Comparing the Effects of a Sheltered Classroom to a Regular Classroom On the Science Achievement of English Language Learner Students

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Comparing the Effects of a Sheltered Classroom to a Regular Classroom

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Approved for the Faculty

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ABSTRACT

This paper explores the effectiveness of a sheltered science classroom on the academic science achievement of English Language Learner students. The study compared the science assessment scores, throughout a school year, of a group of English Language Learner students that were learning in a sheltered science classroom to a group of English Language Learner students that were learning in a regular science classroom with native English speakers. The teacher embedded best practices for teaching English Language Learners into all aspects of her practice in the sheltered science class, while she used some of these practices as instructional strategies during her teaching of the regular class. The paper examines research into best practices in teaching English Language Learners and sheltered instruction. The results of the study are analyzed and then are discussed as they relate to the current literature.

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CHAPTER 1

Introduction

Background for the Project

The project explored possible methods to effectively address the achievement gap that existed between English Language Learners (ELLs) and native English speakers. Thomas and Collier found (as cited in Gagnon & Abell, 2009, p. 50) that this gap mainly existed because native English speakers developed cognitively and academically every school year while continuing to master their first language in an English learning environment but ELLs were working to develop the language skills to master the academic skills within the same amount of time. Cummins defined (as cited in DelliCarpini, 2008, p. 100) two kinds of language; Basic Interpersonal Communication Skills (BICS) was the language for informal communication that was developed fairly quickly, and Cognitive Academic Language Proficiency (CALP) which was the language needed for school and learning. It was this academic language which took longer to learn and was the key to academic achievement. The author taught in a very increasingly diverse school district with students that spoke over 50 different world languages. Historically, students in this school district struggled to make Adequate Yearly Progress (AYP) as defined by the state of Washington. English Language Learners were a cohort group that continued to be unsuccessful as

viewed by the state. The school district had used an instructional program where ELLs, depending on their proficiency level, received English as a Second Language (ESL) classes with ELL endorsed teachers and then traveled to content area classes where teachers who were not trained as ELL teachers tried to adjust the level of English so that subject matter was comprehensible and modified instruction for their ELL students. This particular school year, during the study, a few more sheltered or content-based ESL classes existed for content area subjects. This meant that ELL endorsed teachers taught a class of only ELL students where students learned the academic content while acquiring English. Teachers in these classes used best practices in ELL research to help students develop CALP in order to achieve academic success. Teachers provided comprehensible input, described by Krashen and Terrell (as cited in Coleman & Goldenberg, 2010, p. 61) in a safe, comfortable learning environment. Teachers used strategies from the Sheltered Instruction Observation Protocol model, the work of Echeverria, Vogt, & Short (as cited in DelliCarpini, 2008, p. 100), which used best practices from research on instructing ELL students.

Statement of the Problem

The school made a schedule and created a sheltered ELL science class and randomly put ELL students with a range of English language proficiency from levels one to four. Any other seventh grade ELL student who did not get put into

this class were put into the other regular science classes with native English speakers. The author was interested in determining whether or not the proficiency Level 3, based on scores from the Washington Language Proficiency Test II (WLPT II), ELL students in the sheltered/content-based ESL science class would be more successful academically than the proficiency Level 3 ELL students that were scheduled into the regular science classes with native English speakers.

Purpose of the Project

The author wanted to determine whether or not the sheltered science program made a difference in students' achievement in science. The author explored how a specific classroom learning environment that used more ELL best practices and a different pace impacted students' academic success in science.

Delimitations

The project started in November 2009 and went until March 2010. It took place at Showalter Middle School in the Tukwila School District in Tukwila, WA. The program studied was seventh grade science, both the sheltered class and the regular classes. Instructional materials used were the curriculums adopted for seventh grade (Energy, Machines and Motion by Science and Technology Concepts for Middle Schools (STC), Genetics by Science Education for Public Understanding Program (SEPUP) and Earth in Space by STC), instructional strategies using many different resources; including and not limited to Sheltered

Instruction Observation Protocol (SIOP), Guided Language Acquisition Design (GLAD), High Yield Strategies, Robert Marzano's Six Steps of Vocabulary, and best practices based on research for ELL students from various resources. (Refer to the Appendix). The participants were Level 3 ELL students in the author's seventh grade classes.

Assumptions

The first assumption related to this project was that the curriculums adopted by the school district for seventh grade science were age appropriate and were designed to align with the state science standards. Another was that the teacher was qualified in science and to teach middle school aged students. Also, that the teacher had qualifications for teaching ELL students. Another assumption was that the all of the subjects in the study (both in the treatment group and the control group) tried their best in class and on any assessments. It was also assumed that all of the subjects in the study (both in the treatment group and the control group) started at approximately the same place at the start of the school year in terms of science achievement because they all came into the seventh Grade at the same time and also because they were randomly scheduled into the different classes.

Hypothesis

Sheltered science instruction strategies (including SIOP, GLAD and others) have positively impacted the academic achievement of ELL students. English Language Learner students (Level 3) who were in the sheltered science classroom receiving more specialized instruction designed to support their language learning as they learned science concepts would achieve greater assessment scores in science than ELL students (Level 3) who were in the regular science classroom.

Null Hypothesis

English Language Learner students (Level 3) who were in the sheltered science classroom would not achieve significantly different assessment scores in science than ELL students (Level 3) who were in the regular science classroom. The thresholds for the test of significance were determined for probability greater or equal to 0.05, 0.01 and 0.001.

Significance of the Project

This project was significant because determining effective ways to meet the academic needs of ELL students was crucial. Students in Tukwila School District were not meeting standard on state tests for a number of consecutive years. These students were not getting the instruction they needed in order to be successful as they were acquiring English. Research by Rance-Roney (2008)

showed that in 2001-02, 42.6% of teachers in the United States instructed ELL students in their classrooms. Researchers have also predicted that by 2030, 40% of the school-aged population in the United States would be ELL students (Thomas and Collier, 2002 from DelliCarpini, 2008). Federal legislation was also making school districts and schools more accountable for teaching these students academically rigorous content, and although this was a big step in ensuring ELL students received the education they need, this created a great challenge for educators.

The Tukwila School District needed to create or change programs to meet the needs of their ELL population. If the results of this project were positive it would support the use of sheltered classes and therefore more teachers needed to become qualified to teach them (by getting their ELL endorsements). If the results did not turn out as expected it would say that sheltered classes were not the way to go but instead all teachers needed to become qualified ELL teachers in order to use ELL best practices in their regular classes.

Procedure

The author collected data from two groups of students. The treatment group included Level 3 ELL seventh grade science students in the sheltered science class with one teacher in 2009-10. The control group included Level 3 ELL seventh grade science students in the regular science classes with the same

teacher in 2009-10. The data collected were the students' scores on science assessments from November 2009 to March 2010. The author used a statistical analysis (t-test) to determine if the differences in the mean science assessment scores of students in the sheltered science class were significantly different to students in the regular science class.

Definition of Terms

comprehensible input. Comprehensible input was defined as language input that is comprehensible to students. (Krashen, 1987).

content-based English as a Second Language (ESL). Content-based ESL was defined as the ELL trained teacher uses ELL practices to ensure ELL students were learning the academic curriculum while becoming proficient in English. (Office of the Superintendent of Public Instruction, OSPI, 2010).

ELL endorsement. ELL endorsement was defined as the endorsement on a teacher's certification that they were qualified to teach ELL students.

native English speakers. Native English speakers were defined as students whose first language was English.

proficiency levels. Proficiency levels were defined as the levels into which ELL students are classified in English proficiency based on their scores on the WLPT II which assessed their reading, writing, speaking and listening knowledge and skills. (OSPI, 2010)

regular science class. Regular science class was defined as the science class which has native English speakers with ELL students.

sheltered science class. Sheltered science class was defined as the science class which was designed as a content-based ESL classroom.

Acronyms

AYP. Adequate Yearly Progress

BICS. Basic Interpersonal Communication Skills

CALP. Cognitive Academic Language Proficiency

ELL. English Language Learner

ESL. English as a Second Language

GLAD. Guided Language Acquisition Design

OSPI. Office of the Superintendent of Public Instruction

SI. Sheltered instruction

SIOP. Sheltered Instruction Observation Protocol

WLPT II. Washington Language Proficiency Test II

CHAPTER 2

Review of Selected Literature

Introduction

The research problem compared science achievement of ELL students in a sheltered science classroom to science achievement of ELL students in a regular science classroom. The first area of literature that the author reviewed was best practices for teaching ELL students which consisted of research-based effective practices and strategies to promote academic success for ELL students. This related to the research problem because the study's main focus was teaching ELL students. Another area of literature reviewed was best practices for teaching science to ELL students, and the exploration found that there was an abundance of current research showing the effectiveness of teaching language through science content due to many similarities between the two content areas. This related to the research problem because the study's focus was the achievement of science content by ELL students. A third area of literature examined was sheltered instruction which was the philosophical basis for the treatment group in the study.

Best Practices for Teaching English Language Learner Students

Research indicated that the primary goal in the practice of teaching ELL students was to make the academic content accessible. DelliCarpini (2008) noted that in the past the focus for teaching ELL students was mostly about grammar

and learning language to communicate but then the focus shifted to learning academic content while simultaneously learning language. Cummins described (as cited in DellaCarpini, 2008, p. 100) two types of language that ELL students acquire: BICS and CALP. All agreed that CALP was required for students to be successful academically and for success in a career that required academic achievement in secondary schooling and beyond. Coleman and Goldenberg (2010) even made the point that these two types of language were not distinct. It was found to be beneficial to explicitly make the connection for students that everyday language helped them to learn academic language by transferring their social language to academic contexts.

A proven effective best practice for teaching ELL students that made academic content accessible was sheltered instruction. This protocol used meaningful and relevant content and built on students' prior knowledge and background experiences. There were different models of sheltered instruction. The SIOP model, the work of Echeverria, Vogt, and Short, (as cited in Coleman & Goldenberg, 2010, p. 62)) stressed the importance of using content and language objectives for student learning, focused on standards-based content, connected learning to students' lives, used a variety of methods and materials to give input that was comprehensible (which meant giving information to students in a way they can understand), provided opportunities for interaction/discussion

of ideas, provided practice time, gave timely feedback, incorporated native language use and provided a review of concepts and vocabulary regularly using formal and informal assessments. Sheltered instruction strategies were effective because they used input that was comprehensible to help make learning accessible but Coleman and Goldenberg (2010) argued there was also a need to learn expressive language so that students could speak, write, participate and show their understanding on assessments.

Research was performed at four highly performing schools where ELL students had demonstrated proficiency on state assessments significantly higher than ELL state averages and in some even higher than state averages for all students (Aleman, Johnson Jr., & Perez, 2009). Researchers collected data on the main characteristics of all four of these schools. The first was that all four schools had high expectations for all of their students. This was evident in all classrooms where all students were required to use high order thinking skills throughout their day. All classrooms used benchmark assessments to gauge where students were and teachers collaborated to plan any needed intervention strategies. The second common characteristic was each school had a focus on understanding concepts. It did not matter what curriculums were being used, they all had an emphasis on promoting deep levels of understanding. Some used specific academic vocabulary strategies of Marzano and Pickering (as cited in Aleman, Johnson, & Perez, 2009,

p. 67), others used realia (real life objects used in context to build understanding), and all had students explaining, discussing and writing to show understanding. Aleman et al., (2009) noted "as we observed classrooms, we heard student voices more often than teacher voices." (p. 68); which showed there was a focus on giving student opportunities for discussions. At all schools there was a culture embedded where students were valued, cultural backgrounds were valued and celebrated (through bulletin boards, assemblies, assignments). The schools recognized exceptional work, academic achievements and student character. The principals respected, valued and appreciated teachers. Finally all four schools had intelligent, constant, supportive and shared leadership.

Rance-Roney (2008) discussed the importance of building collaborative learning environments in the classroom to effectively meet the needs of ELL students. These learning environments focused on scaffolding learning for ELL students to help them develop the language to become proficient on state tests and they valued all students. Rance-Roney's motivation was the rise of ELL students in classrooms in the country and the federal legislation that caused some to see ELL students "as liabilities and not as resources in the daily life of a school" (Rance-Roney, 2008, p. 18). The main ingredients for success of her collaborative learning environment were collaborative groups (mixed with ELL and native English speakers) that were encouraged through assignments to talk,

ask questions, develop critical thinking skills and construct new knowledge together. Rance-Roney modeled positive group interaction with her students in their heterogeneous groupings so they could support each other. Rance-Roney used differentiation so students could use their different strengths to be valuable contributors to their group. Rance-Roney created an effective practice of frontloading her ELL students information for future lessons to increase success. Rance-Roney's idea came from Echeverria et al., 2008 who developed lessons that pre-taught struggling students background material and vocabulary to help them with future lessons. Rance-Roney (2008) came up with packets to give to students that included a preview of vocabulary, content and adapted text for a future unit of study. What was most effective was that she had her collaborative groups make these packets as an assignment and each student used their strengths to contribute and depending on the upcoming unit of study different students acted as resources throughout the year and the packets they developed helped other students to access the content.

Best Practices for Teaching Science to English Language Learner Students

In the literature researched, several recurring themes were found in regards to best practices for teaching science to ELL students. The first theme was that teaching science and language skills in an integrated way was beneficial because students would be engaged in activities that were comprehensible and

meaningful for them and they also had the opportunities to use English to cooperate and solve problems. Pray and Mondhardt (2009) stressed the importance of making learning meaningful and allowing students to engage in meaningful communication, question asking, and ways of showing their understanding. This happened through inquiry used in the learning of science concepts. Gagnon and Abell (2009) also mentioned the success of inquiry-based, meaningful, hands-on learning for ELL students to use observation and exploration to develop explanations. Lee and her colleagues found that (as cited in Gagnon & Abell, 2009, p. 51) ELL students that were in inquiry-based classes scored higher on science and math achievement tests than students in other classes.

A second theme that surfaced in the literature was the benefits of providing students with opportunities to use language. Pray and Monhardt (2009) listed interaction time (for discussion of ideas and use of the language) as a best practice for teaching science to ELL students. Olson, Levis, Vann & Richardson Bruna (2009) described providing students with opportunities to produce language as an effective strategy in ELL students' success in science. Gagnon & Abell (2009), Pray and Monhardt (2009) and McDonnough & Cho (2009) all described interaction time as a best practice to promote learning of English during science learning. This interaction provided students with time to talk about and

make sense of their science learning while using English language in a meaningful way.

A third theme that appeared in the literature addressed the fact that in science, students needed to learn different meanings to everyday words that have specialized meanings in science. A best practice that was discussed was using and teaching key vocabulary to ELL students during instruction of science. Pray and Monhardt (2009) noted that it was also important to differentiate between content terminology and process terminology. McDonnough & Cho (2009) called these two types of language, content-specific and content-relevant respectively. Olson et al. (2009) mentioned this key vocabulary should be accessible to students in the classroom, for example on a word wall. They noted also that teachers should be aware of other words that ELL students may not be familiar with that join key vocabulary in sentences and to use resources like graphic organizers and sentence starters/stems to scaffold learning for students.

A further theme in the literature was that using students' background knowledge and prior experiences was a valuable tool in effective science teaching for ELL students. Pray and Monhardt (2009) stressed the importance of discovering students' background knowledge and experiences in order to connect the lesson to their lives and therefore making the learning accessible to them. Edmonds (2009) also said that drawing on this information to connect learning to

students' cultures and lives was a key to their academic success. McDonnough and Cho (2009) suggested that connecting learning and instruction to students' prior knowledge and experience was a strategy that increased comprehension for ELL students in science.

The issues involved with assessment were also addressed in the literature. Pray and Monhardt (2009) offered a rubric for use when assessing ELL students at different levels of proficiency on the same science standard. It demonstrated the idea that all students should be achieving the same science standards but they would get there and show their understandings in different ways. The demonstrations of learning ranged from using pictures and words to using phrases with graphic organizers, to writing lengthy paragraphs tying the learning together. Edmonds (2009) discussed the value of using samples and models for students before they produced evidence of their learning and of providing feedback as they progressed through the work. Olson et al. (2009) pointed out that ELL students should also be given alternative forms of assessment to show their understanding of science concepts including models, projects, drawings, and verbal explanations.

A final subject broached the idea of learning science as part of a cycle. Olson et al. (2009) described a best practice of building a foundation for students by presenting objects or events as an introduction to a topic, then developing the

understanding throughout the lesson by referring back to the object or event and finally having the students apply the knowledge by solving a problem. Edmonds (2009) described a technique of having students explain a concept in their own words, then the teacher would repeat it using scientific vocabulary and write it down for students to see the new terms and then use the new terms often in the course of instruction.

Sheltered Instruction

In the literature researched on sheltered instruction, several topics reappeared throughout. The first topic was the large amount of research that showed the increasing number of ELL students in schools in the United States and the enormous challenges and inequities they faced to be successful academically. Valdes found evidence that (as cited in Abadiano & Turner, 2002, p. 50) ELL students showed limited language and academic proficiency in the 1990's. Short (2000) discussed the fast growth of the ELL student population and the huge range of language proficiencies and subject matter knowledge that they brought with them to the classroom. She noted that those students with limited formal schooling and lower than grade level language proficiency were most at risk of failure. Thomas and Collier found that (as cited in Short, 2000, p. 18) most ELL students needed between five to nine years of instruction before their academic scores were comparable to average native English speaking peers. Short (2000)

noted that teachers expected students to show proficiency on standardized tests within one to three years on tests that were designed for native English speakers who grew up and were educated in the United States.

Another topic that surfaced was the research that showed the effectiveness of sheltered instruction in promoting academic achievement and success for ELL students. Echevarria et al. found that (as cited in Hansen-Thomas, 2008, p. 166) students that were in classes with teachers that were trained in sheltered instruction did better than students in classes with teachers that were not trained. Cummins found that (as cited in Abadiano & Turner, 2002, p. 52) in order for students to be successful academically in the content areas, they had to be developing competence of the English language. Abadiano & Turner (2002) also noted that research has shown that one of the most successful ways to do the former is through sheltered instruction. Short (2000) described the results of a study where they found a significant difference in writing skill improvement between students instructed by teachers who were trained in sheltered instruction and students who were instructed by teachers who were not trained.

A consistent theme throughout the literature was that effective instruction of ELL students included a focus on both academic language and English language. In the article by Hansen-Thomas (2008) different models of sheltered instruction were described: Specially Designed Academic Instruction in English,

Cognitive Academic Language Learning Approach and SIOP all incorporated academic language and English language into their theory and practice with an explicit focus on helping ELL students understand and use academic language. Verma, Martin-Hansen & Pepper (2008) also reinforced the idea that sheltered instruction should be designed to help students speak and understand academic language. Rennie concluded that (as cited in Abadiano & Turner, 2002, p. 51) the program models that were most successful met the academic, language and affective needs of students. Abadiano & Turner (2002) reviewed the similarities between effective quality instruction for all students and sheltered instruction and found with all the features they had in common, the main difference between them was that sheltered instruction also addressed students' language needs.

Many of the same strategies re-emerged in all of the literature that was reviewed. The best practices of sheltered instruction included: a focus on academic language and English language and an integration of the two, using appropriate grade level activities, building on and making connections to students' background knowledge and prior experiences, providing opportunities to use academic language in meaningful ways, using hands-on meaningful activities, using comprehensible input (visuals, demonstrations, graphic organizers, vocabulary previews, predictions, cooperative learning, native language support, slow down speech, be aware of word choice, explain tasks

clearly, models, examples), scaffold instruction, give opportunities to apply new knowledge, promote higher level thinking skills, frequently assess, give frequent feedback and using different forms of assessment.

Finally sheltered instruction was seen to be most effective when there was school-wide staff development and consistent implementation in all classes. Rennie concluded (as cited in Abadiano & Turner, 2002, p. 51) that program models that were most effective implemented sheltered instruction in the whole school and there was staff development for all teachers. Short (2000) also pointed out that sheltered instruction worked best if it was part of the whole school and that all teachers should be trained in ELL best practices. Short (2000) also explained that the SIOP can be used also as a tool for administrators to observe staff to look for best practices. The Sheltered Instruction Observation Protocol (SIOP) was an instrument for observation as its name suggested. It had 30 items (the best practice features of sheltered instruction) sectioned into eight parts. Each item was scored on a Likert scale from four to zero. Not only could it be used by administrators for observations, but it could also be used by teachers to develop lesson plans, to self-evaluate and reflect, to assess their own instruction in order to improve the academic success of ELL students.

Summary

The literature that was reviewed included research-based best practices for teaching ELL students. Since the research problem of this paper was to compare the achievement of ELL students in a sheltered ELL science classroom to the achievement of the same level of ELL students in a regular science classroom it was important to know and understand what research said about how to best teach ELL students, because the teacher should have been using those types of instructional strategies in the ELL sheltered class. Also, teaching science content had its own best practices and instructional strategies and therefore another area of literature that was reviewed was the best practices for teaching science to ELL students. The teacher in the study should also have been using those strategies in her practice. Finally, since the study described in this paper used a sheltered ELL science classroom as the treatment for the treatment group, it was required to review literature about sheltered classrooms.

CHAPTER 3

Methodology and Treatment of Data

Introduction

This research project investigated whether Level 3 ELL (this level was based on the WLPT-Written Language Proficiency Test scores from the previous school year 2009) students in a sheltered science classroom achieved greater assessment scores in science than Level 3 ELL students in a regular science classroom. The current research/literature provided evidence that ELL students who received special instruction designed to meet their needs were more successful academically. The current research/literature provided evidence that ELL students received special instruction designed to meet their needs were more successful academically. DelliCarpini (2008) discussed her own teaching experiences with ELL students and then went on to discuss current research. She described Jim Cummins work and the importance of ELL students developing CALP (Cognitive Academic Language Development) which included the cognitive language and literacy skills that ELL students needed in order to be successful linguistically and academically. DelliCarpini went on to illustrate activities that were effective to help ELL students be successfully academically. She explained the concept of sheltered instruction and that research in second language acquisition has shown the students were successful when they used the

language being learned in meaningful and relevant ways (while learning a content class). DelliCarpini outlined the features of the SIOP (The Sheltered Instruction Observation Protocol) model that provided a framework for sheltered instruction in the content classes. DelliCarpini's journal article supported the hypothesis of this research project in that certain strategies and protocols helped ELL students be more successful in their academics. Rance-Roney (2008) described her teaching experiences that led her to develop strategies to promote community in her classroom to support ELL students in their learning. Rance-Roney also discussed the work of Cummins and Collier who concluded that ELL students take five to seven years of learning English to catch up to their native speaking peers in academic English proficiency. Rance-Roney discussed the importance of building a community of learners that collaborate and support each other during learning. This idea and the strategies she described also supported the hypothesis that students in a sheltered learning environment designed with specialized instruction for their needs would achieve greater academic success than their peers that were not scheduled into this same type of environment. The hypothesis stated that Level 3 ELL students who were in a sheltered science classroom receiving specialized instruction designed to support their language learning as they learned science concepts would achieve greater assessment scores in science than Level 3 ELL students who were in a regular science classroom. The null

hypothesis stated that Level 3 ELL students who were in a sheltered science classroom would not achieve significantly different assessment scores in science than Level 3 ELL students who were in a regular science classroom.

Methodology

The research method used for this project was quantitative causal-comparative research. The grouping variable was whether ELL Level 3 students were scheduled into the sheltered science classroom or the regular science classroom. The dependent variable was the students' assessment scores in science. This experimental study involved a treatment group (the group of students in the sheltered science classroom) and a control group (the group of students in the regular science classroom).

Participants

The participants in this project were seventh grade ELL students who qualified for ELL services at Level 3 based on WLPT II scores. Some of these students were scheduled into a sheltered seventh grade science class (treatment group) where there were only ELL students (of all proficiency levels 1-4) in the class. Some of these students were scheduled into regular seventh grade science classes (control group) where there were native English speakers and all levels of ELL students. They were selected based on convenience sampling as it depended

on which class they were scheduled into by the school. All of the participants had the same science teacher. These participants were a sample of the population of seventh grade Level 3 ELL students who were in sheltered or regular science classrooms. The sample came from a population of students in which 76% participated in free and reduced lunch. There were Hispanic Spanish speaking students, Turkish-Russian students, students from Vietnam, Tanzania, Somalia, and Afghanistan in the sample. In regards to gender, 47% of the participants were male and 53% were female.

Instruments

The data gathering devices were the science classroom assessments based on the learning targets that were derived from state science standards for middle school. These devices gathered data from the treatment group and were compared on science assessments to the control group. All participants in both groups were in the same grade, at the same school, had the same science teacher and received the same assessments at basically the same time during the school year. The devices were administered in the same room for both groups. These assessment tools were commonly used and accepted in the science program as they were aligned to state science standards for middle school. The devices should have been reliable because the assessment scores of the two groups, treatment and control, could be compared consistently and repeated in other studies.

Design

In this causal-comparative project, the grouping variable was the group of Level 3 ELL students that were scheduled into the sheltered science classroom. The dependent variable was the group of Level 3 ELL students that were scheduled into the regular science classroom. Students in the sheltered science classroom received more specialized instruction designed to help them learn English while they were learning science concepts and the pacing was slower. Students in the regular science classroom still received instruction designed to assist with language while learning science concepts but not as much and the pacing of the class was different; the teacher went slower at times and went into more depth for certain learning activities. Both groups received the same classroom assessments that tested their knowledge and understanding of state science standards. In terms of validity and reliability, it was difficult to know how equivalent the two groups were at the start because they were not randomly assigned to groups and no pre-test data was collected. Also, mortality could be a problem because according to Gay, Mills and Airasian (2009) if there was no pre-test data this meant there was also no information on what was lost when students left. Having a control group to compare to the treatment group was a positive for history because anything that happened outside of the experiment (in the classrooms) should have affected both groups equally.

Procedure

Teacher taught the seventh grade science curriculum to the treatment group and control group in a different manner. There were classroom assessments every three to four weeks.

1. Teacher embedded more ELL best practices and strategies, from Appendix A, into the instruction with the sheltered science class to support language acquisition as they learned science concepts. Teacher also went at a slower pace that supported their learning, and allowed more time for reflection and questioning. Teacher spent more time on vocabulary strategies with the sheltered science class.
2. Teacher embedded ELL best practices and strategies, from Appendix A, into the regular science classroom but not as intensely. Pacing of classroom instruction for this group was moderately faster.
3. Teacher gave the same regular class assessments based on the state science standards to both groups.
4. Teacher collected scores for Level 3 ELL students from both groups.
5. Teacher analyzed data as described in the next section.

Treatment of the Data

For each separate assessment given, the data were collected and then the mean scores for students in each group was calculated and compared. One t-test

for independent groups was used to measure if there was any significant difference between the mean scores for each group in order to see if the treatment made a significant difference in academic achievement. The control group was compared with the treatment group with an independent t-test which tested for significant differences.

Summary

The research project investigated whether or not Level 3 ELL students scheduled into a sheltered science classroom would achieve greater academic success in science than Level 3 ELL students scheduled into regular science classrooms. The research was done using quantitative causal-comparative research design. The participants were seventh grade Level 3 ELL students from a middle school in Tukwila, Washington. The instruments used to gather the data were teacher-designed science classroom assessments based on Washington state middle school science standards. These can be found in the Office of the Superintendent of Public Instruction of Washington's website (see References). The students in the sheltered classroom received more specialized instruction designed to meet their language needs while learning science content than the students in the regular classroom. Students in both groups were assessed regularly on their knowledge and understanding of state science standards. The assessment scores were analyzed for significant differences.

CHAPTER 4

Analysis of the Data

Introduction

The study was designed to determine whether or not proficiency Level 3 (based on WLPT II scores) ELL students in a sheltered/content-based ESL science class would be more successful academically than proficiency Level 3 ELL students that were scheduled into a regular science class with native English speakers.

Description of the Environment

The project started in November 2009 and went until March 2010. It took place at Showalter Middle School in the Tukwila School District in Tukwila, WA. The program studied was seventh grade science, both the sheltered class and the regular classes. Instructional materials used were the curriculums adopted for seventh grade (Energy, Machines and Motion by Science and Technology Concepts for Middle Schools (STC), Genetics by Science Education for Public Understanding Program (SEPUP) and Earth in Space by STC), instructional strategies using many different resources (including and not limited to Sheltered Instruction Observation Protocol (SIOP), Guided Language Acquisition Design (GLAD), High Yield Strategies, Robert Marzano's Six Steps of Vocabulary, best practices based on research for ELL students from various resources). The

participants were Level 3 ELL students in the author's seventh grade classes. The same teacher taught the sheltered science class and the regular science classes. The teacher was highly qualified (with National Boards in early adolescence science) to teach science in the state of Washington and the teacher had an ELL endorsement. The teacher had been teaching science for 12 years and ELL students for eight years.

Hypothesis

Sheltered science instruction strategies (such as SIOP and GLAD) have positively impacted the academic achievement of ELL students. English Language Learner students (Level 3) who were in the sheltered science classroom receiving more specialized instruction designed to support their language learning as they learned science concepts would achieve greater assessment scores in science than ELL students (Level 3) who were in the regular science classroom.

Null Hypothesis

English Language Learner students (Level 3) who were in the sheltered science classroom would not achieve significantly different assessment scores in science than ELL students (Level 3) who were in the regular science classroom. The thresholds for the test of significance were determined for probability greater or equal to 0.05, 0.01 and 0.001.

Results of the Study

Table 1 described the raw scores that students in both the control group and treatment groups, achieved on science assessments throughout the school year during the study. There were high and low raw scores in both groups for different assessments. On certain assessments scores were relatively lower for both groups. Certain students from both groups maintained relatively high scores for most assessments and certain students from both groups had relatively low scores for most assessments.

Table 2 described the mean science assessment scores for students in both the control and the treatment groups. Mean science assessment scores for the students in the treatment group were higher (the range of scores was 1.61-3) than those of the students in the control group (the range of scores was 1.41-3.94). However the lowest mean score (1.41) was for a student in the treatment group.

Table 3 displayed the statistics for the data from the study. It described the mean assessment score, it showed the number of scores for each group and it displayed the t-value (independent t-value) which compared the mean assessment scores for the treatment and the control group. The t-value was an inferential statistic which allowed the author to determine whether or not there was a significant difference in the mean assessment scores between to the two groups. This allowed the author to determine whether or not the treatment itself (being in a sheltered/content-based ESL science class) made a significant difference in student achievement in science. Since the t-value was a positive number this meant that the treatment group had a larger mean value than the control group.

Table 4 described the distribution of t and showed the author whether or not there was a significant difference in the means at different probabilities. At 0.05 probability there was a significant difference between the means. At 0.05, the null hypothesis, which stated that Level 3 ELL students in the sheltered science class would not achieve significantly different assessment scores in science than Level 3 ELL students in the regular science classes, was rejected. Consequently, there was support for the hypothesis, which stated that Level 3 ELL students in the sheltered science class would have significantly higher assessment scores in science than Level 3 ELL students in the regular science classes. The author could have said with 95% confidence that the treatment made a significant difference in student achievement on science assessments. At 0.01 probability there was no significant difference between the means and the null hypothesis was accepted and therefore the hypothesis was not supported. At 0.001 probability there was no significant difference between the means and the null hypothesis was accepted and consequently the hypothesis was not supported.

Table 4 Distribution of t

	p		
df	0.05	0.01	0.001
15	2.131	2.947	4.073

(Adapted from Gay, Mills & Airasian, 2009, p.563)

Findings

The author found that at 0.05 probability there was a significant difference between the means of the treatment group and the control group. The author determined with 95% confidence that the instruction in the sheltered science class (slower pace, more research based strategies and practices designed for ELL students) made a significant difference in the academic achievement of Level 3 ELL students as shown in their science assessment scores. The author determined that there was no significant difference between the means at 0.01 and 0.001 probability.

Discussion

The results of the study were consistent with the author's expectations. The author expected that the sheltered science class that was designed to specifically support ELL students' acquisition of language as they learned science would help these students be more academically successful than their counterparts in the regular science classroom where less ELL best practices and strategies may have been used. Compared to the literature, the basic outcomes were consistent with the work of Cummins (as cited in DelliCarpini, 2008, p. 100) that students need CALP in order to be successful academically, and the sheltered class focused on academic vocabulary. It was also consistent with the theory of comprehensible input (as cited in Coleman& Goldenberg, 2010, p.61), the sheltered class provided students with information in a comprehensible manner.

The general findings are also consistent with the research done on highly performing schools that had a higher average of ELL students being proficient academically than state averages (Aleman, Johnson Jr., & Perez, 2009). These schools had high expectations for students, promoted deeper levels of understanding and used specific vocabulary strategies described by Marzano and Pickering (as cited in Aleman, Johnson & Perez, 2009. p.67) which were all embedded into the sheltered science class.

Summary

The study was designed to see the effectiveness of a sheltered science class for Level 3 ELL students. The students in the control group were Level 3 ELL students that were scheduled into the regular science classes with native English speakers. The students in the treatment group were Level 3 ELL students that were scheduled into the sheltered science class. The results of the study found that there was a significant difference in mean scores on science assessments between the two groups. The null hypothesis, which stated that students in the sheltered science class would not have significantly different science assessment scores than students in the regular science classes, was rejected at 0.05 probability. Consequently, the hypothesis, which stated that the students in the treatment group would have significantly higher science assessment scores than the students in the control group, was supported at 0.05

probability. However, at both 0.01 and 0.001 probabilities the null hypothesis was accepted and therefore the hypothesis was not supported.

CHAPTER 5

Summary, Conclusions and Recommendations

Introduction

The purpose of this research project was to investigate the effectiveness of an ELL sheltered science class. The project compared the science achievement of Level 3 ELL students learning in a sheltered ELL science classroom to the science achievement of Level 3 ELL students that were learning in a regular science classroom with native English speakers.

Summary

The project was used to explore strategies to address the problem of the achievement gap that existed on state assessments and academic achievement between native English speakers and ELL students. The Tukwila School District served a highly diverse student population and there was a need to find and implement strategies and programs to meet the needs of their students. One possible strategy was the implementation of sheltered content classes for ELL students. Since the school district was already starting to do this, the author decided to investigate the effectiveness of a sheltered science class and compared the science achievement of Level 3 ELL students in a sheltered science class compared to Level 3 ELL students in a regular science class with native English speakers. In order to ensure that instructional and classroom practices were based on best practices, research of the current literature was done on best practices in

teaching ELL students, best practices in teaching science to ELL students and sheltered instruction. The design of the project was a causal-comparative experimental study with a treatment group and a control group. A t-test was done to test for significant differences between the mean scores on science assessments throughout the school year between the two groups. A significant difference did result at 0.05 probability and here the null hypothesis was rejected and consequently there was support for the hypothesis which stated that ELL students in the sheltered science class would achieve significantly greater assessment scores in science than ELL students in the regular science class. However, at 0.01 and 0.001 probability the null hypothesis was accepted and there was no support for the hypothesis.

Conclusions

The results of the study were consistent with some of the current literature on best practices when working with ELL students. The teacher in the study embedded best practices and specific strategies for teaching ELL students into the daily practice of her sheltered ELL science class. The teacher in the study also used best practices and strategies for teaching ELL students in her regular class but not as purposefully or extensively for every learning activity. The results indicated that the author could say with at least 95% confidence that there was a significant difference between the science scores for the two groups and therefore could conclude that the sheltered science class made a difference in the

achievement of Level 3 ELL students. If sheltered instruction was designed based on best practices and implemented with fidelity, it could impact the learning of Level 3 ELL students and help them to achieve higher assessment scores compared to their like peers learning in a regular classroom.

Recommendations

The study is encouraging for those who advocate for more sheltered classes as a strategy to meet the needs of our ELL students in an increasingly diverse student population. The author thinks that studies that investigate the impact of other strategies or programs designed to close the achievement gap between ELL students and native English speakers are also necessary. One study could look at the effectiveness of teachers having an ELL endorsement when teaching ELL students compared to those without one. The study could compare regular classes (including ELL students) with ELL endorsed teachers, using best practices for teaching ELL students, to regular classes (including ELL students) with teachers who are not ELL endorsed and therefore not necessarily knowledgeable on best practices and how to implement and embed them into their daily practice. Although the results of this study indicated at 0.05 probability that a sheltered science class can be more beneficial to the learning of ELL students, at 0.01 and 0.001 probability they did not. At 0.01 and 0.001 probability, the null hypothesis (which stated there would be no significant difference between the science assessment scores of the ELL students in the sheltered class and the ELL

students in the regular class) was accepted and there was no support for the hypothesis. Therefore the author recommends doing the same study again but this time with more students. The sample size was not very big and this could have impacted the results. Also, the research could include regular anecdotal data from the students and the teacher to see the ongoing impact the two learning environments have on their thinking, their learning and also to compare the two groups' reflections on the learning activities.

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APPENDICES

Appendix: ELL Best Practices and Strategies

Goal: Achievement of academic standards by **all** students

Principles:	Strategies:
Increase Comprehensible Input	-develop and maintain routines -use clear signals for classroom instructions -announce learning objectives/targets for each lesson -list instructions step by step -present info in a variety of ways -enunciate (do not raise your voice) -non-verbal communication, gestures -use facial expressions -face students -pause -point out (physically) what's important -avoid "asides" (going off topic..) -use shorter sentences -focus on meaning not grammar -avoid interpreting regularly -use images, visuals, pictures -print clearly, legibly (not cursive) -use realia (real objects, documents, etc…)

	-frontload key vocabulary and emphasize key vocab -connect to home culture -use hands-on/manipulatives -modeling -use repetition/review frequently -check for understanding -avoid idioms, slang -present new info in context of known info -connect to prior knowledge, experiences -scaffold learning --ask simple questions --establish questioning patterns --ask for elaboration "tell me more.." --use good listening skills --ask for clarification -TPR (total physical response) -use graphic organizers
Increase Interaction	-cooperative learning -intentional groupings/pairings -think-pair-share -role playing -songs/chants

	-gestures -games -music
Increase Thinking Skills by Making It Cognitively Challenging	-use wait time -make predictions -ask higher order thinking skills -compare and contrast -use real world/real life examples, problems -use open-ended questions -use graphic organizers -give choices for output -have clear expectations -have clear learning targets -provide exemplars and samples -validate students' thinking -make learning meaningful and purposeful
Connect to Students' Lives/Culturally Responsive Teaching	-promote cross cultural understanding by using a variety of examples, linking to different cultures and experiences -have high expectations for all students -be aware of students' different cultures (including different values, beliefs, behaviors, language, communication style, gender roles, child rearing practices, holiday traditions, religious beliefs..)

	-be aware of your own biases -recognize differences and think of ways to value diversity regularly in the classroom -be positive role models -include multiple perspectives -bring in diverse speakers, videos -draw on multicultural literature -teach to diverse learning styles -teach cross-cultural awareness -teach directly about prejudice -teach conflict resolution -empower students to work towards social justice -make lessons relevant to students' lives -recognize student success but be aware that in some cultures overt, individual praise can be considered inappropriate and so then embarrassing or confusing to student
Decrease "Affective Filter" (decrease feelings of anxiety, fear, worry, embarrassment…)	-create a welcoming, safe and comfortable environment for everyone -be inclusive-try to incorporate different cultures into classroom
Support First Language	-encourage use of first language at home, school (reading… etc.) -literacy in first language carries over to second language

	-communicate this to parents when possible

Ideas for assessment:

-do practice tests

-assess verbally

-allow students to use pictures, diagrams, labels to show understanding

-differentiate assessment

-teach how to do multiple choice questions, true or false, short answer

Table 1

Data from Control and Treatment Groups- Raw Scores

	Control Group Raw Scores									Treatment Group Raw Scores							
	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7	Test 8		Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7	Test 8
C1	2	2.5	2	0	1.75	1	1	2.5	T1	2	1	1.5	3.5	1.75	1	2	1.75
C2	2	2	3.5	1.5	2.5	2	2.5	2.25	T2	2.5	4	0.5	2.25	3.25	2.75	2.5	2
C3	3.5	2	3.5	1	1	1.75	3.75	0.75	T3	1.5	1.5	1	2	1.5	1.75	1	1.5
C4	1.5	2	3	1.25	1.25	2.5	1.25	2	T4	2	4	3	3	4	3.75	3.25	4
C5	3	2.5	3	1.25	2.75	2.75	2.25	1.25	T5	3.5	3	4	2.5	3.25	4	2	1.75
C6	2	1.5	2.5	1	2.25	1.5	0	0.5	T6	3.5	4	3.5	3.5	3.5	3.5	4	3.5
C7	3	2.5	1	1.5	2.25	3	1.5	2	T7	3	3.5	2	3	3.25	2.75	3.25	4
C8	3	3.5	3.5	3.25	2.75	3	1.5	3.5	T8	4	4	4	3.5	4	4	4	4
									T9	2.5	4	4	3.5	3.25	3	3.5	3.5

Table 2

Data from Control and Treatment Groups- Mean Scores

Control Group Mean Scores		Treatment Group Mean Scores	
C1	1.82	T1	1.81
C2	2.28	T2	2.47
C3	2.16	T3	1.47
C4	1.84	T4	3.38
C5	2.34	T5	3.00
C6	1.61	T6	3.63
C7	2.09	T7	3.09
C8	3.00	T8	3.94
		T9	3.41

Table 3
STATPAK Table

Statistics	Value
No. of Scores in Group X	9
Sum of Scores in Group X	26.2000
Mean of Group X	2.91
Sum of Squares Scores in Group X	81.84
SS of Group X	5.57
No. of Scores in Group Y	8
Sum of Scores in Group Y	17.1400
Mean of Group Y	2.14
Sum of Squared Scores in Group Y	38.00
SS of Group Y	1.28
t-Value	2.34
Degrees of freedom	15