedies, obligations, or liabilities whatsoever.

d. Counterparts. This Agreement may be executed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same instrument.

e. Headings. The headings and other captions in this Agreement are for convenience and reference only and shall not be used in interpreting, construing or enforcing any of the provisions of this Agreement.

IN WITNESS WHEREOF, each of the undersigned has caused this Agreement to be duly executed in its name and on its behalf.

DATA PROVIDER **DATA RE**

Signed: [redacted] gned: [redacted]

Print N int N

Print Title: Walden University Student Print Title: Principal Wahluke High School

Appendix E. Permission to Use SIOP Rubric

From: Forschler, Jenell
Sent: Wednesday, September 01, 2010 11:14 AM
To: jvidot@charter.net
Subject: Permission agreement

PERMISSION AGREEMENT
Div: 0C: Code: 9780205521067
Req No: 40874: Cust No: 15574

SEP 1 10

Jose Vidot
[redacted]37

Jose Vidot:

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To use the SIOP checklis.. pp. 191 196 to conduct classroom observations of Sheltered Instruction of mathematics for use in Jose Vidot's dissertation entitled "The Efficacy of Sheltered Instruction Observation Protocol (SIOP) in Mathematics Instruction: An Evaluative Case Study," to be completed as a requirement for graduation at Walden University.

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Sincerely,

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Appendix F: Request for Permission From School to Conduct Research

Jose Vidot

John Jones, Principal
Washington State High School (pseudonym)

August 15, 2010

Dear Principal Jones,

I am writing this letter as a request for assistance from you and Washington State High School as I complete my Doctorate in Education with an emphasis in Teacher Leadership and Administration through Walden University. As part of my requirements for this degree, I would like to conduct a dissertation project at Washington State High School on The Efficacy of Sheltered Instruction Observation Protocol (SIOP) in Mathematics Instruction. The purpose of this research is to determine if there is a relationship between SIOP strategies used in the mathematics classroom, the quality of teacher participation in Professional Learning Communities and student mathematics achievement. For this research, data would come from NWEA MAP scores, classroom observations, and staff interviews. I am asking for permission to observe, interview and survey 2010-2011 grade 11 students, mathematics teachers at the high school, and have access to the student MAP and HSPE scores. As participants, students and teachers will have several definitive rights. These rights are:

- Right to refuse to answer any question at any time,
- Freedom to withdraw from the survey/or interview at any time,
- Freedom to withdraw consent at any time without prejudice,
- Participation is completely voluntary.

Specifics to student participation in this research include:

- All surveys/and interviews will be conducted in-person;
- The survey should take no more than 10 minutes to complete;
- Interviews will be conducted by Jose Vidot and may last up to 20 minutes;
- All interviews will be tape recorded;
- All interviews will be transcribed by the researcher, Jose Vidot;
- All data gathered will be housed on a single password-protected computer and/or locked in a secured cabinet when not in use to avoid risk of unintended disclosure of such information;
- All names and responses will be kept confidential;
- No descriptors (name, school) will be used to specifically identify subjects;
- Student grades will not be affected by participation or information collected;

- Excerpts from surveys/interviews may be made part of the research dissertation and subsequent publications; yet, under no circumstances will names and identifying characteristics be included;
- Participants will not receive compensation.

If granted permission to conduct this study, I plan to share my research study and its findings with you. Please feel free to contact me regarding any questions concerning my request. I have provided contact information below for my faculty mentor from Walden University if you would like to speak with her regarding my research.

Sincerely,

Jose Vidot

Faculty Mentor:
Marilyn K. Simon, PhD
Phone: 858-259-0345
E-mail: marilyn.simon@waldenu.edu

Appendix G: Permission Letter From School Principal

[redacted]

August 16, 2010

Dear Mr. Vidot,

The purpose of this letter is to confirm that I am authorized to, and in fact do give my permission for you to run your doctoral research study at [redacted] High School and in the [redacted]

I have read your research proposal, and am very excited to see that you are to the point with your studies that you are ready to conduct your research study. It is with pleasure that I approve of your conducting your dissertation project *The Efficacy of Sheltered Instruction Observation Protocol (SIOP) in Mathematics Instruction* at [redacted] during the 2010 – 2011 school year. As you prepare for the work, please note that the [redacted] is now an "Opt out" district rather than an "Opt in" district when it comes to the use of students' names, pictures, and other similar identifying information.

I understand that the data you collect as part of this research will remain entirely confidential, and may not be provided to anyone outside the of the research team without permission of the Walden University IRB.

In closing, let me say how proud I am of you and your efforts towards your continued education. Efforts such as yours help us to make [redacted] he best it can possibly be!

Respectfully,

[redacted]

Appendix H: Interview Reminder

Dear (Participant's Name):

I just wanted to remind you of our interview date, time, and location.

My records show that we will meet (date) at (time) in (location). I am attaching a copy of the interview questions. Please look over each question before our interview. During our interview, I will use the Interview Guide to guide us through the interview.

After the interview, I will transcribe your answers and give you a copy to review before I finalize the study. Remember, I will keep your name confidential.

Thank you for your time and willingness to help with this study.

Sincerely,
Jose Vidot
jose.vidot@waldenu.edu

Appendix I: Lesson Plan Submission Guidelines

Submitting a Lesson Plan

Please submit at least one lesson plan or an outline of a unit where you are using SIOP to teach mathematics

- The lesson plan does not need to be in any prescribed format.
- You may attach any materials (e.g., activity sheets, resource materials, etc.) that pertain to the lesson
- Provide a brief explanation of where you got the idea(s) for the lesson plan.
- You may mail or e-mail the lesson plan to Jose Vidot:

Jose.vidot@waldenu.edu

You may also submit other artifacts you feel will contribute to the research study (e.g., photographs, videos, e-mail, minutes of meetings/trainings, etc.).

Thank you for your participation, help, and support in the research study of the efficacy of SIOP in mathematics instruction.

Jose Vidot

Appendix J: Letter of Consent Pilot Study Participant

You are invited to take part in a pilot study of the efficacy of SIOP in teaching math: a case study. You were chosen for the study because of your two years experience in implementing the SIOP model as a full time mathematics teacher in the study high school, and two additional years experience as a mathematics coach and team teacher implementing SIOP in the study high school. The results of the pilot study will assist in refining the interview process and interview question guide for the research study. This form is part of a process called "informed consent" to allow you to understand this study before deciding whether to take part. This study is being conducted by a researcher named Jose Vidot, who [redacted] at [redacted] School, the [redacted] a mathematics classroom teacher at [redacted] and a do[redacted]n University.

Background Information:
The purpose of the research study is to determine the efficacy of implementing SIOP as a mathematics teaching strategy and the impact on student achievement in your high school. Since there are indications that the implementation of SIOP has a positive relationship helping students who lag in the language and background skills used in the mathematics classroom, it is imperative to determine the impact on student achievement of instructional models and the implementation of teaching strategies. The study will report on the efficacy of implementing SIOP in mathematics instruction.

Procedures:
If you agree to be in the pilot study, you will be asked to:
• Meet with researcher to discuss the study and establish a schedule for interview
• Complete an audio-recorded interview with the researcher.
• Complete a follow-up audio-recorded interview to address further questions
• Meet with researcher to discuss the transcripts of the interview and data analysis.

Risks and Benefits of Being in the Study:
There will be minimal risk to the participant. Your participation in this study is completely voluntary. At the culmination of the pilot study, all three mathematics teachers at [redacted] are being asked to participate in the research study. The teacher will only be asked to allow the researcher to observe classroom instruction using the SIOP checklist, an audio-recorded interview of no longer than 40 minutes, a follow up interview and review of interview transcripts. This pilot study will investigate pertinent factors that could influence mathematics achievement at the high school level. Included in this study is the analysis of SIOP strategies at the high school level in mathematics, as well as curriculum expectations and perceptions that are prevalent in the high school classrooms. Teachers will benefit from examining the findings of this study in relation to successful implementation of professional development and teacher collaboration and support, and how this may lead to positive influence on student achievement.

The results of the study will be shared with the pilot study participant and will help to refine the interview process for the larger research study.

Compensation:
There will be no compensation for participation in the study.

Confidentiality:
Any information you provide will be kept confidential. The researcher will not use your information for any purposes outside of this research project. Also, the researcher will not include your name or anything that could identify you in any reports of the study.

Contacts and Questions:
You may ask any questions you have now. Or if you have questions later, you may contact the researcher via phon [redacted] e-mail jose.vidot@waldenu.edu. If you want to talk privately about your rights as a participant, you can call Dr. Leilani Endicott. She is the Walden University representative who can discuss this with you. Her phone number is 1-800-925-3368, extension 1210. Walden University's approval number for this study is 01-18-11-0073390 and it expires on January 17, 2012. The researcher will give you a copy of this signed form for your records.

Statement of Consent:
I have read the above information and I feel I understand the study well enough to make a decision about my involvement. By signing below, I am agreeing to the terms described above.

Printed Name of Participant

_____

Date of consent

_____

Participant's Written or Electronic* Signature

_____

Researcher's Written or Electronic* Signature

_____

Electronic signatures are regulated by the Uniform Electronic Transactions Act. Legally, an "electronic signature" can be the person's typed name, their e-mail address, or any other identifying marker. An electronic signature is just as valid as a written signature as long as both parties have agreed to conduct the transaction electronically.

Appendix K: Interview Transcripts

Pilot Interview

How would you describe the culture at the school?

Culture here is by and large is a culture of mutual respect I'd say compliance but not in a negative way. People know what is expected from them and are happy to work with the system and expectations there is not a lot of defiance or outlying behavior. The language is primarily English from the curriculum there is a dual culture around Spanish or Hispanic; such as tastes in foods..There is a more formal part that looks more classical mainstream.

How would you define school climate?

Sort of related to the tenor, the energy level of the school, the inspiration, helping people become what they can.. Our school climate is more of a functional understanding and compliance with the business of the school not characterized by extremes …such as wild excitement or acting out. So in general it is sort of a between extremes….

In the past three years how has the school culture changed for mathematics?

I'm not sure that the school culture has changed significantly since I have been here. I noticed there was a lot of attention..The level of compliance was amazing...Looking back sort of way off base...and the kids just dove right in..Looking five years forward that unquestioned acceptance of what teachers want has sort of diminished...How is this relevant...how is this going to help me…Organizationally there have been a lot of changes in mathematics…One of the changes is that we are more consistent with curriculum, the way we teach and the way we assess, because we are dialoguing and

collaborating with teach other there is an understanding on how we teach kids..That was not the case when I first got here...we were in isolation then.

In the past three years how has the school climate changed?

When I first got here there was the WASL and the state of urgency was high..I do not know if we did a good job..but the urgency was there..now we are in the upswing again and more enthusiasm…kids more prepared at the earlier grades and more willing to tackle the tough challenges…

What is the current professional development model?

We have the PLCs that provide teachers with opportunities to share student data and to strategize around assessments and some of the classroom practices. Peer coaching and observations that gives each other a snap shot of each other's teaching. We have instructional coaching and district wide professional development that is ongoing. We have ESD resources that teachers and coaches go to look at practices from other districts.

What about SIOP? How did SIOP come about in the District?

SIOP was a district initiative started 5 years ago as a way to bridge the language barriers that many of our kids experience. It started out as a district professional development model but then it was decided to make it more building specific. Individual SIOP trainers were assigned to each building showing and modeling how to write objectives, etc. We now have a building specific SIOP trainer. Normally there building administrator checks up on that

Have you seen in any changes in the effectiveness of professional development of SIOP?

We are always looking to see if what we are doing making a difference. As far as student achievement is concerned it is hard to say if SIOP was responsible..I am sure there has been some improvement..As for student improvement there are factors such as their capacities based on cohort. It has been difficult to really say.

How has the school leadership responded to SIOP?

Principals had to accommodate the practices in their buildings because SIOP was a district mandate..My sense is that the teachers and the principals had no input in SIOP. It was a case of the Supt and a small group of people making the decision based on looking at the data because we were desperately in need language intervention program.

Has the leadership affected the implementation of SIOP in any way since its inception to the current day?

Absolutely..in some building the admin was very conscientious about implementing the various SIOP elements…and had been trained and knew what to look for..in other buildings that was informally done..no real structured accountability for teachers. One building wanted to phase elements from the 30 elements in the SIOP model. Our building is in the spectrum of informal leaving it up to the wisdom of the teacher. It is that way because there is an innate sense in teachers to work with those things that they know to work. Just to try a method because it works somewhere else we think sometimes we think is not good enough.

What are some of the greatest challenges facing your students?

Lack of language plus academic readiness. They go hand in hand. They sort of feed off each. A student receiving ELL services is generally 2 to three years behind academically. Language and the academic readiness levels is the greatest challenge.

What about your students. Strengths and weaknesses

Strength: Students want to acquire skills..They want to make English one of their main languages. They leverage their desire to learn English into good effort to learn the content. Effort is vital to acquiring skills.

What motivates them to learn?

They want to please me because I express to them how happy I am that they are doing well. That interchange is one way. Another is the sense of accomplishment and achievement. Another would be to confirm their self image as responsible hard working person. I do not think like:" I am doing this to build for my future or try to solve the world's problems or become a better husband are not the main motivators".

What strategies have you employed to motivate students?

My view of motivating is that I facilitate their ease to become motivated and achieve. I cannot create motivation. I try to give lots of positive feedback on effort and progress. That is one thing I like to do.

How did you accommodate for English language deficiencies?

When I first started I had no accommodation. My basic approach is to still have a high level of English. I do not speak Spanish. I try to be sensitive by trying to emphasize important words and try to explain words with double meanings. In my geometry classes

in a whole class setting I ask students to explain and provide multiple opportunities to explain. Sometimes I would ask students to generate questions and sentences.

How did you employ differentiated instruction?

I did not do it in terms of creating groups but I did it on an individual basis and I accommodate as needed.

What does differentiated instruction mean to you?

Providing access to content in different cognitively demanding levels.

What would scaffolded instruction mean?

I was not very able to do it very well so I did not try it. I tried to get everyone to learn to threshold.

What SIOP strategies do you use most frequently and why?

Comprehensible Input is a nice general approach to helping students who have difficulty with the English language. The other part would be adjusting the text; making the reading assignment understandable.

Are there any SIOP you would eliminate?

None come to mind

Let me talk about the Content and Language objectives. The way this has been presented to the staff is "Thou shalt write out the content and language objective in kid friendly language. You read them verbatim or have someone read verbatim. At the end of the language the process is repeated and the class is asked did we meet our content/language objective and the class is supposed to nod their head and say yes we did. And that is the rationale. My thought is that the content objectives are rich statements. Ask what will this look like or it won't look like. You need to teach what the objective is really saying. It is

not enough to read and write it in kid friendly language, but you have to teach the students we have been announcing objectives for years and years without SIOP.

I prefer that the perfunctory question of whether the objectives have been achieved should be followed with an opportunity to have them reflect did we do it well, not so well, what did we do well, etc.

What are the challenges implementing SIOP?

Consistency of putting up the objectives (3 preps 30 objectives to write in the week) with so many preps and changes in the high school. The way math is run

What would you different?

The language issue plays out a lot in conversations. An expert from the ESD said that there is very little opportunity for academic language use in conversation. The most successful things were around group work and focused on one task being accomplished and done well during the hour. I could get more information from the students. Hear what the student is thinking. The idea is that there should be opportunities for expression.

Is this something you began doing in the past or due to SIOP?

I have done it in the past and was consistent with SIOP. The kids wanted to please me and answer but they felt that they could not answer or communicate or they shut down. I tried to adjust the difficulty and complexity of the problem. What I did in the past was tailored and modified.

Was any of this modification due to SIOP training?

The lexicon in the district is SIOP. So whenever that was brought up (SIOP) it was reminder that language was important. It was more about perspective of a heightened awareness and not necessarily a skills set.

Do you believe that SIOP had any role in mathematics improvement in your classes?

The content objectives and the emphasis of having the students aware of the objectives and business of the day was one improvement. I remember when I taught in homogeneous white schools I did not have to do that because those kids were habituated to the use of the language and much of the content. I was more explicit in identifying the content.

How have the students in your current classrooms responded to the SIOP strategies you implement?

When I give the students a test..I don't get where did this come did from, etc. The students seem more aware of the content and the organization of the content. I have done some sheltering, using SIOP strategy as a comprehensible input.

What about mathematical rigor?

I do not see that as a specific strategy for language learners but a general strategy for learning. You have to have some command of the vocabulary then you can synthesize, compare and contrast, analyze. But without a command of the English language, it cannot happen.

There is almost a dual process in learning mathematics where you need to gain a command of the language in order to attain academic rigor. Marzano states you should always insist on rigor on every level of language and cognitive learning. We need to come to terms with mathematical rigor. For example, I heard one teacher say that it is hard to implement rigor when the kids cannot even multiply or divide. I believe that you can create rigor by having students model a multiplication fact, or operation. There are

ways to do that but we have to be really creative if we look at SIOP as a language strategy.

Is SIOP something should be continued?

Yes. I think that we have this idea that these 30 elements and 8 components are universally in ten years we will see that certain elements are more successful for certain age groups and other elements for other age groups. Marzano has said that not every strategy is applicable for every situation. That being said, it appears as if the expectation is to use all of the elements for asll of the students although the research does not support that notion.

T1 Interview

Read the overview of the process and the time expectation. Teacher confirmed that he understood.

Q1. Can you tell me something about your experience in regards to education in general and then you can transition into SIOP?

I have been a teacher for almost seven years total. I graduated in 2001 with my BA from my particular college. I went to work for my first district for three years. Got my Masters and went to work for this district. This is my third year and I am going on my fourth year technically. SIOP itself was not fully implemented when I first came to this district. I had not been introduced to SIOP until I came to this district. However after seeing SIOP it's not hard to see that SIOP is the same things we have been taught from the beginning on becoming an effective teacher.

Q2.Have you ever had anything similar to SIOP prior to coming to this district? Can you remember any components or models or is it a general teaching background for good teaching?

It is a general teaching background for good teaching. We have been talking about modeling for some time. SIOP is big on manipulatives. Using manipulatives to teach big ideas and trying to find avenues within education that explains those processes to our kids so they can see what is going on.

Q3. Have you had professional development in mathematics or SIOP?

Yes and no; we have a lot of in district seminars taught by our own coaches. Since these in district workshops were SIOP focused we did not necessarily have people brought in from out of district. As far as sending us out of district to learn SIOP techniques none that I can think of.

Q4.What can you tell me about the culture of the school and what culture means to you?

Culturally it is a night and day difference. In my previous district for instance I worked with various groups of people but the majority of the people were from middle to upper class children. I had a freshman come to me one time when I was teaching applied math which was the lowest level of math you can teach in high school and tell me that I didn't have to teach him to do math because his dad was going to give him the business. So I asked him how will you do that without math, he said that is why you hire people to do that for you. And that type of mentality was something that I faced constantly. Yes I also worked with other kids but those kids generally went neglected, emotionally abused, or physically abused. We had one student who slept out in the woods all weekend because his mother locked the door so she could entertain a gentleman. In this community that I

am teaching in now, there is a very strong sense of family. The families support each other but the majority of the kids here..not all but the majority of the kids start at the bottom rung of the ladder. And they understand that they can stay where they are at or they can change. That type of work ethic changes from family to family. It also depends on how much the teacher is willing to love. The kids here are very receptive to that. They are very openly welcoming to that. Normally if you are sensitive to that but still holding a firm line, they are normally receptive to that and actually want to succeed for you.

Q5 How do you view the efficacy of SIOP terms of helping the students?

SIOP in general I feel is a collaboration of good teaching ethics. In a sense in terms of that idea it is great for helping the kids move upward. It teaches the kids how to take good notes, something that I was not taught in high school something I had to learn from a different avenue. Vocabulary is important; I try to break it down into a different formats. I always try to make sure that the simple vocabulary was just as easily understood as the complex vocabulary. What I lacked before is that I did not focus on the technical vocabulary was just as important for future knowledge and progress. So I do feel that is important to keep that in mind. The grouping of collaboration of thoughts and ideas; There are times that I believe there can be too much of a good thing, there are so many activities in SIOP that sometimes teachers overuse them to appoint where there is not enough fluidity and consistency. Therefore keeping that same simple but good concept will keep that balanced feel where students can pick the tools they like to learn with and you are still reusing them and the students are making progress and continue making progress down the road. SIOP is really nothing new in a sense. It is just a collaboration of good teaching.

Q6.Is that useful?

Yes, there are lots of people that can use them. There are lots of people it has been said that those can do more teach but it does not mean they are great at teaching. For example, although it is easy for me to open up to people, I am not the most creative. So from that sense there is a wealth of ideas in SIOP. In our training, bubble maps were taught as a SIOP technique. But it is not a SIOP technique per se; it has bee around for years. It's just that it fell to the way side and people are reminded about bubble maps. It's not new it something old that was brought back.

Q7. Would someone new to teaching benefit?

I think colleges nowadays and in general do not tell us how to teach. They taught us about the laws and the structures. But they did not teach us how to teach. I think in some ways to try to teach someone how to teach is like teaching someone how to think. Someone teaches differently than someone else does. So your method is different. When you view it like that, I think it gives a new person coming in a good starting point. We have a gentlemen starting new but he did not have the tools because he was not taught the tools. So by teaching the SIOP technique he felt that he had more tools. Well this is no different that him sitting down with a good mentor teacher and learning techniques that mentor teacher uses. The difference is that instead of the mentor teacher, these ideas are in a book.

Q8. What is the specific benefit of SIOP?

The one thing that is good in SIOP technique is the student goals, breaking down the overall chapter goal so the students know what they are learning. The one downfall is that it seems that it's like hand feeding the kids. However, I do like the idea of the students

knowing what the end goal is supposed to be. This is the one true SIOP technique that I would say is SIOP.

Q9. What are the challenges with implementing SIOP?

It's adding in that second component, showing the students the end goal is challenging. We sometimes lose sight because we are so focused on our goals that we do not emphasize enough the student goals. There are teachers that struggle with putting down student goals. SIOP has such a specific way that they want you to say or write things. For example if I was doing a lesson in graphing linear equations the student goal I would be writing is "graph the equation as a line." The way the SIOP technique would want me to write it would be "draw a picture of the line of the math problem."

Q10. Why do you think they do this?

I have a theory. Part of it is that they are trying to create a new idea out of old knowledge. They are saying that if you are doing it this way it is a nuance specific to SIOP.

Q11. What are the successes of SIOP?

Well…the benefit I can see is that the goal is to help second language learners. In this district we have a majority Spanish speaking culture. Most people speak both English and Spanish. Because of that, the majority of the kids aren't that great in either language. Myself for example, I was born in Korea my first language was Korean but at a young age I had to make a switch. Because of that you have to make a change in how your brain thinks. I remember in elementary school because I can remember that far back, my ability to speak was horrible. I did not have good enunciation and my word choice was poor. Because of that I struggled. I think the majority of the kids in this district have the same trouble because the majority of them come from Hispanic background and they come to

an English speaking culture where they have trouble. I think the specifics of SIOP helped students create general terminology that allows them to understand what they are learning that is new. By keeping it simple, it helps the students adapt and also by giving them a vocabulary it helps them adapt to new learning down the line as well.

Q12. What about rigor (mathematical) with SIOP?

Since my junior year in HS I wanted to be a math teacher. By the time I was in third grade I could solve problems that were 10 digits long and five digits high. I could solve math problems of that complexity without problem. That was because of my mother. And if I missed them, I had to go over them and fix them; that's just the way it went. I feel that a lot of our rigor has disappeared over the years with the introduction of technology. I feel that technology has not only greatly benefited the world but it has hindered the world. And so for me mathematical rigor not only required the student to be fully engaged in the classroom but their brain has to be fully engaged in the mathematics of the problem. I mean they have to understand where the numbers came from. How do you truly understand the concepts if you have no clue where things would be coming from? I have had situations where I would put a problem on the board and the students would ask me where did I get that problem from-I made –literally-pulled it out of my head… and there's the problem. And the students say "why" and I say 'because it's an example there is nothing more to it'. So we'll go over the problem and get the answer and they will ask "so how did you get this answer?" and it's as simple as 12 – 4 and they don't get it because that basic concept is beyond them. And so mathematical rigor in my mind is the work involved to actually understand how numbers work and the why. I feel a lot of that has been lost with the introduction of the calculator and the big push for that technology.

Does SIOP apply to math rigor in that sense? No. SIOP is more focused on language and speech. It is translational…being able to translate from one language to the next. When it comes to number sense, it has nothing to do with it. It does have something to do with the vocabulary. So from that sense it does work to enhance mathematical rigor.

Q13. What activities do you use that are SIOP in nature?

Well we do a lot of word walls for the language aspect. In my class we do not allow calculators. We use calculators maybe a total of 5 days in the year. However they are still required to do it mathematically and mentally on paper. To address words that students may not know I always relate it to something they are familiar with, once again that's just a best teaching practice and not necessarily a SIOP teaching technique. These questions don't always come from ELL students, sometimes Anglo-Saxon kids will ask.

After JV read off the eight components of SIOP the teacher responds:

And when I hear that I think headache. Take the first one preparation is just showing you how to break down a lesson and then they want to know how you are going to do this. There is nothing there that is not good teaching practice.

Q14. Do you use them all evenly or do you favor some?

When you break it down they ask you to list reading, writing, listening, or speaking. I favor all four. I write my notes on the board clearly and cleanly. I very much enjoy a large class format but at the same time during my large class lesson I incorporate small group and partner. I generally like a large classroom design lesson but I incorporate other ideas partner or group based lesson throughout the thing. Some days I incorporate a small group activity it just depends on the lesson.

Q15. What do you feel motivates students?

'What motivates students is the excitement of the teacher-in all honesty'. It was once brought up in a meeting what we have to do to entertain our kids. Well keep in mind that we are competing against video games, movies, cartoons, and the world. In my case I like to bring a lot of humor and some real world truth and honesty. At the same time I have had some students come back..One example was in my previous district I had one student that we used to butt heads. He left the school and then came back and the first thing he did was to come into my class and say you were right I was a jerk. And I said cool. It's just that understanding that you want to be real world with them but they are still kids.

Q16. Is this what you refer to as culture-the video game culture?

Not always. Some kids are just interested in boys. The other day we were talking about number groupings so I used the example of a girl's closet because she likes clothes. They understood that when we talked about the idea of categories of numbers, real rational, whole numbers…It is important to relate it to something we all understand.

Q17. Is there anything in SIOP that you modified from its pure form or that you believe is not effective at all?

Not necessarily, the number one rule book for teachers is flexibility. We are going to have to adapt what we are teaching. There is a book called 99 teaching ideas from SIOP. There is no way that I can incorporate all of them. Going through that book I chose four that I felt could be incorporated in my class. Each technique is specific so the important thing to keep in mind is that SIOP is mainly directed for English learning. So with that in mind the majority of these techniques are for a reading or English based classroom. In mathematics we are teaching a language. So the techniques that we use are not the easiest to apply because our language is more written and less verbal. Those techniques are a

hard way to go. There is no technique that I disagree with. It is a good collection of old ideas that people can apply as they need to apply them.

T2 Interview

V. Prior to the interview confidentiality and overview description by the researcher.

Q1. I started teaching back in 1990 back then they were focused on Madeline Hunter model laid out format (scope and sequence) And so when they bought up the SIOP stuff I thought I had seen a few good role models and instruction wise a lot of them were quite different in their delivery methods some that were successful and some that weren't. . When SIOP came out there were things that I had seen before. What they were trying to do with the SIOP was to call it different things. There is a language objective and a content objective in other words how do you use language in your content when you are trying to teach it. For students who do not have the base language, you pay a little more attention to vocabulary. But math is its own language…it doesn't matter if you speak Japanese, or Swahili math has its own language anyway.

Q2. When did you first come across SIOP?

I started taking TEOSEL classes here to keep my certification up. Since our school district had a heavy influx of non-English speakers I thought it would be beneficial to take the English as a second language classes. This was around 2003-2004. This is when I came across the term SIOP. At first they wanted to call it Sheltered Lang Observation protocol but SLOP wasn't going to be too catchy..(Humor), I have 15 credit hours amassed in that area. So for 7-8 years you have heard of SIOP as I was taking the TEOSEL classes.

Q3. With all of your year's education what have you seen as a trend in education?

You always hear about how Asian and European high school students do really well whereas American students do rather poorly. I don't think this is a fair comparison. When I was in SA I saw how they attached certain things such as division, but the ideas are the same. I think that we have to be number 1 we gotta be doing poorly and if not we run around trying to do things instead of focusing on our kids learning. I don't think that kids are taught poorly it's that if you compare to other places we don't. It's not fair because we try to educate everyone.

What about Motivation for student learning? Do you see a relation between this and the call to action?

Q4. I get a little frustrated because after teaching students that don't want to be here or do not make any effort to learn. When I sit back and reflect to when I went to school, there were kids in my class that were the same way. So I am reluctant to think in some ways that anything has really changed as far as motivation of students is concerned. I think a lot of what you see is political. Maybe business people are saying I don't want to spend my money. I believe that a lot of change that we see in education is caused by political movement.

Q5. How do you see the role of our leadership and its influence on the culture of the school?

They fall into the politics and say look I am doing my part without really looking to see if it is an effective change. It seems in this district that whenever someone come up with an idea or research that says look at how well those kids performed, we jump right into to it

without really seeing if it could be set up like a good working model. This actually disrupts the student's; earning sometimes instead of helping.

Q6. Why do you believe this is the case?

I think it's a political movement or a reactive type of leadership. It gets me wondering when the next change is going to come. I get to the point where I feel just like…leave me alone and let me do my job. Don't get me wrong, I believe there should be some parameters set in we should be held accountable to see if students are learning. While we started in AYP jail because of their language now we had students back then that were in our district from the beginning that made leaps and bounds advancing beyond what other districts made. It's just that they never reached the level..You know we are in AYP jail because of it.we saw great advances that showed that we were doing a really good job.

Q7. Tell me about professional development and collaboration.

It doesn't hurt to collaboration. I do not know if we should say that if you don't teach to this mode or lesson plans to this structure then you are a poor teacher. When they brought the SIOP model, I think SIOP models are effective because I don't see how they are different from the Madeline Hunter model. Still if you take the time to look at what I am teaching and what the students know and there is a big impasse between that, we use what's called scaffolding in other words MH lesson del what are you going to do to make the lesson comprehensible. I don't think of SIOP as necessarily new..If you take SIOP as something presented that is unique, you focus to a small part of what we are going to teach the student. If you went with true fidelity to a SIOP model you would only scratch the surface of what the student need.

I don't know if I would call it a subset of what they need but you can take a SIOP strategy and apply it to each goal, I took kids and portioned into groups and partitioned the book and made the students teach those components of each student at large, they had to present lesson plans and tests. That is a SIOP strategy because they collaborate with each other. Stuff like that takes a very long time. I see that SIOP strategies require 2 – 3 days to disseminate information that would take 1 part of a lesson in say the Madeline Hunter model. SO I see SIOP as being very time consuming and making it difficult to hit all the objectives that you are trying to address.

Q8. What about Mathematical rigor and SIOP.

It depends on what strategies of SIOP. Rigor means that it is challenging in a way and that you have to live up to a certain standard. You have to apply and show that you applied and keep at a certain pace. It also means that students have to demonstrate that they are advancing through the content objectives and them doing their part.

Q9. Can you talk about the SIOP components that are effective?

Well you talk about a student that didn't understand the concept of congruence and talk about the difference between two things being congruent and two tings being equal. If it takes 15 minutes to get it through as opposed to 90 then you have to see what strategies you want to use. Comprehensible input in SIOP is what was called lesson delivery in the Madeline hunter model. A lot of things that they are taking for good teaching strategies; I do not think there is anything wrong with SIOP. I believe that SIOP can affect the mathematical quality of instruction just like the Madeline Hunter, model can. I believe that they are the same thing and they both can be effective because I do not see too much difference between them

Q10. What are the strengths of SIOP?

Because you look at their students, what they know what you want them to know and then figure out what to do to get them there to build their background.

Q11. What are the weaknesses with SIOP?

A lot of the tools they give you to try are very time consuming, not just in preparation but in the actual integration of them into the classroom. Starting out the year if you have 600 diff terms they have to understand, with some of the SIOP strategies you may only get through 1/3 of them because it takes a lot of time.

Q12. What would you do different?

I have sports anecdotes, what would you do with diff teams. You go with what you are given to work with. I believe that if you put in the effort you can learn from anyone. I think we are getting more and more to where we are being asked to teach to all learning styles. I think that teachers should be allowed to teach to their teaching style. For example a teacher that is musically inclined should use that. Instead of being forced to teach in a certain prescribed format is a fallacy. As a district it's good that they bring these things in, the more tools that you have at your disposal the better you are going to be. Not one is better than another, it depends on the situation.

Q13. How effective Is SIOP?

As effective as you are effect using it; it can be effective. It has made me feel a little more pressure; I am trying to please the administration. It some places it may help. But in my career I always use tools that would help my students.

Q14. How has it impacted mathematical rigor?

I do not know if it has impacted it all that much. I feel that I can incorporate many tools that would be helpful. I try very hard to determine where my students are and break down the content in chewable chunks. The challenge is that regardless of what you get students that say they do not get it.

Q15. Have you modified any SIOP components?

I do not think I have.

Q16. How are your kids doing?

They are doing ok. The weaknesses I see are the cultural issues and not necessarily from the country they are from but the subculture of "we are here only because the law requires it." Quite often when I get students that were students in other countries they were wonderful. They would pay attention to the particulars and the patterns and get those quite readily. A lot of our students are extrinsically motivated and not intrinsically. Paying close attention in mathematics to a word and how it is used could be a useful application for SIOP.

T3 Interview

Q1. Tell me something about yourself, your experience; you can go back as far as you want anything that relates to background, training, etc

I have been teaching for 1.5 years now. I have a little diff perspective on education. I kind of grew up in a teacher family and my dad was on the school board and I have accumulated my ideas by seeing both lenses of teaching. When I was in HS I think that my teachers were really good and they put a lot into their students. Another thing is that I grew up in a farm and gives me the other option of teaching. When I grew up I did not

want to have to choose farming, I choose to be a teacher because I can. The reason I teach is because I want for my kids to have the choices to do what they choose and not be stuck in a certain mold.

Q2. Tell me about your perspective on what leadership and school culture is.

I think most of the direction of a school comes from the kids that are in it. I k now when I was being in high school, my perspective is different. I think that teachers can affect change but if you have a good group of students that is leaders you get a better school that if you do not. Teachers can be a positive role model is to facilitate and if you see students with the potential to be leaders you encourage them to step up and be leaders.

Q3. What do you view as the pros and cons of professional development / collaboration?

The real pro for me is that whenever I go it makes you inspect what you do as a teacher. When you go to training there is something you can learn as long as you apply it to what is going on your classroom. As long as you are applying it to your own teaching that's what professional development is; it's time to reflect on what you do.

As far as collaboration goes, as long as you are unified in what you do with one goal in mind, usually that collaboration will turn out with positive results. Usually there is some motivation to strive to get to that point. Whether it's a school, a department or team teaching if you are moving in the same direction the kids will see that.

Q4. What would you say was your main obstacle in implementing SIOP?

I would say it's that I had never seen SIOP before. I was asked in the interview if I ever saw it before and I said no. I came into a new culture. Kids, building, program. Trying to apply these components of SIOP was new. I also struggled with finding the time to fill

out a SIOP lesson plan or three quality content objectives. It takes about 30 minutes a day just for content objectives

Q5. Would you anything different now?

Not really. Now that I have been teaching for a year I can focus on other things. I am doing things dif because I can focus more on SIOP strategies and ideas of SIOP.

Q6. How much SIOP do you use?

I guess it's hard for me to brand it as SIOP.bec when I make a lesson I am not explicitly thinking SIOP. I am thinking about the same end goals as SIOP like building language goals. When I write an activity or think about what I am going to do, I do not think explicitly about SIOP but rather think about what I am trying to accomplish. A lot of these strategies are consistent with SIOP. I do not necessarily think I am going to do a particular activity because SIOP says to do it.

Q7. Does your instructional approach align well with SIOP?

Yes. If you came into my class you would see that what I do aligns well with SIOP. I have had teachers and coaches come in and say they like what I do with SIOP. I do not teach to be like SIOP it's more about the student. And with these students SIOP works.

Q8. Have you found any strategies that have been effective in affecting rigor? In other words has SIOP been effective at all. Has it had any impact on the rigor?

I think so. With these kids the language is the main issue. I have used a lot of different SIOP activities. If I taught in a school where language was not such an issue, I would teach it a totally different way. SIOP is more rigorous in language. Not necessarily in mathematics. But mathematics has its own language so it is helpful that way

Q9. Have you found that SIOP has helped with the quality of mathematical activities?

It depends on what you mean by mathematical. For example, I have done activities where students find words and ideas where they match words with symbols. I have done some activities that I found straight out of SIOP book that have helped a lot of kids. I have also made up some activities that have helped kids.

Q10. Have you have modified SIOP somewhat?

Oh yes.

Could you elaborate?

Well if you look on the wall I use foursquare a lot because in math taking the word to the picture to the symbol helps a lot. The foursquare is the one I use a lot.

Q11. Are there any specific within SIOP that you find encouraging?

Probably building background is the one I use a lot. I know that mathematics is very foreign to these kids. I try to focus on the words and try to get them to understand what some of these words mean.

Q12. Do you find any use in putting up the content and language objectives?

If I did a better job of referring to them, yes. A lot of times, the students don't have to look at the board to know what we are doing. A lot of times I will be put up on the board my content objective and the three things we are going to learn today

Q13. What motivate your kids to learn?

Some are extrinsically motivated. If you work to help them they will work to learn. I think a lot of times they need encouragement. My favorite saying for some of these kids is that some day you are going to be a math teacher so you better get this down.

Q14. How are your kids doing?

I wish they would learn more. But on the state test I do not kow. SO many kids lack so many skills that it is very hard to get a kids that does not know how to multiply and divide to learn algebra .I see progress and there are some that show more progress than others. Most students have improved good not necessarily in math, not in their attitude that math is not all bad, I have gotten smarter.

Q15. Do you differentiate?

I do …My first period class has one student that got an A first semester. My third period class has nine students that received an A in first semester. SO the difference in classes is pretty huge. SO if it means finding different ways to group kids, find different ways to scaffold them. My biggest differentiation is between levels. For example I do not teach Algebra 2 anywhere near the way I teach pre-algebra. I use more manipulatives and hands on with pre-algebra. The strategies that I use depend at the level that the student is on.

Well that concludes our interview. Thank you for your time.

Appendix L: Curriculum Vitae

Jose Vidot
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The efficacy of Sheltered Instruction Observation Protocol (SIOP) in mathematics instruction:

Skills:

- Bilingual and Bicultural English, Spanish; (some conversational Russian, Portuguese, Italian)
- Successful experience as a school administrator
- Implementation and knowledge of a variety of instructional models
- Excellent writing and verbal skills
- Technology savvy (WIKI's, websites, networks, e-literate, Angel, WEB-CT, networking)
- Professional learning team leadership experience and mentoring skills;
- Successful instructional leadership experience
- Ability to procure grant and other funding.

Recent experience:

- *Employer*: Wahluke School District - *Role:* Teacher: Mathematics instructor, mentor, department chair, and teacher leader for PLC for Wahluke High School. Subjects taught include: pre-algebra, physical science, algebra 1, algebra 2, and calculus.
  Accomplishments: As a whole departmental team, our students growth demonstrated on MAP (across the board in mathematics department), curriculum alignment and materials adopted using AIM process, peer collaboration and observations, building level curricular consistency, spearheaded the development of a department shared culture of transparency, and successful mentorship of new teacher. As a departmental and district team we helped our students increase their state mathematics assessment levels from 8% in 2009, 30% in 2010, and 49% in 2011.

  Role: Summer School Principal: K-12 program of 512 students and 42 staff. Duties included coordination with transportation, health and safety, nutrition, curriculum, staffing, and instruction.

Prior administrative experience:

- *Employer*: Wahluke School District –*Role:* Principal of Summer School (2011)
- Grades K-12 program with 520 students. Students and staff training in Smartboard technology. Coordinated district operations for summer school program with nutrition transportation, maintenance and security.

- *Employer*: Washington State University Tri Cities –*Role:* Director of Early Outreach Partnership Grant and Program; Oversee and implement programs in the partner K-12 school districts and community colleges throughout Washington state that encouraged under-represented students to attend college. Duties included budget management and speaking to large groups of parents and staff.

- *Employer*: Boston Public Schools – *Role:* School principal at O'Bryant School of Mathematics and Science. Grades 7 to 12 programs with 1300 students of diverse ethnicity, language and creed; School raised state achievement from 55% passing state assessment to 98% passing state assessment. School increased 200% student participation in AP programs. Special programs include Bridges to College, and NJROTC (Naval Junior Reserve Officer Training). Collaborated in the development of a community science center complete with solar array and a parent resource center with fulltime staff.

- *Employer*: Yakima School District – *Role:* Principal at Davis High School. Grades 9-12 programs with 1800 students from Yakima constituency area Special programs included; International Baccalaureate and the Bill and Melinda Gates Small Schools Project (Achievers Program)

- *Employer*: Kennewick School District –*Role:* Assistant Principal at Kennewick High School. Grades 9-12 programs with 1700 students from Kennewick constituency area; special programs included International Baccalaureate, Do the Right Thing, RAVE. Supervision areas include ASB, sporting and extra-curricular events, mathematics and science staff, IEP meetings, technology, attendance and discipline.

Classroom teaching experience:

- *Employer*: Columbia Basin College –*Role:* Adjunct mathematics professor

- *Employer*: Ephrata Schools – *Role:* Mathematics teacher, mentor, WASL evening program coordinator; Subjects taught include: geometry algebra 1, and Calculus.

- *Employer*: Keefe Technical and Vocational High School –*Role:* Science teacher, Numeracy coordinator; Subjects taught include: Physics and Chemistry

- *Employer*: Natick Schools –*Role:* Long Term Substitute Science teacher. Also helped with after school discipline (detention) supervision; Subjects taught include: Physics and Physical Science

- *Employer*: Heritage College – *Role:* Adjunct mathematics professor

- *Employer*: Sunnyside Schools –*Role:* Mathematics teacher, Citizenship evening program coordinator, football coach, key/builders club advisor; Subjects taught include: computer mathematics, algebra and pre-algebra.

- *Employer*: Quilcene Schools – *Role:* Mathematics teacher, mentor, Basketball coach; Subjects taught include: geometry algebra 1, and calculus.

- *Employer*: New York City Schools – *Role:* Mathematics teacher at Andrew Jackson High School; football coach. Subjects taught include: geometry algebra 1, and calculus.
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- **Formal schooling:**

  Walden University (2006-present): Coursework in Leadership and Administration for Teaching and Learning towards Ed. D
  Heritage College (1992-1994) M.Ed. School Administration
  Columbia University Teachers College (1987-1989) M.A. Mathematics Education
  Albany State University (1981-1984) B.S. Applied Mathematics; Minor: Physics
  United States Marine Corps (1976-1980) Infantry-Communications-Marksmanship Instructor

- **Most recent on the job training:**

  Mathematics Leaders and Coaches Collaborative, ESD 105
  TMP project for mathematics, ESD 105
  PLC Leader training: Wahluke Schools
  SIOP training Wahluke Schools
  Reading MAP Data: Wahluke Schools
  AIMS (Assessment of Instructional Materials process): Wahluke Schools and ESD 105

- **Current Organizational Memberships**:

  NCTM (National Council Teachers of Mathematics

  MENSA

  Kappa Delta Pi

AERA (American Educational Research Association)

Lifetime: New York State Academy of Sciences

- **Workshops and Conferences Presenting**

1988	New York City Schools	Technology and mathematics in the classroom
1996	Kennewick High School	Anticipation and positive action as a discipline plan
1998	Kennewick High School	Becca Bill
1999	Kennewick KIWANIS	Positive engagement of youth: Kennewick High School programs
2000	Rotary Club Yakima	Gates Grant: What it means to your community
2005	Keefe Technical	Numeracy: How well is your school doing weaving mathematics into curriculum?
2008	WSU	College Spark: Research findings on college outreach programs.
2010	WA State Math Council	Presentation at Mathematics Educators Regional Conference Spokane, WA
2010	Wahluke High School	Professional development on literature review on the efficacy of SIOP

Awards:

1989: Empire State Fellowship

1999, 2001, 2004: KIWANIS Club recognition for service to youth;

2001: Bill and Melinda Gates Achiever Grant

2002: Davis High School band parents recognition for support of music and academics

2003: Boston City Council citation for meritorious performance as school principal;

2003: Siemens Achievement Award for increased AP participation

2003: COMPASS school awarded for achievement on state assessment

2010: Recognition of Math Leadership through Wahluke School District in Showcase of Staff.

2011: Nominated for Presidential Award for Math and Sciences Teaching Excellence