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Use of Vocabulary Strategies to Aid English Language Learners in a General Education Biology Classroom

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USE OF VOCABULARY STRATEGIES TO AID ENGLISH LANGUAGE LEARNERS IN A

GENERAL EDUCATION BIOLOGY CLASSROOM

A Dissertation
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Education
Education Systems Improvement Science

by
Virginia S. Perry
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Accepted by:
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Abstract

The demographics of the typical American classroom continue to present as a more diverse student population with the increase of English Language Learners (ELL) entering public schools. General education teachers on a secondary level are challenged with incorporating academic language instruction into content instruction for ELLs. Many of these teachers seek appropriate instructional strategies to teach ELLs academic language skills related to literacy to comprehend the specific content taught at the secondary level. A deeper understanding of language and skill acquisition within a secondary classroom can help guide future efforts in implementing effective literacy strategies to address ELLs' academic language needs. This qualitative case study aimed to explore how the implementation of vocabulary strategies in biology general education classrooms improves English Language Learners' content acquisition. The conceptual framework for this study included Cummins' and Krashen s theories of second language acquisition. The participants included three general education biology teachers and seven ELLs at a high school in the southeastern area of the United States. Teacher interviews, student focus groups, and classroom observations were utilized to answer the research question. Data were analyzed via open coding to generate the themes. The study findings revealed that implementing visual vocabulary strategies in secondary general education biology classrooms was necessary for the academic language acquisition of ELLs for core content. This study s findings may positively affect change by informing stakeholders' efforts in implementing vocabulary strategies to provide academic language instruction to ELLs for success in acquiring core content material in secondary classrooms.

DEDICATION

      I dedicate this to my Lord and Savior, Jesus Christ. He continues to give me the strength, passion, and determination to impact the lives of others in this world. I approach each day knowing that His guidance will sustain me and allow me to be His hands and feet in working with others.

ACKNOWLEDGMENTS

This is a journey I have wanted to embark on for many years. I have been blessed to have a community of support with me throughout my life, and countless people have influenced who I am and who I hope to become. That support sustained me throughout this most recent journey as well.

First, to my husband Tim. Thank you for allowing me to complete this journey that I have been seeking for so long! Your support and encouragement were the fuel that kept me going during those long hours of studying and writing. I appreciate your supporting my wild idea to go back to school and fulfill a dream while balancing being a wife, mother, coach's wife, and career, among other things life has thrown at us. I am so blessed that God chose us to spend our lives together.

To my children, thank you for allowing me to sit at your practices and games while in class online, meeting with my cohort for assignments, and reading endless pages in a text. You have been with me through every step of this journey, and I appreciate your willingness to help me fulfill a dream. I want to be the best version of me that I can be for both of you! I pray that you will continue on your lifelong learning journey and follow God's path for you in every way.

To my mother, my brother, and my sister-in-law, thank you for the support you have always provided to me in school and life. You have always supported my dreams and always picked me up when I thought I could not perform to my ability. You believed in me when I didn't believe in myself, and you always gave me the talk or the swift kick to push me along. To my nephew, you have always been my third heartbeat! Part of my dreams in life have always included you. I pray that you continue to seek God in everything you do and that you continue to

follow your dreams! I am equally proud that we get to share this graduation together - my final degree and your undergraduate degree! Go Tigers!

To my in-laws, thank you for your constant support in this journey. You often question how I do it all, and I have never had that answer, but I appreciate your encouragement and interest in all the crazy things I decide to do.

To my school family, past and present, you are the very reason I have written this dissertation. The faculty and staff I have the honor of working with each day and the educators I have been blessed to work with in years past have helped shape my career. We can change the world through our daily work, and I am so grateful to walk alongside you on this journey. I am especially grateful for the teachers who committed to working with me in this study. Your time, effort, and belief in me in working with you and your students will never be forgotten.

To my committee chair Dr. Reginald Wilkerson. Thank you for everything you have done for me! I value the way you questioned me, pushed me, and helped me throughout this dissertation process, but also from the very first class we had in the program, where I felt completely overwhelmed. You have influenced my growth as a student, researcher, and educator. I will forever be grateful for sharing this experience with you. To my committee members, Dr. Antonis Katsiyannis, Dr. Hans Klar, and Dr. Rhonda Miller thank you for your time, support, and guidance during this process.

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Introduction and Overview

Jose moved to the United States from Honduras when he was 8 years old due to repeated earthquakes that destroyed his home and school. The first year Jose's family lived in the US was difficult as they bounced from town to town and state to state trying to find affordable housing. When they finally settled, there were no records available from his school in Honduras. Therefore, at age 10, Jose was placed in the 3rd grade.

The demographic of the typical American classroom offers a diverse student profile and the diversity noted continues to increase each year. As English Language Learners (ELLs) enter American schools, they are tasked with acquiring a new language while being immersed in unfamiliar academic institutions with instruction that is, pardon the pun, foreign to them. Achieving academic language proficiency simultaneously can prove to be extremely difficult for many students for whom English is not their native tongue. English Language Learners come into schools with different experiences, and diverse backgrounds related to their knowledge and academic skills (Duran et al., 1997). ELLs also commonly experience educational obstacles in American schools, such as a lack of effective teaching strategies and overwhelming language barriers (Abbott et al. 2017; Blattner & Dalola, 2018; Wassell et al., 2018 as cited in Jimenez-Johnson, 2021). These factors exacerbate the difficulties students' face as they find themselves absorbed in the American educational system. The ELL population continues to grow in American schools as non-English speaking families immigrate to the United States, bringing with them a variety of cultures and linguistic styles which often present academic difficulties for the student population.

The incredibly fast growth of the ELL population raises other important concerns about whether states have the resources (e.g., trained teachers, language support programs, curricula,

and materials) and infrastructures to accommodate these students ensuring they have appropriate and effective academic instruction at school. For ELLs to place value in their learning, the implementation of multiple low-cost classroom strategies should enhance the delivery of academic content to elicit student success (Hovey et al., 2019). This study aimed to investigate the viability of both providing and incorporating literacy strategies to teachers capable of enhancing ELLs' vocabulary acquisition so that these students can find success in school. Many immigrants see America as a "land of plenty" or as a place with "streets paved with gold," for many this ideal is called the American Dream. However, for many immigrants the acquisition of this American dream is uniquely tied to their language and academic proficiency. This study seeks to improve those opportunities for ELL students.

Growing Population of English Language Learners

The ELL population in American public schools consists of a heterogeneous group of students from many countries around the world. Goodrich et al. (2021) noted that while Asian immigrants have exceeded Hispanic immigrants as the largest group arriving to the United States yearly, Hispanic immigrants still account for more than 25% of those individuals moving into the country. Although often referred to as Hispanic, many Latinx immigrants come to America from Mexico, Central America, and South America and are often entering the country with low levels of English proficiency and are disproportionately represented in America among low-income families (Goodrich et al., 2021). Immigrant English Learners who are born in the US to immigrant parents, often do not speak fluent English and have become the fastest growing population in American schools (Calderon, 2011). In addition, the amount of formal education or the quality of education ELLs received in their home countries varies depending on the country or the specific region of the country they have moved from (DeCapua 2020).

Rationale for Research

An increase in the disparity between ELLs and English-proficient students related to achievement has occurred due to an increase in the population in American schools. To bridge this achievement gap, schools must "address the language, literacy, and academic needs of English learners more effectively," (Calderon et al., 2011, p. 103). This can be done by putting into place appropriate supports and providing professional development learning opportunities for teachers to expand their knowledge of the population. Based on several studies, Calderon et al. (2011) indicated "the quality of instruction is what matters most in educating English learners," (p. 103). For teachers to provide quality instruction for this population of students, teachers need to focus on skill acquisition and improvement supported by a keen sense of cultural awareness for all students. Infusing the culture and individualism of ELLs prior to teaching content should increase students' academic learning opportunities and their performance on standardized testing.

Developing academic vocabulary skills is essential for language learning (Chen et al., 2021) although ELLs continue to struggle with acquiring the necessary skills for acquisition (Ferlazzo & Sypnieski, 2018). Malone (2018) states that the language success of ELL students ultimately depends on effective instruction for acquiring academic knowledge, which requires language learners to be able to make connections between academic and content-specific vocabulary words (p. 658). Teachers often struggle with knowing how to provide appropriately targeted instruction or strategies to help ELL students develop their vocabulary skills for them to understand the content being taught (Irby et al., 2018).

Teachers receive little support in how to best work with the ELL population as there is a lack of evidence-based interventions provided for ELLs who are experiencing academic

difficulties in core content area (Artiles et al., 2010; Denton et al., 2008; Linan-Thompson et al., 2006; Solari et al., 2012; Tam et al., 2006; Vaughn et al., 2005). At the secondary level, this has become an even greater concern as most research focuses on ELLs mostly in the elementary grades (Carlo et al., 2004, Denton et al., 2004; Kim & Linan-Thompson, 2013; Tam et al., 2006). Feiman-Nemsar (2001) emphasized the importance of evidenced-based practices and teacher training to help improve the learning outcomes of ELLs as it is essential for teachers to prepare lessons and plan class activities where they can scaffold the learning process for their diverse learners.

Providing more of the same type of instruction ELLs received in elementary school will not bring about necessary improvement. As content specification and complexities increase little attention is paid to language acquisition in the quest for academic success. Therefore, effective strategies should be taught and implemented (at all levels) with fidelity to best meet the needs of this ever-growing, uniquely diverse group of students present in American schools.

All students, no matter their culture, race, background, or other factors, have the right to a free, appropriate public education in the United States of America. With that, the American educational system must determine how to make education equitable for all populations, all cultures, and all students that attend schools. For ELLs to have the tools necessary for their success, some policies and procedures may need extra consideration to ensure that the resources are available as they move through school and into the world. A one-size-fits-all approach to addressing the many needs of this growing and diverse population of students simply does not work and can no longer exist. The time has come to ensure that all students have an opportunity to learn in a manner that befits their culture, customs, traditions, and heritage; ELLs in our country deserve nothing less.

Problem of Practice

The problem of practice which guides this study focuses on the notion that ELLs have historically scored lower than their English-proficient peers on standardized assessments according to national statistics (OELA, 2018). Teachers continue to struggle in providing effective interventions and strategies for teaching content to ELL students, which generates a tremendous amount of stress on both teachers and students with expectations of elevating test scores. In addition, many ELLs diligently work to learn the English language while also attempting to increase their academic cognitive skills; skills necessary for the comprehension of material taught at a high school level. When these same ELL students experience academic and cultural frustration, they become dejected with the amount of time left in school for academic success and many disengage from the educational process. Therefore, teachers need better resources along with additional teaching strategies to help ELLs learn the new language as well as acquiring academic skills for success in their core content classes.

<div align="center">

Research Questions

</div>

This study involved investigating the teaching and learning of academic vocabulary strategies in secondary science classrooms to support vocabulary building for ELL students.

This qualitative research study was guided by the following formal research question: *How can the implementation of vocabulary strategies in the biology general education classroom improve English Language Learners' content acquisition?* In answering this overarching research question of this study, a sub-question emerged leading the researcher to investigate a secondary research question: *How can teachers improve in their support of ELL students' academic language acquisition in biology?* The two questions help direct the inquiry upon which this study is based.

Definition of Terms

The following definitions are provided to help contextualize the language used in my study while also providing a common language to promote a deeper understanding of the topic presented. The identifying terms for this population have evolved over the years, but for the purpose of this research, the terms below will be used throughout the study.

English Language Learner (ELL) - An English Language Learner is a student whose first language is not English and who has not acquired complete language proficiency.

English for Speakers of Other Languages (ESOL) - The type of class students attend or get support from when English is not their first language, yet they are attending American schools with English instruction.

Limited English Proficient (LEP) - A student categorized as Limited English Proficient is someone who lives in the United States but is not fluent in the English language. Many of the standardized assessments that students take in schools use this term as a subgroup when reporting scores.

Language Acquisition - The ability to acquire the constructs of a language to produce and understand as a means of communication with others.

Basic Interpersonal Communicative Skills (BICS) - the language necessary for conversational skills and day-to day communication with individuals at school and in the community (Cummins, 1979).

Cognitive Academic Language Proficiency (CALP) - the language necessary for proficiency with academic language or any language used in an academic setting related to content of material (Cummins, 1979).

End of Course (EOC) - a standardized assessment in the state of South Carolina that high school students take in the areas of English 2, Biology 1, US History, and Algebra 1.

"Does Not Meet Expectations" - The South Carolina standardized assessment that all 3rd through 8th grade students take for ELA and math place students into four performance levels based on their scores on the exam. The "Does Not Meet Expectations" performance level means that based on grade level standards, a student "needs substantial academic support to be prepared for the next grade level and to be on track for college and career readiness" (SCDE, 2022)

"Meets Expectations" - The South Carolina standardized assessment that all 3rd through 8th grade students take for ELA and math place students into four performance levels based on their scores on the exam. The "Meets Expectations" performance level means that based on grade level standards, a student "meets expected standards and is prepared for the next grade level and to be on track for college and career readiness" (SCDE, 2022).

Common Core State Standards (CCSS) - The standards "provide a consistent framework to prepare students for success in college or the 21st century workplace. They also represent a logical next step from the current South Carolina Academic Standards (SCDE, 2012).

Review of the Literature

Population Data for ELLs

National Data

The number of ELLs in US schools has grown over 50% during the last 10 years, and it continues to show steady growth (Dussling, 2020; Irvin et al., 2021; Snyder et al., 2017) Traditionally thought of as recent immigrants to a country, data suggests that the majority of ELLs in the United States are Spanish-speaking, US-born children, who have been in schools in the US since kindergarten (Kieffer & Vukovic, 2012). During the 2017-2018 school year specifically, the enrollment of ELLs grew to over five million students in grades K-12 in United States schools (OELA, 2021), which showed an increase in population of more than 50% over the past decade (Counts et al., 2018). Students who have attended United States schools for more than six years without reaching full language proficiency are classified as Long-term ELLs (Syrja, 2011). DeCapua (2020) added that approximately 57% of adolescent ELLs (ages 10 to 18) born in the United States continue to struggle with second language acquisition and achievement in American schools through middle and high school. Even with attending American schools for this period, this particular sub-section of the ELL population has an increased risk of potential special education placement and academic failure (Menken et al., 2007; Olsen, 2014) due to achieving low scores on state standardized tests (Syrja, 2011). The

students often remain at a level three (speech emergence) in language acquisition for the duration of their time in public schools as well (Syrja, 2011).

Adolescent ELLs pose a risk for reading failure because they exhibit limited English vocabulary, hindering comprehension, especially when reading academic words found in texts written for secondary students (Carlo et al. 2004). The rapid growth of the demographic and the underperformance of ELLs academically places considerable pressure on classroom teachers as they experience limited resources for their classrooms that support the continual needs of the growing population (Herrera, 2018), little to no support from others in the building (Moser et al., 2018) and insufficient foundational knowledge in working to meet the diverse needs of these learners (Cole et al., 2017; Trahehy & Spada, 2020; Villegas, 2018; Deng et al., 2021).

State Data

The state of South Carolina during the period between 2000 and 2010 experienced the most rapid growth in America amongst the Hispanic/Latino population (147.9% growth in population). This growth continued long after 2010. According to data from the South Carolina State Department of Education (2016-2020), there were 766,819 students enrolled in public schools for the 2020-2021 year with the Hispanic/Latino population comprising 11.38% of that total population. Also, during this period, the state of South Carolina experienced the 7th highest percentage increase in English Learner student population across the country (OELA, 2021). Furthermore, out of the 43 states with an increase in ELL population, South Carolina recorded a 765.1% increase in population between the school years of 2016-2017 and 2000-2001 (OELA, 2020).

According to Quintero and Hansen (2017), 55% of all public-school teachers teach ELL students in their classrooms, while only one-third have the requisite training necessary to support

ELLs. The Education Committee of the States (2020) revealed in 2014 that over 30 states do not require any ELL training for core subject area teachers beyond that mandated by federal law. In South Carolina, there are no English language training or on-going professional development requirements for general education teachers specified in the state statutes or regulations (Education Committee of the States, 2020). However, research supports the idea that teachers skilled and equipped to work with ELL students can effectively enhance the ELL students' development (Quintero & Hansen, 2017).

Local Data

This research study took place in a comprehensive, public high school in South Carolina. Bluff Falls School District (pseudonym), which is in a suburban area in central South Carolina is often referred to as the "Midlands." This district has become the largest of the districts located within the same county. As of January 2022, the student population in the district consisted of over 20,000 students from pre-kindergarten through 12th grade in over 30 schools. Over the past 10 years, Bluff Falls School District has grown by an average of 457 students per year. Bluff Falls serves 5 high schools with varying levels of enrollment and diversity among the student populations. The demographics of Bluff Falls School District consists of 68.4% White, 13.2% Black, 9.6%, Hispanic, and 3.2% Asian. Interestingly, 9.6% of all enrollees in the district are ELLs representing 44 spoken languages as of January 2022.

Green Valley High School (GVHS) (also a pseudonym), located within Bluff Falls School District, became the second largest high school in the district during the 2021-2022 school year. Families zoned for Green Valley High School socioeconomically range from low income to upper class. The demographics of Green Valley High School consists of 70% White, 10.8%

Black, and 7.2% Hispanic, and 7.1% Asian. ELLs comprise 10.4% of the student body at GVHS. There are 22 reported languages spoken at GVHS for the 2021-2022 school year.

National Data on Assessments for ELLs

Difficulties regarding the educating of ELLs extend from kindergarten through high school. While the issues may look slightly different depending on the grade level, one thing remains the same, ELLs tend not to perform as well as their native peers on a consistent basis in the classroom or on standardized tests. All public-school students in the United States take the National Assessment of Educational Progress (NAEP) at some time during their school careers in either the 4th, 8th, or 12th grades. This assessment reveals a score based on a student's grade level and measures what skills students should have mastered at that point in their career.

National statistics from the administration of this assessment indicate that ELLs in 4th, 8th, and 12th grades continue to score well below non-ELLs regarding reading skills. Appendix A provides an overview of national average reading scores achieved by ELLs and non-ELLs at the 4th, 8th, and 12th grade levels. While there was an increase from a below basic level to a level between basic and proficient in the 8th grade for the population, there remains a 35-to-43-point difference in the scores between ELLs and non-ELLs. Essentially, little to no change has occurred in performance for reading scores for 8th-grade ELLs on the NAEP over the past 10 years (OELA, 2018). The most recent NAEP scores also reveal that ELLs are scoring significantly lower (32-point difference in 4th grade and 39 point difference for 8th grade) than their non-ELL peers at 4th and 8th grades; however, their scores are the same as they were in 2019 for both subgroups (NCES, 2022). Even within a 3-year span of these assessment scores, ELLs continue to score significantly lower than their native speaking peers.

State Data on Assessments for ELLs

In South Carolina, when discussing standardized assessments, the state refers to ELLs as Limited English Proficient (LEP) students. South Carolina standardized testing results reveal that as low as 30.9% of 4th grade LEP students and as high as 38.6% of 8th grade LEP students fall into the "Does Not Meet Expectations" category (SCDE, 2017-2018), whereas half of the white students assessed scored in the "Meets Expectations" category. It should also be noted that LEP students in grades 3rd, 5th, 6th and 7th scored within the 30% range for standardized testing (SCDE, 2017-2018). It is clear that "race is still a salient issue in society and education that must be addressed if we are to have a fighting chance at educational equity, justice, and diversity" (Milner, 2020, p. 167).

While discrepancies between ELLs and their native speaking peers exist in all aspects of standardized testing, for the purposes of this study, a close examination of Biology I End of Course (EOC) assessment in the state of South Carolina was reviewed. The data in Appendix B reveals that LEP students continue to fail the EOC exam at a rate significantly higher than the non-LEP population in public schools. The school years between 2014-2015 and 2018-2019 are being used to identify a trend in data patterns over a 5-year span prior to the school year when the COVID-19 pandemic occurred (2019-2020). Between the years of 2014-2015 and 2017-2018, a 14% difference existed between the LEP and non-LEP populations scoring in the failing range whereas 35% or higher of the LEP students scored in the failing range on the EOC exam. The gap closed slightly during the 2018-2019 school year with only a 7% difference in scores within the failing range.

Standardized assessment (EOC) data was limited for the 2019-2020 school year, as many schools in the state did not participate in the EOC exams due to the COVID-19 pandemic and

closure of schools. The following school year, 2020-2021, provided test results as the SC State Department of Education allowed students to opt-out of taking the exams due to the continuing COVID-19 pandemic. Some students did participate in the exam, but their scores did not factor into their final grades, therefore, some students did not take the exam seriously (see Appendix C). [1]

Local Data on Assessments for ELLs

In further review, data from Green Valley High School revealed similar patterns to the national and state data where the LEP population performs poorly on the state EOC exam at a higher percentage than the non-LEP students (Appendix D). Between the years of 2016 and 2019, Bluff Falls School District experienced between 13% and 31% of the LEP students failing the biology 1 state EOC exam. The percentages have fluctuated over the course of the five years noted, but the numbers have not decreased significantly for any year. Some inconsistencies in test data for the 2015-2016 and 2016-2017 school years for GVHS exists as the test scores do not reflect the number of students enrolled in ESOL classes for those years. Even though the ELL population has increased over the past five years, fluctuations of scores remain for Biology 1 EOCs with as few as 10% failing the exam in 2017 and as high as 31.4% failing the exam in 2019. This fluctuation of failing rates and the percentages at which these students are failing this exam worries educators.

Students at GVHS did not participate in the EOC exams during the 2019-2020 school year due to the COVID-19 pandemic; therefore, data for that school year does not exist. As mentioned previously, the following school year, 2020-2021, produced test results as the SC State Department of Education allowed students to opt-out of taking the exams due to the COVID-19

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[1] Limited English Proficient (LEP) is language specific to the demographics for standardized testing according to the South Carolina State Department of Education.

pandemic and some other students did not take it seriously (see Appendix C). With data from the national, state, and local areas proving that ELLs perform below their native peers on standardized assessments, educators need to determine the best ways to meet their needs daily at school.

Theoretical Framework

The theoretical framework for this study is based on Cummins' (1979; 1985; 2016) research on Second Language Acquisition and Krashen's (1982; 1994; 2015) focus on Second Language Acquisition Theory.

Figure 1

Conceptual Map
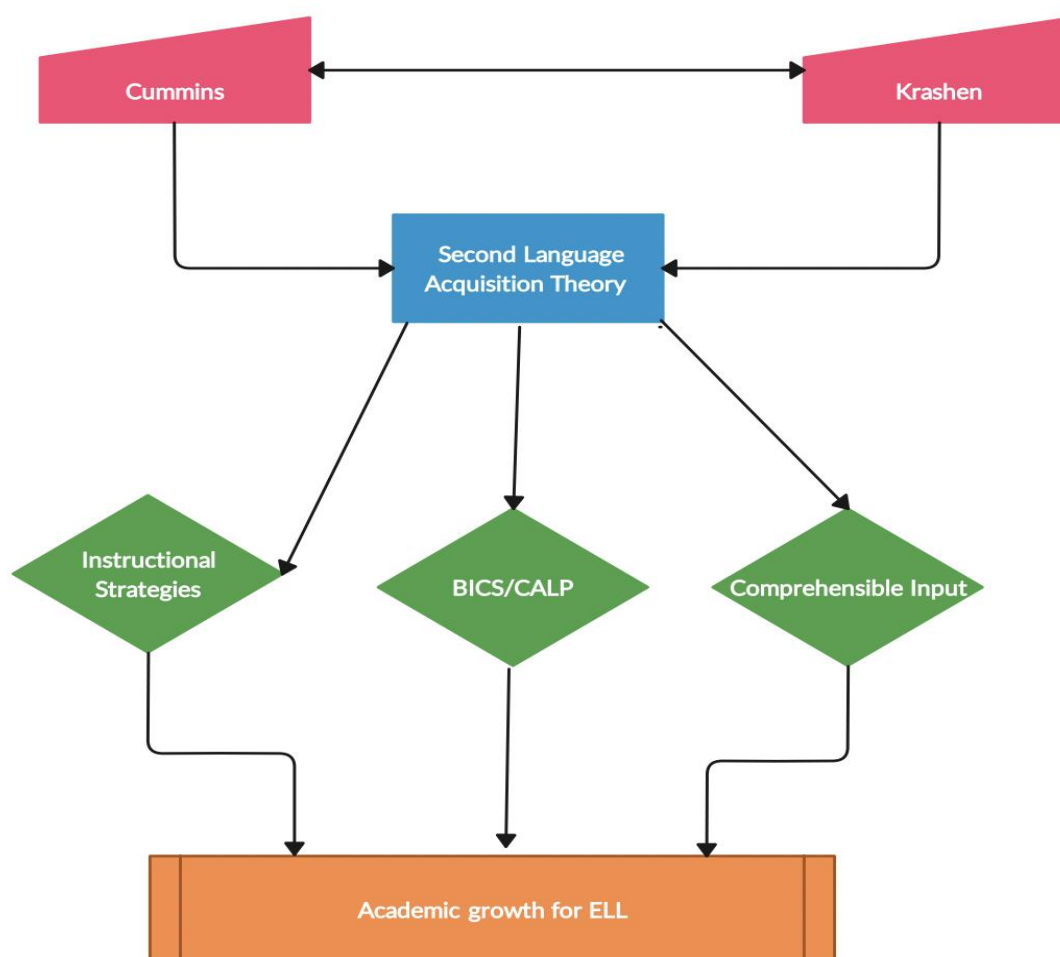
Cummins' Second Language Acquisition Theory

While researchers continue to discuss the process of ELLs acquiring a second language when moving into a new country, the research on language acquisition itself is not new. James Cummins, the founding father of Second Language Acquisition Theory, discussed how language develops in English Language Learners by clarifying the difference between acquiring basic interpersonal communicative skills (BICS) and cognitive academic language proficiency (CALP) (Cummins, 1979). Cummins suggests that it takes approximately two years to acquire age-appropriate conversational fluency (BICS) when students enter the United States and approximately five to seven years to achieve academic English that can be successfully utilized in American classrooms (Cummins, 2016). However, ELLs typically develop English language fluency on a conversational level after being exposed to the language consistently for several years.

Zwiers (2008) explains this with a simple example of "a conversation with a friend about a recent sports event would involve much social language, whereas listening to a lecture on globalization would be more academic" (p. 20). According to Cummins (2016), if a student has proficiency in Spanish as their first language, then attempting to learn English as a second language should become more manageable for them as the emergent language skills have developed. In addition to learning the second language for communication purposes, ELLs also learn academic content in English, which presents daily challenges until proficiency is achieved (Haager & Osipova, 2017). Cummins (1985) further explains that frequently the poor academic performance of these students is no longer presented as linguistic, cultural, or socioeconomic status differences, but, rather, as cognitive, learning, or cultural deficiencies.

Krashen's Theory of Second Language Acquisition

Stephen Krashen, known for his work as a psycholinguist, indicated that a second language can be obtained just like a first language with environmental support (Febriani et al., 2021). The interactions between students and other individuals surrounding them can only enhance the process of learning a language. Students should attain language proficiency at least on a conversational level first in this way. Krashen developed five hypotheses in his Theory of Second Language Acquisition to explain how ELLs need meaningful interactions within the second language while receiving formal instruction in the native language. This will better aid the students in acquiring the new language just as they acquired their native language (Raju & Joshith, 2018; Hill & Flynn, 2007). Formal instruction and understanding the basic rules of the language increases the acquisition of the second language as an individual learns the language itself (Krashen, 1982).

Krashen's theory stresses that the idea of obtaining comprehensible input for ELLs exceeds in importance that of learning grammatical rules of the second language for understanding (Krashen, 1982; Raju & Joshith, 2018). Raju & Joshith (2018) wrote "meaningful output is only possible when we get valuable input," (p. 180). One of the most effective ways for one to acquire a language lies within comprehensible input. Comprehensible input uses a variety of tools such as exposure to books, watching videos, having conversations with native speakers, and listening to individuals converse in the second language. ELLs need a wide variety of language inputs for better acquisition of the second language (Raju & Joshith, 2018). Acquisition will occur when a supportive classroom environment exists without a student's fear and anxiety of being in a classroom and not understanding the native language. Krashen (1994) indicates that when students feel a high level of anxiety, lack motivation, or lack self-confidence, their ability to

acquire the second language decreases. He further recommends not to push the ELLs until their anxiety to perform in a classroom setting decreases otherwise their comprehensible input to their brain for acquisition may not occur (Krashen, 1982).

More recently, Krashen (2015) offered a new theory related to second language acquisition. Within this new theory, Krashen indicated that second language acquisition is acquired when language learners are engaged in the learning process. He further described that academic vocabulary is an important variable when individuals are learning a new language. Learning vocabulary with specific strategies proves to be the most effective for ELLs as they begin to develop their academic vocabulary skills. In many general education classrooms, teachers struggle to provide appropriate literacy instruction in the content only classrooms. As a result, students do not always provide the strategies necessary for comprehensible input for them to learn the English language while also acquiring academic skills.

Legal Mandates and State Policy

No Child Left Behind (NCLB)

The No Child Left Behind Act of 2001 (NCLB), existing from the period of 2002-2015 focused on K-12th grade public school education in the United States. Two specific pieces of the Elementary and Secondary Education Act (ESEA) relative to this study were the Equal Educational Opportunities Act (EEOA) and the Bilingual Education Act. These acts specified that school districts had to overcome language barriers from English language students for them to participate equitably in instructional programs in the school setting (Miller & Katsiyannis, 2014). It also required schools to provide services for ELLs, so they attain language and academic proficiency (OESE, 2020). However, each state had discretion in determining how to provide these services (Batalova et al., 2007). Prior to NCLB being instituted in American

schools, little to no focus on the progress of disadvantaged students existed, just a focus on the majority of students. So, the goal of NCLB became more of a focus on students of poverty, students of color, students with special needs or disabilities, and those students who speak and understand limited to no English (NCLB, 2001). This act held schools more accountable for the success of the disadvantaged populations related to how they learn and achieve in American schools. Consequently, NCLB, forced schools to focus on ALL students in American public schools.

The NCLB Act of 2001 included provisions through Title 3 on how to address the ELL population within our schools to ensure that they attain language proficiency and achieve academic standards successfully in the American school system. However, due to the pressures that NCLB places on schools for ELLs to rapidly become English proficient, these students receive instruction in mainstream classes possibly before they are ready due to not first learning the English language (Syrja, 2011). This has become an increasing concern as students enter middle and high schools where the cognitive demands for academic skills are much greater, but also where their language acquisition skills are not strong.

NCLB monitored and oversaw the ELL programs and outcomes related to the academic progress of various subgroups in the United States. When the Every Student Succeeds Act (ESSA) was initiated, the responsibilities moved from a federal level to a state and local level for implementation and monitoring of all subgroups (Callahan et al., 2022). These subgroups were counted for accountability measures for school districts. In 2015, Every Student Succeeds Act (ESSA) forced schools to look at ELLs as a subgroup for the development of their English language vocabulary and skills in mastering the curriculums. (US Department of Education, 2015).

Profile of the South Carolina Graduate

In the state of South Carolina, a framework exists called the Profile of the South Carolina graduate. The framework's intent is for every high school student to achieve academically so they are career and college ready upon graduation.

Emanating from the South Carolina K-12 Technology Initiative, the Profile of the South Carolina Graduate identifies three sets of attributes that seek to align the state's educational system with attributes that have been identified by employers and business leaders as being critical to the future success of the state's workforce. This framework should produce graduates from high schools with the necessary skills for career readiness and competitiveness in the workplace. However, these attributes include rigorous standards in reading and math for college and career readiness as well as critical thinking and problem-solving skills and life characteristics such as self-direction and work ethic (SC Schools K-12 Technology Initiative, 2022). The Profile for the South Carolina Graduate requires certain courses paired with specific scores on the ACT or SAT and a certain level of grade point average for complete success. This requirement presents extreme difficulty for ELLs to achieve as they are acquiring language proficiency in a second language while being expected to master academic content in classes to earn a high school diploma. While national and some state agencies have determined policies and procedures for ELL education, the challenges they experience continue to exacerbate their ability to achieve academically.

Challenges for High Schools Working with ELLs

Entering high school, Jose was performing several years below his grade level peers in all content areas. His cousins were constantly ridiculing Jose because he wanted to learn

English and become successful. He was encouraged to quit school and work to support the

family.

A growing number of ELLs entering American schools experience linguistic, cultural, and cognitive shift challenges that can be difficult and can cause further concern for the population (Prince, 2017). Research indicates that ELLs in secondary schools have an increased dropout rate "not only because they are learning English, but also because they are significantly more likely than the general population to be disadvantaged, poor, and born to immigrant parents, each a status group at heightened risk of dropping out" (Rodriguez et al., 2020, p. 4). While graduation rates have increased by 11% between 2010 and 2018, the graduation rate remains short of that for the rest of the student population (OELA, 2018). Recent data shows that only 66.9% of English learners graduate high school in the United States, an average of 20% below the rate at which the rest of the student population in America graduates high school (OELA, 2018). To increase the concerns, it is noted that English learners graduate from high school at far lower rates than do their native English-speaking peers. ELLs that do not speak English in their homes are 31% more likely to not complete high school in comparison to 10% of students who speak English in their homes (NCES, 2000). Further, Doll et al. (2013) and Rodriguez et al. (2020) both indicate that in addition to linguistic and academic difficulties, the characteristics of the school environment as well as the student's background, socioeconomic factors, and the limited access to social, political, and economic power and resources all have a tremendous impact on the academic success of ELLs.

Research also shows that many adolescent ELL, especially those who are foreign-born and enter United States schools in the later grades, experience greater difficulty than their younger peers due to fewer resources. In addition, ELLs who enter school in later grades have a shorter

amount of time to ensure that they learn English and master academic content to meet graduation requirements (Ross & Ziemke, 2016; Capps et al, 2005). Ross and Ziemke (2016) indicate that if these students have critical literacy gaps in their primary language, then they can become quickly discouraged at the secondary level. The cost of students dropping out has an impact not only on student and family life, but also on the community and society. Students who drop out of school often do not acquire the skills needed to succeed in a global economy.

While students learn formal academic language in school, other factors may enhance their difficulties in the classroom setting (Harry & Klingner, 2006). All these components should be taken into consideration when working with students every day. It becomes imperative and necessary for "the identification of validated intervention practices for ELLs and other students from culturally and linguistically diverse backgrounds" (Linan-Thompson et al., 2006, p. 396). The ELL population is increasing every year and yet, they continue to struggle and perform well below their native peers.

English Language Learners and the Challenge of Language Acquisition

ELLs who display strong linguistic skills in their native language may often acquire English successfully, as having developed linguistic skills provides a basic structure of language, which in turn should help develop an understanding of a new language (Miller et al., 2017). Since ELLs differ in terms of language proficiency, socioeconomic background, ethnicity, prior instruction (Klingner et al., 2006), culture, and language support systems (Solari et al., 2012), we must determine why they struggle to develop language fluency and reading skills in a second language. While English learners may demonstrate good conversational skills, they can often lack the academic vocabulary necessary for success in content area instruction, especially at the secondary level. Oftentimes, when English learners begin to sound fluent, can understand their

teacher's questions, converse with peers in English, and translate for their parents, it can be falsely assumed that they can perform academically, but their daily schoolwork may not reflect this type of fluency (Francis et al., 2006; Hill & Flynn, 2007).

Language learners must first learn situational use of English and how to follow the rules for conversations. Couple these demands with the language demands of school, especially with the Common Core State Standards (CCSS), and it becomes apparent how stressful it can be to learn a new language at the same time and learn challenging academic content at the same time (Vogt, 2020). According to Krashen, "the learner's emotional state or attitudes are part of an adjustable screen that allows or impedes input necessary to acquire language" (Syrja, 2011, p. 74). Those educators that supply comprehensible input in low anxiety situations allow for students to acquire language when they are ready as they remain engaged in learning.

An even bigger hurdle for ELLs who enter the American educational system in later grades involves literacy development. Not only do these students have to master complex course content, usually with little context or understanding of the way that American schools are structured and operated, but they also have fewer years to master the English language. In addition, they often enroll in school at an age beyond when literacy instruction typically occurs, or they exhibit below grade-level literacy in their native language.

Therefore, the most difficult challenge for ELLs involves learning English while mastering standards within each content area requiring them to "double the work" as they obtain oral proficiency and academic content knowledge simultaneously (Short & Fitzsimmons, 2007). This has become an obstacle for ELLs as they come to the United States during their middle and high school years with seven or fewer years to complete all the requirements for a high school diploma. For English learners to make appropriate academic and language acquisition gains,

teachers should provide appropriately leveled instruction and assessments in their content areas (Syrja, 2011).

Strategies to Support ELLs

Teaching from a culturally responsive perspective can support language development while building vocabulary, building background knowledge, and allowing multiple opportunities for practice. These strategies alone will help foster a positive environment within content area classes (Miller, 2016). In addition, teachers should provide a language-rich environment where ELLs can express their understanding of content verbally and by display. Academic instruction can also help advance students' language development and teachers can determine what extra resources or help are needed for their students to become proficient with the state standards. While these strategies are sound examples of pedagogy, barriers continue to exist.

While most mainstream teachers in middle and high schools may want to feel effective in teaching their English learners, but a lack of structures and support within the school systems hinders teachers in this endeavor. The expectations for teachers to "move mountains" related to educational outcomes with ELLs cannot be achieved without appropriate supports (Calderon et al., 2011). As the number of English learners increases in our middle and high schools, more and more of our teachers seek the support that will aid them in teaching the population effectively (Calderon et al., 2011).

Many educators are unprepared to provide appropriate instruction to ELLs (Jackson & Durham, 2016). Teachers must apply what they learn about second language acquisition and educational best practices for implementing high-impact strategies in the classroom. Benefitting from specific instructional strategies will help English learners access the course content to help improve their outcomes for success (Hovey et al., 2019). ELLs deserve to receive the same high

quality, systematic, intensive, and differentiated instruction for their individual needs just like their English-only peers receive (Snow, 2006). Vocabulary instruction for ELLs requires long-term, comprehensive, and explicitly taught instruction during all content- area lessons. When teachers provide rich and varied language experiences in their classrooms, teach with literacy learning strategies, and foster the importance of learning as many words as possible, ELLs benefit greatly (Calderon et al., 2011).

Direct and Explicit Instruction

Shanahan & Beck (2006) explain that ELLs benefit from both direct instruction and strategy instruction, especially when both practices are combined in the classroom to increase student's English language skills. When presented with quality instruction, many ELLs find success in gaining literacy skills at the same levels as their English-only peers (Lesaux & Geva, 2006). In addition, when implementing effective instructional practices used in all classrooms with ELLs, their literacy skills increase which can, in turn, reduce the risk for reading difficulties as content material becomes increasingly difficult at the high school level (Snow, 2006). Hovey et al. (2019) further indicates that an evidence-based practice such as explicit instruction using modeling, guided practice, peer practice, and individual practice help ELLs to practice skills for independent use as steppingstones.

Comprehensible Input

The use of comprehensible input to better understand what someone says or what someone presents to them in classrooms proves key in ELLs' learning. Various teaching aids of comprehensible input can be used in the form of visuals, pre-teaching of vocabulary, speaking at a natural pace and enunciating clearly, cooperative learning groups, activating a student's prior knowledge of the material, graphic organizers, use of gestures, and using partnered activities

such as think-pair-share (Weisner-Groff, 2021). This way students can see what the language means through a picture or motions. Also, being able to write key words or using a flip chart for vocabulary and graphics while discussing the content can enhance meaningful language development and comprehension among ELLs (Gersten & Baker, 2000; Hovey et al. 2019). In addition, using technology will help ELLs engage more in the learning process as well as help them communicate during classroom activities (Prince, 2017) as technology has become an additional source for instruction.

Oftentimes core subject area teachers who teach ELLs are challenged due to teaching grade-specific standards and curricula to students who display varying language proficiency abilities (Uribe, 2019). Therefore, when teaching ELLs as they develop academic language proficiency, it is necessary to provide instructional strategies that include essential reading, academic vocabulary, and language skills across all content areas (Turkan & de Jong, 2018; Uribe 2019).

Academic Vocabulary Strategies

To be successful in language learning, ELLs must develop a strong academic vocabulary foundation. Since ELLs are challenged with the daunting task of learning a second language, building an academic vocabulary foundation for the language, and striving to meet grade level expectations at the same time (Gibson, 2016), their success mostly depends on their ability to acquire content-area academic vocabulary to experience academic success (Brandes & McMaster, 2017). Emphasizing instructional strategies by targeting academic vocabulary concepts specifically for this population of students will support their ability to make connections with text (Ardasheva & Tretter, 2012) which in turn should lead to better

understanding of academic content. It is imperative that ELLs can understand academic

vocabulary to access the content area curriculum being taught (Crosson & Moore, 2017).

Effective academic vocabulary interventions begin by situating word learning within the

context in which the words are used, often by reading an engaging text or series of texts on a

topic and by providing oral and written language activities (Kelley et al, 2010; Fang &

Schleppegrell, 2010 as cited in Galloway & Lesaux 2015). Using real objects, pictures, and

photographs that match with unfamiliar words can also provide visuals that help ELLs make

sense of the new words, e.g., photographs of frogs and salamanders to illustrate "amphibians"

(Sibold, 2011). When teaching vocabulary words to students, research also suggests that

focusing on a small number of words will best serve ELLs and their peers in understanding the

meanings (Galloway & Lesaux, 2015). For instance, focusing on seven-ten words as part of a

weeklong instructional cycle is not uncommon in successful interventions (Stahl & Nagy, 2006;

Graves 2006 as cited in Galloway & Lesaux 2015).

Graphic Organizers

It is important to explicitly teach vocabulary using effective strategies that will engage

students in wanting to learn new words. Strategies that allow students to understand critical

words in the content area include the use of academic vocabulary journals, academic vocabulary

charts and graphic organizers such as Frayer's Model. Graphic organizers can appear as charts,

word webs, vocabulary quilts, and graphs (Bolos, 2012). Graphic organizers allow students to

see information presented in a way that reduces the language needed to understand the content.

The use of visual tools helps ELLs visually make a connection to understand the content; thus,

helping to store the necessary information from the lessons. The graphic organizers help clarify

the meaning of vocabulary words that students encounter as they read, listen, and view texts

(Winters, 2009). Graphic organizers can be used throughout units of study to cumulatively prepare students for a final exam on an elementary and secondary level. Graphic organizers also offer a visual support for students to use to connect concepts and words to draw meaning from to enhance their understanding.

Theoretically, once a student's language is identified, their targeted vocabulary should be assessed. Measuring students' ability to identify words and their meanings is critical to learning content and must drive instruction in the classroom (Grillo & Dieker, 2013). The use of vocabulary notebooks or word walls provides students an opportunity to put key vocabulary words into their memory storage for content-language recall. This allows students to be fully engaged in learning biology content at a deeper level, beyond surface-level factual knowledge (Grillo & Dieker, 2013). A study completed by Grillo & Dieker (2013) indicated that learning was positively affected by spending only five minutes daily with vocabulary terms on flashcards. This type of intervention at the high school level needs to be easily managed for both the teacher and the student (Grillo & Dieker, 2013).

Interactive Word Walls

A traditional word wall is another visual tool used to help students' reference commonly used academic vocabulary in content classrooms (Jackson et al., 2017; Jackson & Narvaez, 2013). Word walls can utilize images (e.g., photographs and drawings) as visual cues and can also use real items for display (Jackson et al., 2017; Jackson & Narvaez, 2013). Another type of word wall referenced through literature as an effective strategy for increasing content vocabulary is known as an interactive word wall (Vintinner et al., 2015). Interactive word walls provide an environment where the use of visuals and cooperative learning result in benefits for all learners as it helps to increase their understanding and application of vocabulary in the classroom setting

(Vintinner et al., 2015; Zarifi & Taghavi, 2016). Learning and mastering academic vocabulary is crucial for all learners, but especially ELLs' success in the classroom at the secondary level. The complicated academic vocabulary that is presented in biology classrooms presents considerable challenges for ELLs attempting to learn the science content (Shanahan & Beck, 2006; Snow et al., 2009).

According to research by Jackson and Ash (2012), when interactive word walls were used in an authentic, engaging manner there was an increase in high stakes test scores for all students, including ELL students. Harmon et al. (2009) found similar results using a word wall where students demonstrated understanding of the meanings of the vocabulary words and their ability to apply them when writing. An important role in creating interactive word walls is allowing the students to participate in its construction. Jackson et al (2017) explained,

> "Interactive word walls are planned by teachers but constructed by students. As students create interactive word walls, the process enables them to build on prior knowledge, have multiple encounters with new academic vocabulary, and connect learning to inquiry activities in the real world (p. 72)."

Students can be very creative in their development of the word walls in the way they group vocabulary words in units or by relationships that make sense to the students based on the content specific units being taught. Word walls should continue to be utilized through repetition as the students encounter these words through labs and classroom activities as well as writing, speaking, discussing, and listening (Vintinner et al., 2015).

Aligning the Problem of Practice and Theory

Creating a solution to solve a problem requires significant thought and planning to

make sure all aspects of the issue are addressed. The problem presented for this study focuses on the idea that ELLs consistently score below their peers (non-ELLs) on classroom and standardized assessments. This concern, framed through the lens of Cummins' Second Language Acquisition theory connects the idea that it takes approximately five to seven years for ELLs to acquire academic English to prove successful in American classrooms. Krashen's Theory of Second Language Acquisition also supports this idea as ELLs need meaningful interactions with the second language in addition to using a variety of tools for comprehensible input that will aid them in acquiring the language. To effectively address this problem, a solution must be created that focuses on implementing appropriate literacy strategies within content-specific classrooms while teaching ELLs.

The study addresses the problem of practice by providing general education biology teachers strategies for teaching ELLs. To determine the appropriate strategies for implementation, I used the Theories of Second Language Acquisition as a guiding principle. These two strategies intended to meet the educational needs of ELLs more effectively by providing instruction at a level that was beneficial to the students' second language development. This study is also grounded in the application of Improvement Science. Improvement Science uses short cycles of intervention to test and modify strategies while analyzing data for improvement. Improvement Science is predicated upon the implementation of PDSA (plan, do, study, act) cycles which for this allow for general education teachers to implement teaching strategies for their ELL students and quickly determine whether those methods worked within their setting. Having a thorough understanding of how a student learns a second language can also be supported by the theory of second language acquisition (Krashen, 2015).

Krashen (2015) believed that students need repeated exposure to language that is both incidental and purposeful. With ELL students faced with learning new words constantly, they need to learn to use them appropriately (Krashen, 2015). Content academic vocabulary exposure with appropriate strategies will help them gain some word knowledge to use the words in different contexts. Without the appropriate supportive target instruction for English language students, gaps in content area academic vocabulary knowledge between ELLs and their peers will continue to widen (Richards-Tutor et al., 2016).

Summary

Implementing strategies into a general education classroom that align with culturally responsive teaching and literacy skills will help ELLs better obtain the specific content being taught at a secondary level. Implementing strategies that help ELLs acquire the second language alongside the academic content being presented has proven important in public schools.

A critical requirement in American schools today should address the academic needs of ELLs (Miller et al., 2017). As the number of ELLs increases in the United States, a great need exists for research to determine how to best meet their academic needs in the classroom across all grade levels. Teachers and school staff implement strategies within their classroom and school wide settings, but sometimes their confidence lacks in differentiating the instruction or implementing the strategies with fidelity. ELLs bring specific concerns to the classroom such as language proficiency levels, stability, maintenance of the student's native language, and whether the student had any educational experiences prior to entering American schools that will change over time (Syrja, 2011). School staff should intentionally implement strategies to fit the needs of ELLs. After all, mandates exist for schools to provide an appropriate education with equal opportunities for all students.

August et al. (2018) agreed that English learners at the secondary level need consistent academic vocabulary instructional support to access grade-level content and to promote academic vocabulary acquisition and reading comprehension skills. There is value in providing academic vocabulary instruction to develop foundational skills of reading, especially for ELLs in the middle grades (Crosson et al., 2019). Therefore, the purpose of this study was to explore the implementation of vocabulary strategies in biology classrooms to improve ELLs' content acquisition as the literature has presented a continual concern that ELLs are not achieving at the same rate as non-ELL peers.

In this chapter, I provided an overview of the issues and problems that ELLs face in obtaining an education in American schools and a thorough discussion from literature and research related to the mandates and policies, the pedagogy, the literacy struggles, and the language proficiency. This chapter also presents a theoretical framework that guides the research in determining ways to best meet the language and academic needs of the ELL population. In chapter two, I explain the process of how the research study was conducted. Specifically, the section has detailed identification of the research design and approach, description of participants and their relevance to the study, and an account of methods that were used to collect and analyze data.

Chapter 2

Methodology

In chapter 2, I introduce and explain the concept of improvement science, the rationale for the research site chosen, the student participants involved, the concept of positionality, and the professional development provided to the teachers participating. Within chapter 2, I also introduce the instruments used to gather data and provide an overview of the research design for this study.

Improvement Science Framework

Improvement science is a framework in which rapid, small tests of change are used to seek improvement in a system or improve practices within a system (Bryk et al., 2017). In education, most individuals are quick to pursue a reform agenda to solve problems; however, the use of rapid-fire interventions does not always work. Instead, implementing small cycles of interventions to measure the impact of change is a better way to improve the system or concerns within the system. Educators are better able to draw upon practical experiences with the tools they already must learn faster and better using improvement science methods (Bryk et al., 2017). Using small test cycles allows for individuals to learn fast in between intervention cycles what works and what may need to be modified as well as aids in implementing interventions well for the next small tests cycles.

Improvement research generally cycles through a process to answer three questions: What specifically are we trying to accomplish? What change might we introduce? and how will we know that a change is an improvement? (Bryk et al., 2017, p. 114). Through small tests of change, a good idea to solve a problem can turn into something that can be executed effectively.

For this study, I started with small, rapid tests of change seeking to improve the academic language proficiency skills of English Language Learners related to vocabulary in biology. These small tests were conducted within each cycle of intervention in this study. The Plan-Do-Study-Act (PDSA) cycle was embedded within the improvement science methodology and guided this rapid learning process.

In this study, I employed a Plan, Do, Study, Act (PDSA) methodology. The PDSA process is a highly applicable, flexible, and effective method for continual improvement in the educational system.

David Langford further describes each phase of the PDSA process through an educational lens (Langford, 2015 as cited in Ripperger, 2021):

> 1. Plan. Consider your initial opportunity for improvement or your problem. Study the surrounding details, likely causes, and collect data as needed.
>
> 2. Do. Develop a theory of improvement. Strategize about the best way to implement the theory and then do so. This is the change, and we're hoping it will lead to improvement.
>
> 3. Study. Look at the results of the change and determine if it worked to solve the problem or improve the situation.
>
> 4. Act. Make more improvements as needed. Decide how the new momentum can be maintained.

Research Site

Local Context

To further contextualize this study, the research took place in a comprehensive public high school in South Carolina. Bluff Falls School District (pseudonym), located in a suburban area in

central South Carolina, often referred to as the "Midlands," has become the largest of the five districts located within the same county. Green Valley High School (pseudonym) is comprised of over 2000 students with ELLs comprising 10.4% of the student body population. Students at GVHS are required to earn 24 credits to receive a state high school diploma. Within those 24 credits, students need seven elective credits. ELLs who participate in ESOL classes can earn one elective credit towards their high school diplomas for each year they are enrolled in the classes.

I used a qualitative research design to investigate the implementation of academic vocabulary strategies in a biology classroom to improve ELL's content acquisition and to determine how teachers can grow in their support of ELL students' academic language acquisition in biology.

Role of the Participants and Consultants

General education teacher participants

There were seven biology teachers at GVHS. Three of these teachers were recruited for this study as they taught biology classes consisting of 9th and 10th grade ELLs who are also enrolled in an ESOL class. They agreed to participate in this study to learn strategies for their classrooms to support their instruction of ELLs. The participants were both male and female teachers from diverse racial and ethnic backgrounds with differing years of teaching experience and different experiences working with ELLs. All individuals participated in this study on a voluntary basis. The participants/ names will not be used, but descriptors such as Teacher 1 will be used in the place of names.

Table 4

Teacher Participant Demographics and Experience

	Gender	Ethnicity	Teaching Experience (years)	Content	Experience with ELLs (years)
Teacher One	Male	White	6 years	Biology 1	6 years
Teacher Two	Male	White	.33 years	Biology 1	4 months
Teacher Three	Female	African American	11 years	Biology 1	11 years

Note. Teacher One is from Brazil but lists his ethnicity as White.

English Language Learner Participants

Student participants were recruited for this study based on their enrollment in a biology 1 class as well as their enrollment in an ESOL class. All students are in the 9th or 10th grades. When class rosters were received in August 2022, there were 14 students who met the requirement to participate in this study across three classrooms. Informed consent forms were translated into the student's native language by a district representative or Google translate so that their parents fully understood the research that took place prior to deciding whether their student would be a participant in the study. After emailing all parents in their native languages, seven of the parents and students agreed to participate in the study and returned signed consent forms. I fielded phone calls from two parents who wanted further information about the study but declined the offer to participate. I met with one parent in person who also declined participating in the study. The other four students who received an email did not respond to that form of

communication nor did they respond to a paper copy of the informed consent sent home via the student.

Table 5

Student Participant Demographics and Experience

Student Number	Gender	Grade	Place of Birth
Student One	Female	9th	Micronesia
Student Two	Female	9th	Honduras
Student Three	Male	9th	United States
Student Four	Male	10th	Venezuela
Student Five	Female	9th	Honduras
Student Six	Male	10th	Mexico
Student Seven	Male	9th	United States

- Student Three and Student Seven even were born in the US but continue to receive ESOL services due to their speech emergence remaining at a level two overall. Both students speak Spanish in their homes and in their communities except at school.

Overview of Professional Development

Professional development (PD) was conducted to help teachers better understand the ELL population and the implementation of interventions chosen, but the professional development was not used for data collection purposes. The initial PD session provided to the teachers included general information about ELLs as to how they develop language proficiency, how their services are determined at Green Valley High School, and to provide an understanding of the ELL needs in the general education classroom. The session gave teachers an initial introduction to the students in their classrooms. The PD sessions facilitated and created by two ESOL

teachers occurred during a common planning time prior to the beginning of the school year and lasted approximately 30-45 minutes. I provided further professional development sessions related to the vocabulary strategies selected for use throughout this study. Each PD session occurred prior to each cycle of intervention to discuss the strategies used and answer any questions related to the implementation. YouTube videos and other websites were used to explain the strategies and provide demonstrations for implementation in the class. The PD occurred during a common planning time for the teachers and lasted approximately 30-45 minutes per session.

Teacher participants implemented the vocabulary strategies in their biology classrooms learned from the PD sessions while teaching content to their students. The implementation of these strategies occurred during the first semester of the 2022-2023 school year with three cycles of implementation – one cycle per science unit taught. The strategies and instructional components used during this study helped to identify the strategy or combination of strategies that proved to be effective for ELLs in increasing their academic vocabulary proficiency in Biology.

Methods of Data Collection

Overview of documents

I created parental and student informed consent forms that were delivered via email initially and delivered through four students as well due to no response from the initial ask. I collected the parental and student consent forms allowing for student participation prior to the start of the study. These forms, printed in both English and the student's native language, ensured understanding of the study the students participated in. The student participants engaged

in focus group discussions once informed consent was received and participated in taking pre- and post-tests for academic vocabulary for each of the three science units taught.

Teacher informed consent forms were also created and provided to the participants prior to their volunteering for the study. This allowed for their participation in interviews pre- and post-study as well as agreeing to implement interventions in the classroom.

Interviews and Focus Group Discussions

Prior to the implementation of vocabulary strategies, I conducted teacher interviews recorded through an online platform as provided data through transcription and comparisons for commonalities or themes. I conducted the initial teacher interviews (Appendix J) consisting of open-ended questions related to the experiences of each teacher, inquiring about their general perceptions of teaching English Language Learners and questions related to their current instructional practices with ELLs within their classroom setting. Final interviews (Appendix K) were conducted with teachers after implementing all cycles of interventions. These interviews also consisted of open-ended questions for teachers to freely express their thoughts about the vocabulary interventions implemented and their impressions of ELLs' academic vocabulary acquisition as well as their performance on the biology unit assessments. Interviews lasted approximately 30-45 minutes per teacher and were transcribed upon completion.

Focus groups discussions occurred at the beginning (Appendix L) and the end (Appendix M) of the study with the ELL participants. The initial focus group discussions included general questions related to when the students moved to the United States, their American school experiences, their initial thoughts about taking a biology course, and how teachers can help them succeed in the classroom. The focus group discussions also occurred at the end of the study and included questions surrounding the ELLs experiences in Biology during the school year, their

thoughts about the specific interventions implemented, and what they found helpful in their learning vocabulary and understanding biology material this school year.

Focus groups provide perspectives of the learners to help identify which instructional approaches are supportive of their learning (Oliver & Azkarai, 2017). It was important to collect this information as the data from both teachers and students provides "multiple realities, or interpretations" (Thompson, 2019, p. 22) of best practices for teaching ELLs. This in turn should bridge the cultural gap that may exist between ELLs and their teachers (Shim & Shur, 2018).

Classroom Observations

I conducted observations on the three Biology teachers at Green Valley High School for approximately 50 minutes each - the length of one class period. These observations occurred every other week during each intervention cycle which lasted approximately four weeks. Therefore, each teacher was observed two times during each intervention cycle for a total of six observations per teacher for the entire study. The purpose of the observation was to ensure fidelity of interventions implemented and to note variance in teaching practices as interventions were implemented in the individual classrooms. The researcher utilized some of the aspects of the Sheltered Instruction Observation Protocol (SIOP) for each observation. The model consists of eight interrelated components offering teachers a well-thought-out model for planning instruction and implementing lessons. All content area teachers and all grade levels can utilize the SIOP model in classrooms (Echevarria et al., 2017). There are some aspects of the SIOP that were utilized for this study and those pieces were listed as Comprehensible Input and Practice and Application; therefore, I used a modified SIOP observation form which uses SIOP's foundational pieces but also added general observations related to fidelity which is needed for the accuracy of the observations for this study. The modified SIOP form was also scored using

"yes" and "no" for the areas in observation. For a teacher to score a "yes" to the statements on the form, the statements had to be observed for the majority of the class period, which equated to at least 30 minutes.

Research indicates that ELLs perform better in academic situations when the teacher gives clear instructions, when a teacher slows down their rate of speech, and when a teacher uses a variety of techniques for making content accessible (Echevarria et al., 2008). Therefore, the Comprehensible Input section from the modified SIOP form was used. The Practice and Application section provided observational data related to using hands-on materials and/or manipulatives for ELLs to practice new content as well as allow for practice applying their language knowledge of the content. Another area within the Practice and Application section sought to observe teachers providing activities that allow ELLs to integrate all language skills (Echevarria et al., 2008). The final section of the observation protocol included general observations that were related to the fidelity of teachers implementing the selected vocabulary intervention.

Pre-test and Post-test

Prior to the first unit of study in Biology, the ELL students completed a vocabulary pre-test of the words that they were exposed to during the first cycle of intervention. The students were provided a word bank to choose the word that matched the definitions for the vocabulary tests. Biology unit one had 13 words for matching responses. At the completion of the unit of study, the ELL students took a vocabulary post-test to determine if their academic vocabulary knowledge increased with the strategy implemented in the classroom during approximately four weeks of instruction. The post-test that the students completed was the exact same as the pre-test that they completed prior to the implementation of the intervention. The post-test also had a word

bank provided. There was a pre-test and post-test given to each student before and after the completion of each unit of study. For unit two there were nine words for fill-in-the-blank responses and biology unit three had 13 words for fill-in-the-blank responses. Again, both pre-test and post-test for units two and three provided students with a word bank. There were three units of study completed in the biology class for the purpose of this research.

Role of the Researcher

I am a school psychologist at Green Valley High School and the researcher for this study. As a psychologist, I have many different responsibilities with one of my primary roles to serve all students within my school who are struggling academically or behaviorally. I also conducted student observations and provided consultative services to aid teachers for students in the general education classroom. For this study, I am considered a full participant as described by Mertler (2016) as someone who is part of the community they are researching, not just an outsider, who also collects data on the group within the community. During this study, my primary role was to facilitate the collection of data from the teacher participants and ELL student participants as well as analyze the data collected for common themes and determine the effectiveness of strategies implemented.

Given my role as a school psychologist, I wanted the participants to understand my positioning as a full participant in this study. To help establish this position and strengthen the relationships I have with the teacher participants, I relied on my experiences working with teachers over the past three years in a consultative position. I relied on these relationships to show the participants that they could trust me as I worked alongside them throughout this study. It was also important that the ELL participants felt comfortable providing open and honest

feedback in the focus groups and in general conversations as I interacted with them throughout this study.

<div align="center">**Research Methods & Design**</div>

Within the context of this study by using the PDSA cycle and by using prescribed interventions in the general education biology classroom, I determined if strategies allowed ELLs to perform at a rate closer to (or exceeding) their native English peers on academic vocabulary formative assessments. As a result, this qualitative research study was guided by the following formal research question: *How can the implementation of vocabulary strategies in the biology general education classroom improve English Language Learners' content acquisition?* In answering this overarching research question of this study, a sub-question emerged leading the researcher to investigate a secondary research question: *How can teachers grow in their support of ELL students' academic language acquisition in biology?*

Plan

The PDSA cycle began with careful planning, including a detailed timeline and expectations for the intervention developed with stakeholders and participants involved. The stakeholders and participants included shared a similar goal and are staff members at GVHS. The stakeholders for this study included three biology teachers. English language students were also recruited for participation in the study and are considered stakeholders in this study. The timeline created by the stakeholders included meeting with teachers prior to the first week of the biology unit to be taught to introduce the strategy to be implemented and answer questions. The implementation of the strategy occurred over the next four weeks as the biology unit was taught. At the end of those four weeks, the post-test was administered to the student participants, and

data was analyzed to determine the next intervention cycle and strategies to be implemented. This same timeline was followed for all three cycles of intervention for this study.

In the "Plan" stage, I gathered materials for professional development sessions to include an understanding of the ELL population - how they develop language proficiency and their services at GVHS as well as the interventions that will be implemented in the classroom. Informed consent forms were developed during this stage written in English as well as the native language of the students and their parents for a complete understanding of the research.

During the planning phase, I also developed interview questions for sessions to be conducted with my participating biology teachers to learn about their teaching experiences, their perceptions of teaching ELLs, and their current instructional practices within ELLs in their classrooms. I also developed questions for use in focus group sessions with identified ELLs. An interpreter was utilized when necessary, during these sessions to obtain the students' perspective of American schools - when they moved to the United States, their thoughts about taking a biology class, and what they have found to help them achieve academically. Finally, I prepared an observational protocol using a modified form of the SIOP that were utilized during the data collection process to ensure teachers were implementing the intervention as designed for the biology classroom.

Research has indicated that ELLs need various things for their success in American schools. Some of the supports needed for these students include supportive environments, collaboration models on the high school level, sheltered instruction or adapted curriculum, intensive language, and literacy instruction (Robertson & Lafond, 2008). While all these supports are important for success, this study sought to illuminate one of the aspects which includes language acquisition and literacy skills. Research indicates that reading fluency,

vocabulary, and comprehension difficulties compound ELLs understanding at the high-school level by the great amount of reading material that students are expected to master across content areas (Hawkins et al., 2011). Therefore, the strategies developed during this plan phase targeted increasing vocabulary knowledge. After the act stage of the first cycle of intervention, I revisited the plan stage with the teacher participants to determine the next strategy for implementation as the teachers did not feel that the Academic Vocabulary Chart (AVC) alone was as effective as necessary for great improvement. The three cycles are represented below as they were discussed during the stages.

Flow Chart for Intervention Cycles 1-3
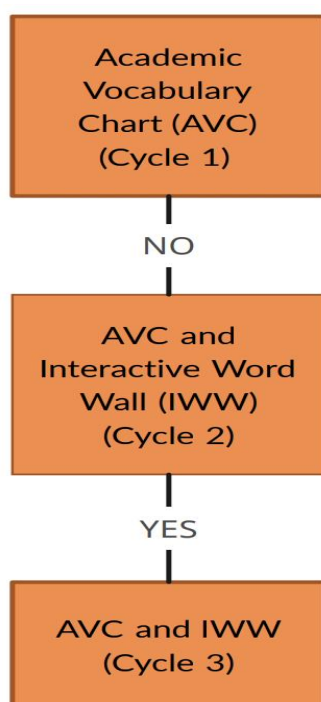
Do

The next stage of the PDSA model refers to the "Do" stage. During this cycle, professional development was the first action taken prior to the implementation of the strategy. I provided professional development sessions alongside the ESOL teachers at GVHS prior to

implementing an intervention related to using a graphic organizer called an Academic

Vocabulary Chart (AVC) during the first cycle of research. I also conducted classroom

observations utilizing a modified SIOP. The Comprehensible Input and the Practice and

Application sections were used from the SIOP along with general observational questions related

to fidelity in implementing an intervention. During this stage, I conducted semi-structured

interviews with teachers related to their experiences and instructional practices used in the

classroom and focus groups with ELLs to gather qualitative data related to their experiences in

American schools and what has helped them understand content in schools. Finally, within this

phase, the biology teachers implemented a vocabulary strategy in their classroom to help their

ELLs increase their academic language knowledge for each science unit taught. This cycle of

intervention occurred in a *four-week time frame* as the biology units were taught.

Flow Chart for Intervention Cycles 1-3
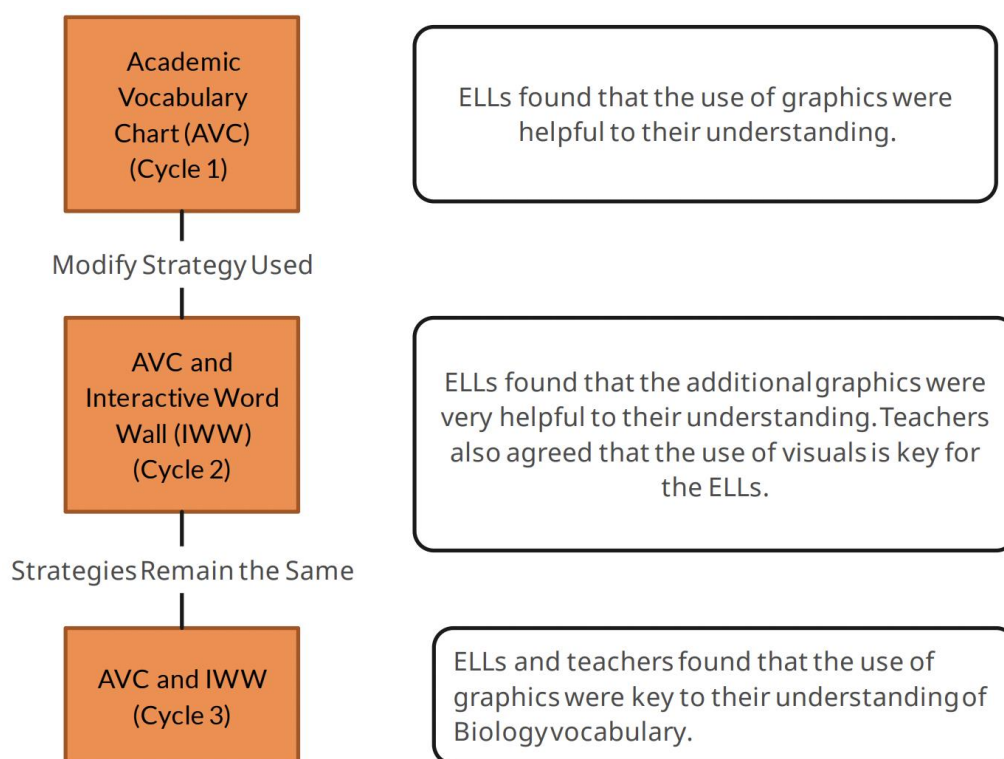
First Intervention Cycle

During the first cycle of intervention, teacher participants implemented a strategy within the biology classrooms related to teaching and learning vocabulary using graphic organizers. The graphic organizers chosen used for the study is known as an AVC. The AVC was implemented during the first cycle of intervention used for biology unit one. Completing an AVC targeting the most important vocabulary terms for the science unit was meant to help students "acquire a deeper meaning of the word," (Sibold, 2011). Prior to this intervention, a pre-test with the selected vocabulary terms was given to the students to assess their prior knowledge of the terms. After the pre-test, the teacher had their students work in groups to complete the AVC for each vocabulary term. The students used a variety of sources (e.g., the internet, textbook, a teacher, or a friend) to complete the charts. The groups shared their information with each other as they recorded the information on their charts so that at the end of the presentations the charts were filled out. The teacher ensured that the students' charts were completed by walking around the room to view them. The teacher referred to the AVC prior to each lesson emphasizing the words that were taught with that standard. The teachers also referred to the AVC multiple times during observations encouraging students to complete it as a reference for understanding the vocabulary terms. After the first biology unit was completed, the students took a post-test on vocabulary terms test to determine if there was an increase in scores from the pre-test and to help determine if the intervention proved effective for this part of the cycle.

Second Intervention Cycle

While students' post-test scores increased slightly, the biology teachers felt that the AVC alone was not going to show the necessary increase in academic vocabulary knowledge to be like non-ELL students. Therefore, during the second cycle of intervention, the teacher participants

implemented an additional intervention within their biology classrooms related to teaching and learning vocabulary, specifically using an interactive word wall. Both the AVC and Interactive Word Wall (IWW) were implemented simultaneously during the second cycle on intervention. Graves et al. (2014) indicated that effective vocabulary instruction includes "both a definition of a word and the word in context, provides multiple exposures to the word, involves students in discussion and active processing of the word's meaning, and helps them review the words in various contexts over time," (p. 335).

To complete an IWW, Jackson (2018) indicates there are three steps to follow. The first step involves planning where the teacher selects vocabulary that comes from the state's science standards taking a close look at words that may be familiar and words that may need more explanation for understanding. During this planning process, teachers determine if there are suffixes, affixes, or root words that need to be explained that can help students throughout the biology class as base words for knowledge. Teachers determined how to use the vocabulary during instruction in ways that truly teach the meanings of words with student-friendly definitions and demonstrations. Teachers also determined which categories or subcategories can be created through the vocabulary words so that the interactive word walls visually represented with connections and patterns for better understanding. Jackson (2018) indicated that teachers should build the word wall frame as a next step, in other words, find the place in the classroom where this can exist as an interactive word wall will be constructed over time as biology units are completed. Therefore, there needs to be enough room for the wall to exist. Finally, the interactive word wall is constructed by the students in the classroom.

The students in this study were placed into assigned groups so that the ELLs were in groups with native English speakers. The students worked as a team to develop their definitions and understanding of specific vocabulary words provided by the teacher. The students used a variety of tools and materials to construct the word walls at the beginning of the second biology unit. As vocabulary terms were introduced by the teacher, the students were allowed time in class to create additions to their word wall, so that at the end of the unit, all necessary vocabulary terms were visually represented for use by the students. At the end of unit two and after a post-test vocabulary formative assessment was given, the teacher and researcher determined the effectiveness of both strategies on the academic vocabulary knowledge for the ELL students. There was again an increase in scores from the pre- and post-tests and teachers felt that the overall understanding of vocabulary terms was increased. Their support for their feeling came from the summative test scores as well as the class discussions.

Third Intervention Cycle

With the second intervention cycle proving successful with an increase of scores for student participants, the teachers and researcher determined that both strategies – AVC and IWW – would continue to be implemented simultaneously during the third biology unit. Again, the student participants completed a pre-test for vocabulary terms for this unit. The teachers determined the vocabulary that was vital to mastering the unit and the students in the classes constructed a new IWW with the new vocabulary words. Teachers made great use of both strategies during the third cycle. Since unit two led into unit three in terms of vocabulary and content, all three teacher participants kept the IWW from unit two on the wall as a reference while teaching unit three with the new IWW. At the end of unit three and after a post-test vocabulary formative assessment was given, the teacher and researcher determined the

effectiveness of both strategies on the academic vocabulary knowledge for the ELL students. There was again an increase in scores from the pre- and post-tests and teachers felt that the overall understanding of vocabulary terms was increased for this unit. The teachers additional support came from the summative test scores as well as the class discussions.

Study

The third phase of the PDSA cycle refers to the 'Study' phase which answered the research question and sub question presented in the study. During this phase, data was gathered and tracked to know whether the implemented strategies created a change for improvement. The study phase occurred after each biology unit was taught and concluded and again at the completion of the three cycles of intervention.

This qualitative study sought to understand student acquisition of vocabulary necessary for success in a high school biology class. Qualitative data collection prior to the intervention implementation consisted of interviews and focus groups. Prior to the implemented intervention, the students were administered a pre-test of vocabulary terms for the first biology unit using a word bank. Observations occurred every other week as part of the data collection process to ensure the intervention was implemented with fidelity. After the first biology unit was completely taught, a post-test was given to the students to determine whether the use of the AVC helped to increase their vocabulary knowledge. For the second biology unit, a pre-test was again administered prior to the implementing the AVC or IWW with classroom observations occurring every other week during the intervention cycle, a post-test of vocabulary terms administered after the completion of the second biology unit. The third intervention cycle occurred the same way with a pre-test, observations, and a post-test to determine the effectiveness of implementing the

graphic organizer and interactive word wall to determine if there was an increase of vocabulary knowledge for ELLs.

The qualitative data for this research (e.g., interviews, focus groups, and observations) was analyzed for the development of codes and common themes. The analysis was compared to the results of the data collected with the initial predictions made prior to the study. I drew conclusions based on the analyzed data and what it revealed in relation to answering the research questions after each intervention cycle. This analysis helped to determine the next phases of the cycle as far as keeping strategies the same, modifying the strategies, or adding more strategies to be implemented at the same time.

Act

The last phase of the PDSA cycle refers to the 'Act' phase where decisions are made based on data analysis. Over multiple parts of the PDSA, I reviewed data to determine what changes need to be made for the intervention cycles. This reviewing of data happened within the Act phase throughout the study.

In this last phase of each intervention cycle, I reviewed all pre- and post-tests data and all qualitative data after each cycle of intervention to determine how to proceed with the next cycles. In the Act phase after implementing the first intervention, I questioned - Would I continue with additional cycles of the AVC alone or would I need to revise or add to the strategy (i.e., AVC) previously tried? After analyzing data for the first implementation cycle, I determined that revisions needed to occur as the first strategy implemented needed an additional component to aid ELL students in acquiring the biology vocabulary for the unit taught. The additional component added was the interactive word wall. I collected new data after adding to the initial

vocabulary intervention (i.e., AVC). After the second cycle of intervention, it was determined through data collection in the Act phase, that the already implemented strategies would continue through the third cycle of data collection due to its effectiveness for our ELLs during phase two. The effectiveness for each cycle was determined by pre- and post-tests scores as well as teacher input after implementation at each cycle of intervention.

Qualitative Data

Qualitative data comprised a significant portion of my overall data for this study; having a systematic and consistent approach to analyze this data was important. For this study, I used a data analysis spiral approach as described by Creswell and Poth (2018). This approach provided me with specific steps to data analysis that helped promote consistency in the results of this study. The Data Analysis Spiral is an inductive approach which is commonly used in qualitative analysis. This approach involves organizing data into themes that will allow the researcher to form relationships between the data collected and the research questions that were formed prior to the study (Mertler, 2016). The process of coding is central to qualitative research and involves making sense of the text that was collected from the teacher interviews, student focus groups, and classroom observations (Creswell & Poth, 2018). While coding, the researcher assigns a short phrase or a word to the text to group similar ideas and information for analysis (Mertler, 2016). At this point the researcher sorts the data and codes while looking for patterns in meaningful categories that will answer the research questions (Mertler, 2016). In the next section, I will describe the specific procedures used with the Data Analysis Spiral and then I will present the qualitative data findings.

Qualitative Data Analysis Procedures

For my data analysis procedure, I followed the Data Analysis Spiral from Creswell and Poth (2018) for all qualitative data sources that produced usable data (the teacher interviews, the student focus groups, and classroom observations found in the Appendices).

Figure 2

The Data Analysis Spiral Approach for Qualitative Data Analysis

Step 1: Managing and organizing the data

Step 2: Reading and memoing emergent ideas

Step 3: Describing and classifying codes into themes

Step 4: Developing and addressing interpretations

Step 5: Representing and visualizing data
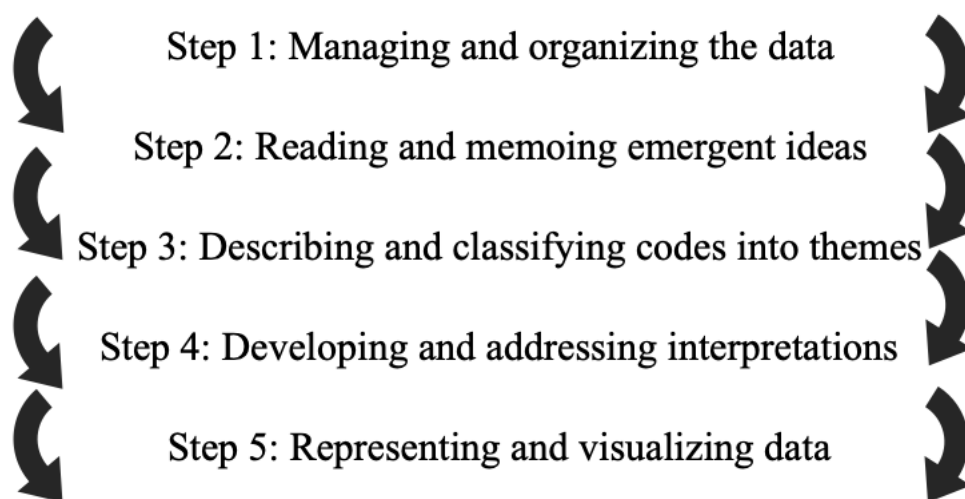
Note. Figure adapted from Creswell & Poth (2018)

The first step of the process involved collecting data and organizing the data into digital files with a file naming system. For the teacher interview form (Appendix J, K), the data was transcribed from an audio file, downloaded onto a computer, and placed into a Microsoft Word document. For the student focus groups interview form (Appendix L, M), the data was also transcribed from an audio file, downloaded onto a computer, and placed into a Microsoft Word document. The data from the classroom observations was downloaded from a paper form and put into a Microsoft Word document as well. The data was also formatted so that it could be uploaded to MAXQDA for coding.

In step two, I read through the teacher interviews, focus group interviews, and classroom observations making memos on general ideas that I formed throughout the data collection process. Memoing as described by Miles et al. (2014) is "not just descriptive summaries of data but attempts to synthesize them into higher level analytic meanings" (Creswell & Poth, 2018, p. 188). For the teacher interviews, I read through the transcriptions and listened to the audio recordings multiple times. I kept memos on the printed copy of the teacher interviews, student focus group interviews, and classroom observations with potential ideas that were repeated within the texts which helped form my analysis in the process. This step was the first opportunity to review all the data collected and to begin to categorize the information for further analysis. The memos that were noted during this step provided me an initial starting point for categorizing into themes as it helped me track the development of ideas throughout the process (Creswell & Poth, 2018).

For the third step of my analysis, I moved from reading and memoing to describing, classifying, and interpreting the data collected in this study. I was able to develop codes and themes and provide interpretations of the data based on my own views and perspectives read in the research. This also allowed me to "highlight noteworthy quotes" as I coded the data (Creswell & Poth, 2018). For example, I applied the code of "purposeful pairing of students" to the interview excerpts from teachers two and teacher three as they referred to that strategy several times as they continue to use it within their classroom setting. The open coding method encourages researchers to remain "open" to all possible interpretations and ideas from the data (Saldana, 2013). Therefore, I did not use a pre-set list of codes, instead I allowed the topic of the data to determine the code that I applied.

For my study I used MAXQDA to digitally code all the data sources. The use of MAXQDA also helped maintain organization and consistency of data. Within MAXQDA, I created individual folders for each data source (teacher interviews, student focus groups, and classroom observations). Once all the data sources were uploaded, I began open coding using a list of initial codes such as visual/pictures, demonstrations/labs/hands-on, and vocabulary instruction (pre-study/post-study). These codes were not predetermined and are representations of broad categories from the data that were applied during this step of analysis. After I completed the codes for all data sources, I re-read the data sources two additional times. This review allowed me to apply all codes to all documents with full understanding of the text.

For the fourth step in the analysis, I began the interpretation process carefully considering "what is meaningful in the patterns, themes, and categories generated by analysis (Patton, 2015 as cited in Creswell & Poth, 2018, p. 195). This was completed through MAXQDA as I continued reviewing the data files as I did in step three in this process. During this phase of analysis, I refined codes by combining like ideas and comments into more specific categories. An example of this was taking the initial code of vocabulary instruction and applying the new code of pre-study strategies and post-study strategies. By clarifying these codes and combining ideas, the data was better represented into themes to answer the research questions. From the coding process, major themes were identified as well as minor themes that supported the major themes. This step in the analysis process was important because it started shaping the data into a final project that could be used to address my research questions (Creswell & Poth, 2018).

An example of this analysis process is how I used my data to form a major theme that helped address my RQ, which looked at how the implementation of vocabulary strategies in the biology general education classroom can improve English language learners' academic content

acquisition. First, I looked at codes that would be targeted toward the use of the vocabulary interventions during lesson delivery and the ELLs response to vocabulary interventions. Examples of these codes were pictures/visuals, ELL understanding, and vocabulary instruction. These codes were then combined to form a major theme from the data, such as theme one, "The use of visuals increased ELLs comprehension of biology vocabulary and content." To further support the major theme, minor themes were identified from the data. One such minor theme was "Teachers referencing visuals as reminders provided quick guides for ELL students to aid in their understanding of vocabulary."

Figure 3

Example of Qualitative Data Analysis Using the Data Analysis Spiral Approach
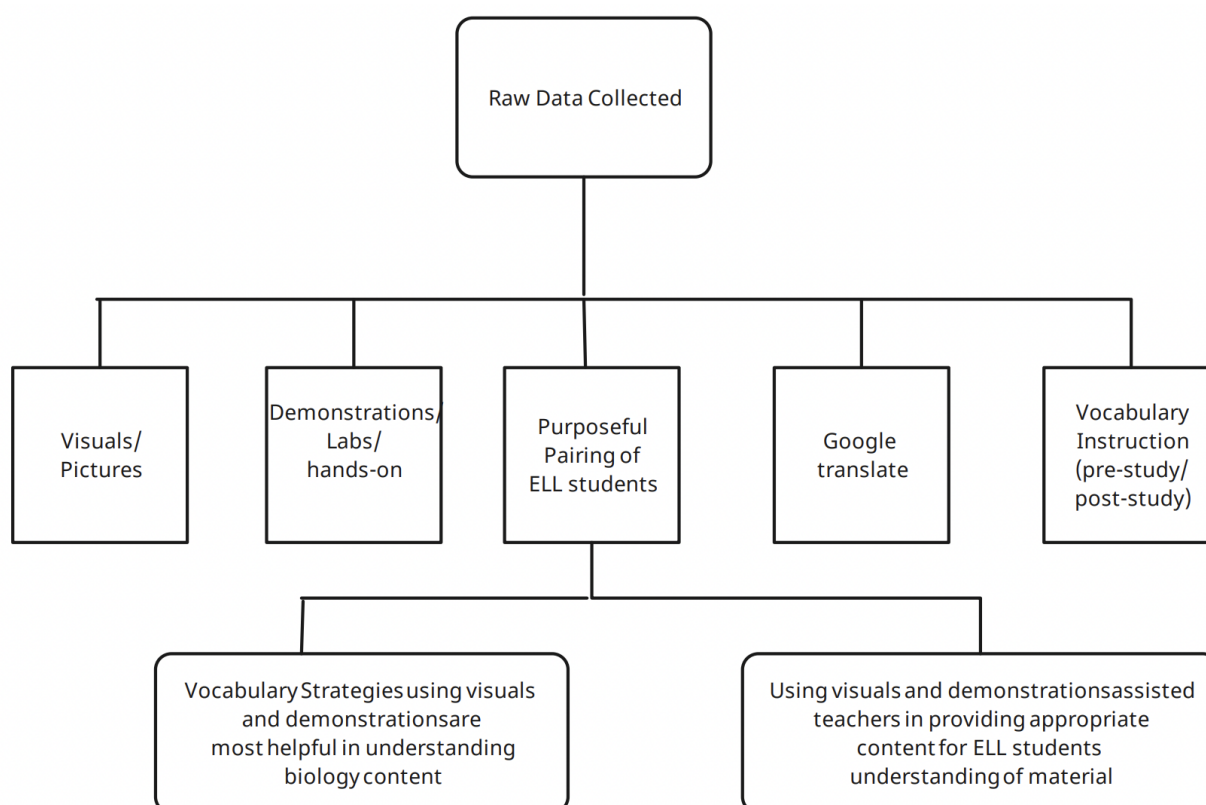
In step five, the final phase of the Data Analysis spiral, researchers use the data for direct interpretation by drawing meaning from the data to establish patterns between categories. During

this phase, the researcher develops naturalistic generalizations of what was "learned" throughout

the case study (Creswell & Poth, 2018). This representation is visual in nature in the form of

diagrams or tables typically. The above figure (Figure three) shows an example of how the data

analysis spiral approach looked for the qualitative data analysis in my study. This figure

illustrates the inductive analysis that begins with the raw data consisting of multiple sources of

information and then broadens to several specific themes and further expands to the most general

themes. Using this approach allowed for consistent analysis and interpretation of qualitative data

from this study.

Validity and Trustworthiness Measures

In developing a quality study, understanding the potential weaknesses that can

occur is important in the study's overall credibility. Examining those potential weaknesses from

a qualitative standpoint is important. For a qualitative research study, it is crucial that the

methods, instruments, and results are considered valid. Validity of a study shows that the overall

results are accurate indicators of what is being measured and that the researcher was able to draw

good interpretations from the data (Plano Clark & Creswell, 2015). Potential threats to validity of

an action research study can come in different areas like data collection, data analysis, and data

interpretation (Ivankova, 2015). For my study, the threats to validity were minimized

using a research proven instrument (Appendix N) to gather data.

For qualitative aspects of a study, trustworthiness is a good measure to determine

the strength of a study. Qualitative research methods involve interpreting data and focuses on

getting the individual's perspective on a given topic (Ivankova, 2015). Issues with

trustworthiness will arise when the instrument used, and the methods of data interpretation do

not accurately display the participants' words. To mitigate any potential issues with

trustworthiness, multiple data sources (i.e., interviews, focus groups, and observations) were used in this study to give an accurate representation of my participants' words. Teacher participants and student participants were given the opportunity to review the transcripts of interviews and focus groups as well. The use of bracketing, from my data analysis procedures, was also key in eliminating the potential for my opinions to impact the analysis of the qualitative data (Plano Clark & Creswell, 2015; Tufford & Newman, 2012). For my study, the effective use of the five-step data analysis spiral method from Creswell and Poth (2018) on all qualitative data ensured the overall trustworthiness of my study and that the voice of my participants was represented accurately. The five-step data analysis spiral allowed me to repeatedly read through the collected data to determine themes and similar ideas. By completing this analysis multiple times, it allowed me to ensure the validity and reliability of the data presented in the results.

Reflexivity

Our moral obligation as educators should include meeting students where they are and providing them with the necessary skills for academic success. An increasing number of ELLs continue to move into the US and into the southeastern part of the US specifically. With an increase in population, pervasive issues related to ELLs academic achievement and the gaps that persist among racial groups continue to exist. As a school psychologist, I have evaluated many ELLs for potential special education services. This has caused me to look further into this special population and attempt to understand many of their academic struggles. I want to ensure trust between the students, their parents, and myself during this process so that they understand the genuine concern and need for my research. The implemented instructional strategies in this study should prove generalizable to other districts within South Carolina as well as parts of the United States. Being able to implement appropriate instructional strategies will help ELLs feel more

successful in obtaining academic skills to graduate from high school, attend college, or find successful careers in the United States. I find great satisfaction in working with students and their families to ensure better educational outcomes for their futures.

Summary

This chapter provided an overview of the methodology used for this study, an overview of the concept of improvement science and the PDSA cycles, the site selected for the study, a description of the participants and their roles, the instruments used in gathering data, and the overall research design. The design and structure of my improvement science research allowed me to gather data to help answer the overall research question and sub-question that guided this study: Can the implementation of vocabulary strategies in the biology general education classroom improve English Language Learners' End of Course exam scores and how can teachers grow in their support of ELL students' academic language acquisition in biology?

In Chapter 3, I further discuss the qualitative data and its analysis along with presenting major and minor themes from the analysis. Findings are also revealed in this chapter related to the themes discovered through the data collection.

Chapter 3

Data Analysis and Results

The purpose of my research was to investigate the implementation of vocabulary strategies in biology general education classrooms to improve ELLs' content acquisition. The study also investigated how teachers grew in their support for ELL students' academic language acquisition in biology.

Qualitative methods were used to address my research questions. In the first section, data collected from the pre- and post- vocabulary tests are discussed. Pre- and post-tests were administered prior to and after each biology unit taught. In the second section of this chapter, the results from the qualitative data and analysis are presented. The qualitative data included information from teacher interviews conducted before and after strategies were implemented, student focus groups conducted before and after strategies were implemented, and classroom observations conducted simultaneously as interventions were implemented. To assist in analyzing the qualitative data, MAXQDA, a software program that allows users to upload data from text and audio files for coding, was used. MAXQDA allows users to code files based on associations for themes that develop within the data. All data from this study was kept on a password protected computer.

Combining results qualitatively takes a thorough understanding of how data is analyzed (Mertler, 2016). Table six provides an overview of the data analysis procedures that were used regarding the research questions. Within this table there is also a breakdown of each instrument and the procedure used.

Table 6

Data Analysis Procedures for Each Data Source as It Pertains to Research Question

RQ1: *How can the implementation of vocabulary strategies in the biology general education classroom improve English language learners' content acquisition?*

    RQ1a : *How can teachers improve in their support of ELL students' academic language acquisition in biology?*

Data Sources:	Data Analysis Procedures:	Aligns to RQ:
Pre-Post Vocabulary Measure	Quantitative Analysis	1
Pre-Intervention Teacher Interview	Qualitative Analysis	2
Post-Intervention Teacher Interview	Qualitative Analysis	2
Pre-Intervention Student Focus Group Interview	Qualitative Analysis	1
Post-Intervention Student Focus Group Interview	Qualitative Analysis	1
Classroom Observations	Qualitative Analysis	1, 2

Pre-Test and Post-Test Data

The pre- and post-vocabulary assessment measured the increase in vocabulary terms acquired by the ELL students from the beginning of each biology unit of study until the end of that biology unit. I administered the pre- and post-tests to the ELLs during independent learning times at GVHS. The administration of the pre-assessment established a baseline reference for the number of vocabulary terms the students understood in context prior to any instruction taking place in their biology classrooms. The post-assessment allowed students to demonstrate their

vocabulary knowledge after completing a unit of study. These assessments were given for each biology unit taught. There were three biology units involved with this research study. For unit one, there were 13 fill-in-the-blank questions for the pre-and post-test. For unit two, there were nine fill-in-the-blank questions for the pre-and post-test. Unit three presented 13 fill-in-the-blank questions for the vocabulary pre- and post-test that the ELL students completed. The pre-and post-test utilized the exact assessments with the questions and word bank in the same order for each unit assessment.

Pre-Test and Post-Test Findings

To determine the amount of change in the pre-and post-tests vocabulary measures that the student participants completed before and after each biology unit taught, analysis of the collected data was completed. The results from the pre- and post-tests were analyzed to determine whether an increase, a decrease, or if there was no change in individual students' scores related to their knowledge of vocabulary terms taught for each biology unit.

Tables eight - ten show the individual differences of each student participants' pre- and post-tests scores on each of the biology units.

Table 8

*Unit 1 pre-test and post-test vocabulary formatives (using AVC only)***:**

Student	Pre-Test	Post-Test	Difference
1	4	3	-1
2	1	3	+2
3	2	7	+5
4	2	5	+3
5	1	4	+3

6	0	2	+2
7	7	7	0

As noted in Table eight, five of the seven student participants increased their vocabulary test scores from the pre-test to the post-test. One student (student seven) had the same score between the pre and post-test whereas another student (student one) decreased their vocabulary score from the pre-test to the post-test. The intervention that was used for the first biology unit involved the academic vocabulary chart where the student participants were asked to complete a chart with vocabulary terms, definitions, and pictures/drawings of each vocabulary term as it was introduced throughout the unit. Student seven indicated that he did not really pay attention during the instruction for the unit, so "I probably didn't learn that much" and that he was not "motivated to learn biology" during the beginning focus group interviews. When student one was asked about this biology unit and the vocabulary terms presented, she revealed that she was overwhelmed by all that was being taught and "because she does not know English very well, she could not keep up with all of the words."

In addition to the five students who increased their vocabulary scores on the pre- and post-tests, there were five students who also passed their summative unit test. However, only three of the five students who increased in their vocabulary knowledge scored a passing grade on their summative assessment. Student seven was not motivated in his daily learning in class, but understand the content taught to receive a passing grade on the summative test. Student six increased his score slightly on the pre- and post-vocabulary test but did not master the unit content for a passing grade on the summative test.

While five students increased their scores on the pre and post-test, the biology teachers did not feel that the AVC strategy was enough for a continual increase in vocabulary knowledge for their ELL students.

Table 9

*Unit 2 pre-test and post-test vocabulary formatives (using AVC & IWW)***:**

Student	Pre-Test	Post-Test	Difference
1	1	2	-1
2	0	1	+1
3	1	3	+2
4	4	5	+1
5	1	4	+3
6	1	1	0
7	4	6	+2

According to the teacher participants, unit two was the most difficult biology of study of the first semester of the school year. To increase the vocabulary knowledge for all the student participants, teachers included the continual use of the AVC with an additional strategy implemented with the use of the IWW. In reviewing the vocabulary pre- and post-tests among the student participants, there was an increase in score for five students with one student (student six) remaining the same between the pre-test and post-test. Student six simply said, "that was hard" when asked about this biology unit and the vocabulary taught. While student six did not increase his score on the pre- and post-test vocabulary tests, he passed the summative assessment for the unit. Again, Student one indicated that biology is "really hard, but I am trying to learn all the words." She decreased in her score for the pre- and post-test test but passed the summative

test at the end of the second unit. Student two and student three increased their scores slightly on the pre- and post-vocabulary test but did not master the unit content for a passing grade on the summative test.

In addition to the five students who increased their vocabulary scores on the pre- and post-tests, there were five students who also passed their summative unit test as well. However, only three of the five students who increased in their vocabulary knowledge scored a passing grade on their summative assessment.

Table 10

*Unit 3 pre-test and post-test vocabulary formatives (using AVC & IWW)***:**

Student	Pre-Test	Post-Test	Difference
1	3	4	+1
2	0	3	+3
3	2	3	+1
4	2	6	+4
5	0	2	+2
6	2	4	+2
7	5	5	0

Units one and two both revealed the same number of students showing an increase in scores from the pre-test to the post-test. Even though the number of students from unit one and unit two remained the same with an increase of vocabulary knowledge, the biology teachers felt that the addition of the IWW to the AVC aided the vocabulary knowledge of their ELL students. While this did not reveal itself in number-form alone, interviews explained the increase of vocabulary knowledge through discussions, labs, and summative assessments.

Due to the success of the AVC and IWW for unit two increasing the number of student participants scores on the vocabulary tests and the teacher participants recommendation for continued use, the strategies for unit three remained the same for implementation. After reviewing the pre-test and post-test scores for the student participants at the end of unit three, it was noted that six students increased their vocabulary knowledge with one student remaining the same with his scores on the tests. Student seven again discussed a" lack of motivation in biology in general." His teacher (teacher one) revealed that student seven has passed all his summative assessments for all three units. He stated that "he typically has a lack of motivation in class. However, when tutoring him one-on-one using the AVC and IWW strategies, he has responded in a more positive manner and can display in conversation his vocabulary knowledge of the terms presented."

While six students increased their vocabulary scores on the pre- and post-vocabulary tests, all seven students in this study passed their summative test for this unit.

Pre-Test and Post-Test Data Summary

The overall analysis of the pre- and post-tests data reveals that 71% of the student participants increased their vocabulary knowledge for the biology unit one of study and that 86% of the student participants increased their vocabulary knowledge for biology units two and three. Overall, there was an increase of vocabulary knowledge for most of the ELL students during all three biology units taught. While this increase in vocabulary knowledge, according to the pre- and post-tests was not large, the qualitative data for this study revealed how the use of the AVC and IWW proved successful in the classroom setting for an overall increase in vocabulary knowledge.

Qualitative Data Findings

The findings from the qualitative data analysis revealed different major and minor themes. Figure 4 presents the major themes that were evident in the data sources. Following Figure 4, data is presented to support both the major and minor themes.

Figure 4

Major Theme 1 and Minor Themes
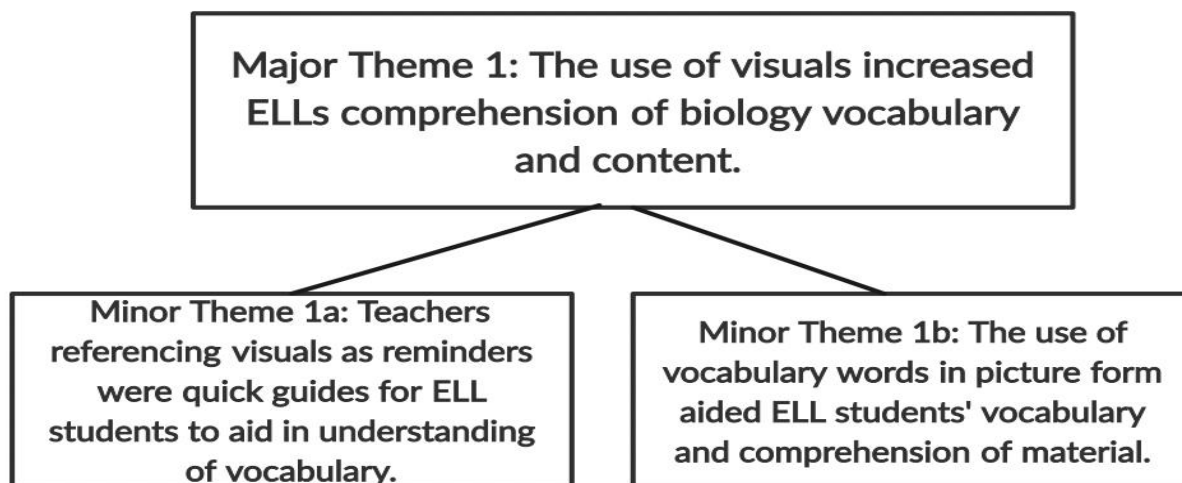
Major Theme 1 - The use of visuals increased ELLs comprehension of biology vocabulary and content.

Students reported that the instructional strategies presented in their biology classrooms increased their ability to understand the vocabulary taught in each science unit. Two minor themes were identified from the data to help inform and support the first major theme. The first minor theme was that teachers referencing of visuals provided quick guides for the ELL students to aid in their understanding of the vocabulary taught. The second minor theme was that the use of vocabulary words in visual form aided ELL students' vocabulary acquisition and comprehension of biology material. Each minor theme will be discussed with supporting facts and a concluding summary describes how the minor themes supported the major theme.

Minor Theme 1a - Teachers referencing visuals as reminders provided quick guides for ELL students to aid in their understanding of vocabulary.

Strategies

Prior to the implementation of interventions in the classroom, the student participants all indicated that if they could see pictures or have drawings along with the vocabulary words that it would "help a lot" (student one, student two, and student six). Throughout the focus group discussions and in hallway conversations with the researcher, student participants referenced repeatedly how important the use of visuals and demonstrations were to their understanding of vocabulary during the biology units taught. When asked about teachers referencing the visuals (i.e., AVC and IWW) in the classroom, student two stated that "when teachers point to it, it then helps me," but student seven indicated that he "did not really notice until the teacher points it out". However, when the teacher referenced the IWW or AVC strategies, student seven focused on them and he found both helpful in understanding the terms presented. Three students also referenced that understanding the vocabulary in class is due to teachers showing them "how to do things" (student seven), "doing labs that I can touch and using pictures are good," (student five) and "doing a lot of experiments with pictures is helpful" (student two). Student two also commented that "showing me what it looks like helps me to understand what the teacher is talking about." There were several references to labs that were completed during this study. The student participants indicated that the ability to use the AVC and look at the IWW helped them in class discussions and when working in labs. The combination of the strategies and the labs conducted helped ELLs in the class understand the vocabulary taught. Students four and six both indicated that "yeah, pictures are a good idea for me as I learn biology" while student one

commented "because it's difficult for me to understand some words in it, but I can understand more with these pictures in class."

Student three shared through translation from their ESOL teacher that:

"When the teacher explains things, she gets some words but some others she has no clue. And she tries to find the translation in Spanish so she could understand but since it takes time she gets behind and then she gets lost and it's difficult for her to complete the assignment."

Student three added further that having pictures on the wall and in her notebook along with the vocabulary terms helped her greatly when she felt lost in class and at home while studying. By the end of the study, all student participants agreed that the IWW helped them to understand the vocabulary better because it showed processes and explained terms. Also, when they had the AVC in their notebooks as an additional reference to the IWW for units two and three, it was even better for their understanding and language learning in biology.

General Observations and Lesson Delivery

In the final teacher interviews, Teacher two indicated that "creating pictures for students and other things like that" helped them to understand more effectively. He added that students seemed more comfortable in trying to understand all the vocabulary and concepts during each unit taught. Teacher one mentioned that he feels that "all the components together helped them to be successful and increase their knowledge. I think it is hard to determine if the specific strategies were solely responsible for their increased learning, but I think adding the visual components to the labs and note-taking helped tremendously for our ELL students to improve their scores and vocabulary knowledge." All three teachers felt that the use of the AVC paired

with the IWW for units two and three was a definite advantage for vocabulary learning for their ELL students.

Comprehensible Input

Observations completed during unit one, unit two, and unit three for all three teachers under the comprehensible input section of the modified SIOP form showed that there were clear explanations of the academic tasks and that the teachers' speech was appropriate for the students' proficiency level. Most of the teachers spoke at a slower rate, enunciated words clearly, and used a simple sentence structure when working directly with their ELL students. During observations, it was noted that teachers referenced the academic vocabulary charts and/or the interactive word wall consistently as they worked through lectures, labs, or cloze note packets. Student five commented that when teacher three talked with her 1:1 she spoke clearly and made sure she understood "all that she teaches us." Students one, two, and three concurred that teachers one and two were careful to enunciate, showed drawings a few times, and referenced the AVC and IWW to make sure they comprehended the material. These three students (students one, two, three) felt that they have comprehended more in biology this year than they thought they would when the school year started. These students indicated they were very nervous for biology class because "it is different in [their] countries," but they said now they feel more confident in getting through the school year and learning more of the content. With teachers speaking slowly and carefully, student five said it was easier to follow along in class discussions.

Minor Theme 1b - The use of vocabulary words in picture form aided ELL students'

vocabulary acquisition and comprehension of material.

Strategies

Using the AVC and the IWW during the biology lessons proved to be helpful for the ELL students in comprehending the vocabulary words for each unit taught. Six of the student participants speak Spanish as a first language with one student speaking English plus a native tongue known as Chuuk. All student participants, even the two that were born in the United States, indicated that vocabulary has always been difficult for them due to the "language barrier" (student four) and because "at home they taught me to speak Spanish and then I went in school, and I didn't understand it" (student 3). Three of the students were entering 9th grade when they moved to the United States, so they are still learning the structure of the English language in addition to core academic content. The student participants were seeking ways for success in biology this year, but with different levels of understanding of the English language, they have found it very difficult to understand many vocabulary words. Student three said that "she wants to have good grades this year, so she has to work out how to learn." Learning how to learn was referenced by two students a couple of times during focus group discussions. Having the AVC and IWW specifically have helped the ELL students in this study to acquire vocabulary necessary for passing biology summative tests during the first semester of this school year.

When asked what teachers have done to help with vocabulary and understanding of material in biology class, student one said that her teacher "gave us work with pictures" and that "pictures are the big thing." Being able to create the IWW and having it to reference for two units of study was "more easy" (student five) and "very helpful" (student three). The students also had the ability to reference and complete the academic vocabulary charts for all three units

and student six said that "all the words are different and it's not something that you talk every day, so it was nice to look at it a lot." While taking end of unit tests, a couple of students commented that the teachers left the IWW up so they could reference it when completing their exams which made their understanding "better than before" (student seven). Student seven also commented that he has started to go to tutoring with his teacher and that they reference the charts and visuals when they review vocabulary words and concepts. Every student participant enjoyed creating the IWW in their classrooms as it helped them work with native English speakers to begin to understand what they would be learning in class as it seemed so overwhelming at the beginning.

General Observations and Lesson Delivery

Teacher three indicated that she likes to "observe the students' comfort level and their level of understanding of the content at the beginning of the class, but [she] quickly realized that the ELL students needed more content-specific resources and implementing the visuals during the lessons seemed to improve their confidence in class." Teacher three also added that she believed that the interventions implemented helped her ELL students improve their understanding of the vocabulary in the units taught. The biology units are structured to build on each other throughout the year, so the interventions "made the improvement more noticeable on the last unit – unit three – of this semester." Teacher three further indicated that when the ELL students were engaged with the content and the interventions were implemented consistently, their understanding and their academic skills increased as noted through conversations with her students.

Practice and Application

It was observed on several occasions that ELL and non-ELL students referred to the AVC and IWW to help with writing and reporting of labs or questions answered during lectures. In conversations while at their tables or in groups working on assignments, students were observed reminding other students to look at the charts or the IWW to help with answering questions. In asking about implementing the interventions within the classroom, teacher one indicated:

> "Funny enough, they knew we were adding interventions, but it was so blended that it didn't feel like a big shift for them or me. The ELL students especially seemed to embrace that there was a different way to help them learn. Even after modifying the intervention from unit 1 to unit 2, it did not seem like a big shift, so the students just kept moving on with their learning."

Teacher one continued that he was able to see how the strategies helped the ELL students in his classroom learn and that "my classroom data proves that" as all his ELL student participants passed two out of three of the summative assessments for each biology unit with one student passing all three summative assessments.

Major Theme 1 Summary

Major theme one focuses on the use of visuals increasing ELLs' understanding of biology vocabulary and content. The major theme highlighted that when teachers referenced visuals as reminders it served as quick guides for ELL students to aid in their understanding of vocabulary and that the use of vocabulary words in picture forms improved the ELL students' vocabulary acquisition and comprehension of biology material. All the students were emphatic in explaining that the visuals were very important for their understanding throughout the units of study. Teachers also indicated that the implementation of the AVC and IWW in their classrooms aided

the ELL students' vocabulary acquisition as most of their test scores improved with each unit taught and their level of understanding was evident during discussions.

Figure 5

Major Theme 2 and Minor Themes
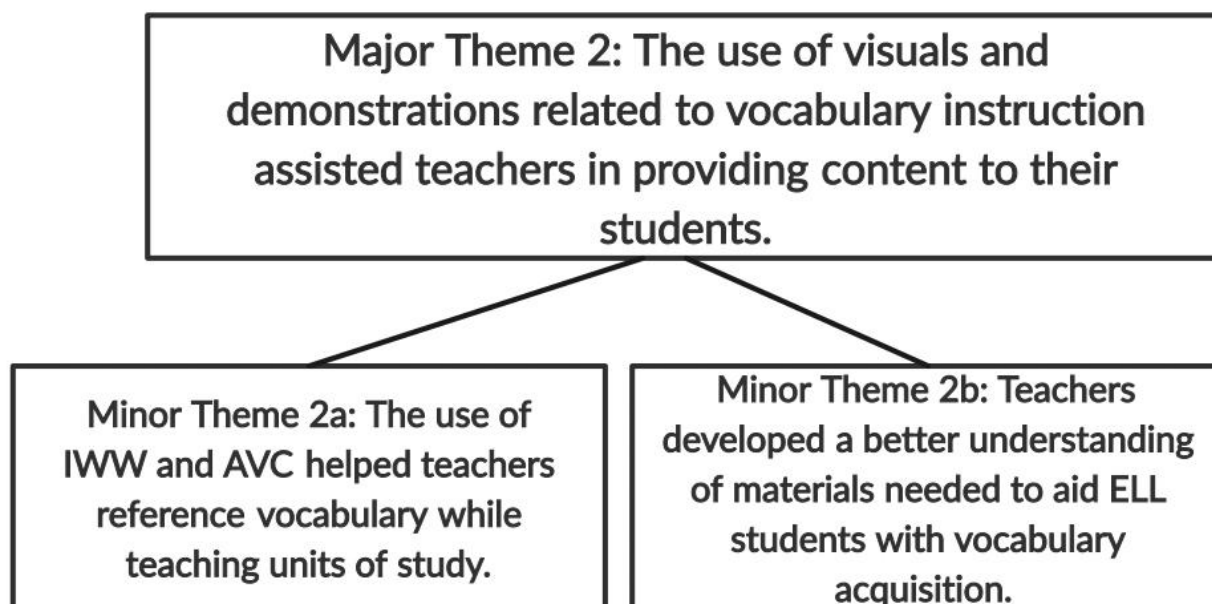
Major Theme 2 - The use of visuals and demonstrations related to vocabulary instruction assisted teachers in providing content to their students.

In forming major theme two, two additional minor themes were developed. The first minor theme showed that the use of the interactive word wall and academic vocabulary chart helped the teachers in referencing vocabulary words consistently while teaching biology units of study. The second minor theme was that teachers developed a better understanding of visual materials needed to aid ELL students with vocabulary acquisition. Each minor theme will be discussed with supporting factors and a concluding summary will describe how the minor themes supported the major theme.

Minor Theme 2a - The use of IWW and AVC helped teachers reference vocabulary words consistently while teaching units of study.

Throughout the study as observations were taking place and conversations were held, it was noted that teacher participants consistently referenced the vocabulary interventions in use as they taught lessons. Teacher 1 indicated that:

 "You know right away when they don't understand because they will tell you 'I don't know what this word means.' And when it's a vocabulary word, you know that you have to go back and reteach the word or give them more examples or find other ways to ensure they understand the vocabulary words."

All three teachers indicated that the use of the AVC and the IWW were easier to implement than they anticipated. Like many high school teachers they were nervous that adding additional strategies into their instruction would create more work, but during the end of the study interviews, teacher two indicated that having the vocabulary taught at the beginning of each unit while building on the words and the use of pictures, charts, and diagrams as the unit progressed helped him to be more aware of what his students understood along the way." All three teachers indicated that the students enjoyed creating the IWW during units two and three which also helped with their investment in utilizing it as a strategy in the classroom.

Prior to this study, all three teachers said they told students to use Google translate, gave work translated in Spanish, or paired students together to help with understanding. While those strategies helped students, all three teachers indicated that they now understand the extreme

importance of the use of visuals for ELL students to enhance their learning and acquire the

vocabulary necessary for mastering biology. Teacher one commented that he "always tries to

give them the vocabulary, have instruction in the beginning so they know what we're talking

about for the whole unit and then break it down one word at a time and reference the words and

definitions constantly throughout my teaching." He also added that having visual aids on the

walls and in the unit, packets helped him consistently review vocabulary terms while lecturing or

working with labs.

General Observations and Lesson delivery

General observations of the three teacher participants proved that the selected strategies

during unit one, unit two, and unit three were being implemented. There was an observation

during unit two with teacher three in which the IWW was completed and on the wall, but there

was no reference to vocabulary terms or to the IWW during the specific observation. However,

when observing during unit three and after discussion with the researcher, teacher three

implemented the interventions as intended more consistently referring to both the IWW and

AVC on multiple occasions. Teacher two often told his students to complete the AVC as they

discussed various vocabulary words while teacher one referred to the IWW during unit two and

unit three as he explained the labs and the purpose of the assignment during observations. All

teachers appeared adequately prepared to deliver instruction as noted during all observations for

the three units of study. All three teachers also demonstrated knowledge of the content taught as

well as the vocabulary strategies that were implemented. A detailed description about the

purpose of the AVC and IWW for their learning and comprehension of material was provided in

each class for teacher one. Teacher two was observed moving from group to group to explain the

use of the IWW and the reason for its creation. In observations in the classroom of teacher two,

the students appeared eager to work on the IWW as they always enjoy group work, and it was something of a different nature for them to complete.

During an observation for unit two, teacher one was enthusiastic about the IWW and the students commented about "how cool it was" because "visuals help us a lot". In an observation for teacher two, a native English speaker was overheard encouraging an ELL student by saying "that will help us understand these hard words" in referencing the IWW after the teacher explained it. Teacher three talked one-on-one with her ELL students to motivate them in using the AVC and IWW to ensure their understanding of the vocabulary and content taught in her classroom. The teacher saw the students as excited to have something to reference during the lessons as they have told her often how hard biology is for them.

During observations for unit three, teacher two was heard telling students to "make good use of the visuals in the room to help them." Teacher one referred to the IWW as he was lecturing, and it was observed that students were adding the vocabulary terms and pictures drawn to their AVC without prompting by unit three. Teacher three was observed constantly reminding her students to use the IWW and AVC or any other drawings they had to aid them with completing lab reports or studying for quizzes by the end of unit two and in unit three. Having the IWW as a visual for the teachers in their classrooms helped them to consistently mention it in their teachings throughout units two and three.

Practice and application

Teachers used hands-on materials and/or manipulatives for students to practice using new content knowledge through labs completed and cloze notes with additional reminders to complete the academic vocabulary charts with pictures as aids for their learning. There were multiple opportunities observed with activities for students to apply content and language

knowledge in the classroom. This also came in the form of labs in the classroom and visual online labs, the AVC, computer quiz outlets such as Kahoot or Quizlet, and peer work often in groups of three purposefully paired with ELL students and native English speakers to complete vocabulary sections of the notes. All language skills including reading, writing, listening, and speaking were integrated during most of the observations. Students were often paired in groups of three to complete lab reports or in class activities where they rotated the position in which they were working in - artist, writing, and reporting to the class. Teachers were also observed asking students to complete the AVC throughout lessons as students were listening to lectures and taking notes at the same time. ELL students were observed looking at the IWW and student 4 was observed walking across the room to look at the IWW and then wrote his thoughts onto his lab report.

Minor Theme 2b - Teachers developed a better understanding of visual materials needed to aid ELL students with vocabulary acquisition.

Teacher two realized how many different backgrounds are in his classes with a very large number of ESOL students who speak mostly Spanish and that using visual materials was a key way to help them achieve. Teacher two commented, "They have to know the vocabulary - it's the most important thing. So, I have learned that using visuals and hands-on labs is most beneficial for my ELL students." Teacher one added that he "modifies lessons to give examples to [his] students that are going to be more relatable to their lives as science vocabulary is difficult to understand, but it is so important to their futures." Teacher two is a first-year teacher, so he honestly reported at the beginning of the study that he "hasn't seen what does and doesn't work with ELL students." By the end of the study interview, teacher two was elated at how the visuals helped his ELL students understand the vocabulary and content better."

Teacher one indicated that for the past three years he used a pre- and post-test for each unit of study, but with focusing specifically on vocabulary strategies with his classes he has seen the advantage the visuals had on his teaching between the pre- and post-test quizzes. Teacher three agreed that the interventions were easy to implement and helped with ELLs understanding. She also noted that while the visuals were very useful, she had to implement additional accommodations with the level one ELL students such as chunking of assignments and tests and having more one-on-one conversations. Teacher three realized the great importance of visuals for her students but also recognized that her level one ELL students need a lot of support using visuals and other modifications to acquire all the necessary vocabulary in the biology units.

General Observations and Lesson Delivery

When discussing the utilization of the strategies in the class during the final interview with teacher one, he stated:

> "When I utilized the tools consistently, I realized that I was helping the ELL kids and the other students. I had a great experience implementing these strategies and saw the success of my students. I would do them again and again and again. I will implement them in my class going forward because I like how I can connect back to what I am doing in class, and I can see that they are understanding in the end."

Teacher one realized that the visual vocabulary strategies were beneficial for his ELL students in better understanding the difficult biology concepts he taught for each unit. By keeping the IWWs on the Smartboard in his classroom, he was also able to discuss vocabulary consistently throughout the units for understanding as well.

Practice and application

In speaking with teacher one about this study and his practices with ELL students from the beginning of the study until the completion of the study, he felt that,

> "It is very important to remember that some of our ELL students truly do not have the language to understand what I am saying or the content that I am teaching. So, the more strategies you put into your class and the more help you can give them, the more they are going to learn. Using visuals and chunking material along with the visuals and not overwhelming them with all vocabulary at once is definitely something that I have realized during this study in working specifically with my ELL students."

Teacher two also developed a better understanding of using visuals with vocabulary instruction as he stated, "when lecturing, I always try to have the text paired with a picture then on the next slide, I put just the image so I can point to it while I am talking." He also indicated that the interactive word walls are still in his room on the whiteboard so his students can continue to reference it. He realized how using both strategies as supports instead of using them individually were very beneficial to his ELL students in learning the biology vocabulary. Teacher two also noted that giving the ELL students a blank vocabulary sheet like the AVC and asking them to complete it as he taught did not work by itself in unit one. He found that if the students did not understand what a word meant, then they did not always attempt to complete the chart, but adding the IWW and other visuals was "key for my ELL students." Teacher two learned that he had to consistently reference the AVC and IWW with his students. gave an example of using the IWW with the photosynthesis unit and its usefulness as "it helped the students understand certain things like the light and dark reactions of photosynthesis - what happens in the actual ground and the parts of a chloroplast. The students seemed to understand it a lot better with the IWW and

AVC in use and with referencing them so they would look at both a lot of the time." Teacher two said that he plans to use the same strategies on the next unit and moving forward with his students in biology classes.

Major Theme 2 Summary

Major theme two focused on the use of visuals related to vocabulary instruction assisting teachers in providing content to their students. The major theme highlighted how the use of an IWW and AVC helped teachers reference vocabulary words consistently while teaching units of study and that teachers developed a better understanding of visual materials needed to aid ELL students with vocabulary acquisition in their biology classrooms. Teachers indicated that at the beginning of the study they were leery about the addition of strategies to the number of standards required per unit, but that after using the AVC and IWW consistently in the classroom they realized the extreme importance and the impact it had on their ELL student's vocabulary acquisition and comprehension of material in their classes.

Summary

The purpose of my research was to investigate the implementation of vocabulary strategies in biology general education classrooms to improve ELLs' content acquisition. The study also investigated how teachers improve in their support for ELL students' academic language acquisition in biology. Through data analysis two major themes were discovered and each major theme had two minor themes as well. Both themes supported that the use of visual strategies aided ELLs in acquiring the vocabulary content in the biology classrooms. The ELL students became more confident in acquiring academic skills in a second language while the teachers understood the importance of implementing visual strategies to help their students better understand the difficult biology content that was taught.

Chapter 4

Summary and Discussion

The purpose of this qualitative case study was to explore the implementation of vocabulary strategies in biology classrooms to improve ELLs' content acquisition as the literature has presented a continual concern that ELLs are not achieving at the same rate as non-ELL peers. The research questions in this study were analytical in nature and structured to explore how the implementation of vocabulary strategies in the biology general education classroom improve ELLs' content acquisition as well as how teachers can grow in their support of ELL students' academic language acquisition in biology.

Cummins' (1979; 1985; 2016) and Krashen's (1982; 1994; 2015) focus on the theory of second language acquisition informed the theoretical framework of this case study. I used Cummins' and Krashen's theories of second language acquisition as the focus to explore how a second language is acquired while also gaining academic language skills in the second language. I also used it to interpret the study's data relating to the research questions to identify the key findings of this case study. The key findings that emerged from the research questions revealed that implementing visual strategies such as academic vocabulary charts and interactive word walls aided ELLs in vocabulary knowledge and their acquisition of biology content. The key findings also revealed that teachers' utilization of various visual strategies supported ELLs' academic language acquisition of the biology content.

Interpretation of the Findings

The results from the qualitative data show how implementing vocabulary strategies within a secondary biology classroom improved ELLs' vocabulary and content acquisition for all three biology units taught. The study results yielded answers to the research questions, and most students experienced a positive change academically and emotionally because of the strategies implemented.

Research Questions

This qualitative research study was guided by the following formal research question: *How can the implementation of vocabulary strategies in the biology general education classroom improve English Language Learners' content acquisition?* In answering this overarching research question of this study, a sub-question emerged leading the researcher to investigate a secondary research question: *How can teachers improve in their support of ELL students' academic language acquisition in biology?*

Support for RQ1 and RQ1a

The positive change from implementing vocabulary strategies within the biology classroom proved that ELL students gained vocabulary knowledge and content acquisition for the units taught. Within the results, there was an increase in vocabulary knowledge from pre-test to post-test for five out of seven students for unit one and unit two and six out of seven students for unit three. Most of the student participants in this study showed growth in their summative assessments within their biology classrooms for at least one unit taught according to the teacher participants as well. When reflecting on the visual vocabulary strategies implemented within the biology classroom, the student participants were emphatic that understanding the terms through visual means was key to their understanding of the complicated biology vocabulary and

concepts. The ELL participants believed that the strategies that were used in the biology classrooms will be helpful for use in the other content classes. The students also understood that while they did not increase drastically within the pre- and post-vocabulary tests, their acquisition of vocabulary terms and understanding the content increased greatly as was evident by their summative test scores for each unit as well as their ability to communicate with their peers in class about the topics.

When interviewing and observing teacher participants, several statements were made related to the ease of implementing the strategies and the success they saw with the student participants' grades. Teachers indicated that at the beginning of the study, they were unsure about the addition of strategies to the already large number of standards required per unit, but after using the visuals consistently in the classroom, they realized the extreme importance and the impact it had on their ELL students' vocabulary knowledge and comprehension of material in their classes. The biology teachers also indicated that they would continue implementing these strategies throughout the school year as the student participants found success with them, which may help them to receive a passing score on the EOC exam in May. The teacher participants believed that the use of the vocabulary strategies, even showing the smallest gains per unit taught, will impact their classrooms and classrooms all over the state. The impact will be shown in an increase in classroom performance on formative and summative assessments with a higher passing rate for end of course exams. The impact will also be noted within classroom discussions as students will understand the content presented at a higher rate to perform in lab opportunities and other classroom activities. With implementing strategies consistently in classrooms across the school, district, and state, it will prove that English Language Learners can acquire the necessary vocabulary needed for success at a level like their non-ELL peers.

Observations of the teacher participants were insightful and were necessary in witnessing the fidelity of implementing the strategies. Observations completed during unit 1, unit 2, and unit 3 for all three teachers under the comprehensible input section of the modified SIOP form showed that there were clear explanations of the academic tasks and that the teachers' speech was appropriate for the student's proficiency level. Most teachers spoke at a slower rate, enunciated words often, and used a simple sentence structure when working directly with their ELL students. During observations, it was noted that teachers referenced the academic vocabulary charts and/or the interactive word wall consistently as they worked through lectures, labs, or cloze note packets. The ELLs were very nervous about biology class because "it is different in [their] countries," but they said now they feel more confident in getting through the school year and learning more of the content thanks to their teachers' implementing strategies for their success. All teacher participants noted that implementing the strategies with consistency and fidelity was helpful to their instruction because it aided the ELL participants in knowing what to expect in their classes for learning vocabulary.

ELLs have a better chance at success as they become more proficient with their academic vocabulary skills (Jackson et al., 2017). Direct instructional strategies such as an IWW that uses graphic organizers or data tables and highlight connections between academic vocabulary and concepts can increase students' ability to learn and successfully use academic language (Jackson et al., 2017). If a student presents with inadequate knowledge of the academic vocabulary taught, a gap in learning may exist as they continue to build new knowledge in the content area (Rasinski et al., 2017). Students mainly encounter content area vocabulary in the school setting; therefore, educators must determine how to help students master new academic vocabulary while teaching content knowledge.

Much is still unknown about which particular strategies and interventions prove most effective with secondary level students. When students move into American middle and high schools from their home countries, the expectations of learning in English-only instruction before acquiring language proficiency proves very difficult for this population. This study confirms the work of Hovey's findings that to help ELLs better understand the content and meaning of the English language, teachers should incorporate the background knowledge of their students into the classrooms (Hovey et al., 2019). No matter the content area taught, teachers should incorporate literacy strategies into their classrooms as ELLs are trying to learn a new language and absorb all the necessary content in English, their second language, simultaneously.

Limitations

While the interventions utilized in this study were advantageous to core content teachers and ELL students, the study is limited in several ways. One limitation arose from the execution of this qualitative case study. This limitation is due to only involving high school general education biology teachers who teach in one public school. The participants of this qualitative case study included three secondary biology teachers in a culturally and linguistically diverse public school in the Southeastern area of the United States. Therefore, the findings of this qualitative case study may not be representative of all biology high school teachers who teach in the Southeastern area of the United States or even biology teachers who teach in other parts of the United States. In addition to the teacher participants only teaching one subject, there was a limited number of teacher participants (three). This limited number of teacher participants did not represent the overall number of high school-specific content area teachers within the high school in the study. For student participants, there were only seven ELLs within this study, which is a small sample size in relation to the growing number of ELL students within the

district, state, and nation. In reference to the strategies implemented that proved effective for

ELLs' vocabulary knowledge, there are many other literacy strategies that can be implemented

within a general education secondary classroom to aid English learners in vocabulary

acquisition.

Recommendations

The recommendations for future research are based on the strengths, limitations, and

literature review of this study. This qualitative case study offered rich data about secondary

biology teachers' experiences with implementing vocabulary strategies into their instruction for

ELLs in their classrooms. This study was limited to only involving secondary biology general

education teachers who teach in public schools. My recommendation is that further research

should replicate this study in a larger number of high school biology classrooms across the state

or nation which differ in population from the school demographics in this study. Doing this will

allow schools from varying areas around the state and nation to determine the effectiveness of

the strategies presented in this study with their populations. It is also recommended that further

research should replicate this study with other core content areas in secondary settings. The

strategies utilized in this study can be easily replicated in all core content classrooms in a

secondary setting. Middle school and high school general education teachers who teach English,

math, science, and social studies in rural or urban schools might provide additional views about

implementing vocabulary strategies in their classrooms related to their ELLs' acquisition of the

core vocabulary taught. Future research should include replicating this study with core content

teachers within GVHS as only one subject area was considered for this study. Other research

with all content area teachers should be implemented within the state and nation in the same way

to determine the effectiveness of the use of these vocabulary strategies within different settings and subject matter.

Another recommendation for future research should include recruiting a higher number of teacher participants and student participants to include in the study. The analysis of data when there are more participants in a study may yield results that are reliable and valid among a larger population. This study also highlighted the importance of providing teachers with effective literacy strategies for teaching ELLs in the public-school setting. Many teachers do not feel adequately prepared to teach ELLs effectively as they have indicated that due to their teaching certain core classes, they do not incorporate true literacy skills within their classroom setting at the secondary level. Providing teachers with additional literacy strategies will enhance their skills and allow them to confidently teacher all students within their classrooms no matter the need. As this population grows in the US, schools and researchers need to address the ongoing need to support teachers with research-proven strategies that are easy to implement. Such additional data would be valuable for researchers and educators who want to explore further academic vocabulary instruction for ELLs in general education classrooms, specifically at the secondary level.

Teachers should deliver specific content while helping students develop connections and gain generalizable knowledge (Rosenshine, 1995). By presenting new material in small steps, guiding students as they practice, checking for their understanding of the material, and providing various learning presentations, ELLs should develop these connections for further learning (Rosenshine, 1995; Rodriguez et al., 2020). Of course, all of this can only happen after some level of language proficiency has occurred for the ELL student. When English learners have not attained language proficiency or cognitive academic skills one cannot expect them to thrive in

the classroom at the secondary level easily. Secondary educators must find a way to incorporate literacy strategies within content specific classes for ELLs for their mastery of the second language and the standards that are taught for each unit.

In designing future studies, the use of the action research process would be an opportunity for schools to use cycles of research to investigate the individual needs of their schools. The action research process encourages schools to identify a local problem (i.e., teaching strategies for ELLs), develop an action plan for the problem (i.e., implementing literacy strategies), evaluate the plan (i.e., post interviews and focus groups), analyze data, and begin the process all over again with a new plan for implementation. This cyclical process will create a continuous model for school improvement and staff development with the goal of solving a problem with success for all stakeholders. Implementing this process can solve and alleviate many issues that arise in school systems today.

Implications

This research led to easy-to-implement strategies capable of improving ELLs content acquisition in a general education biology classroom. At the national, state, and local levels standardized assessments and classroom education performance for ELL students have consistently second lower than their non-ELL peers. The improvement of classroom performance may lead to an increase ELLs' grades which in turn will allow them to earn a state high school diploma. The improvement of standardized assessment scores may also provide more opportunities for ELL students to take high level course while in high school and could provide more opportunities for them to have post-secondary opportunities. Thoroughly understanding the strategies needed to improve ELLs' content acquisition can benefit the ELL students, secondary level teachers, and local school districts.

The impact already seen at my school within these biology classrooms shows the overall success that these strategies have created. The student participants indicate they feel more confident in their learning, and the teacher participants indicated that they would continue using these strategies for other units taught in their classrooms. GVHS as well as Bluff Falls School District have seen a decrease in biology EOC scores for the past five years. Many ELL students within the school and district have indicated that they have difficulty with learning the English language at the same time as trying to master academic content. According to Cummins' theory of second language acquisition, it takes ELLs approximately two years to learn basic interpersonal communicative skills and five to seven years to acquire cognitive academic language proficiency. So, it should be easily understood as to why ELL students entering United States public schools at a secondary level struggle mightily in core content classes. Results of this study suggest that implementing literacy and language strategies within core content classrooms at a high school level is achievable in classroom settings. This research also shows that successfully aiding ELLs to obtain the necessary vocabulary needed for success or improvement in biology can be achievable. While the increase in individual scores from the pre-test to the post-test for each unit did not show a large gain in vocabulary knowledge for closing an achievement gap, it did show progress and a step in the right direction for ELL students and their learning. The strategies are simple to implement in any core content class at GVHS, Bluff Falls School District, and across the state and country.

Conclusion

The action research process taught me valuable lessons about conducting a research study and the learning of students and teachers in the process. Using a cyclical process such as a PDSA cycle in which you can reflect and problem-solve supports a school in investing time to identify a

specific problem or issue, finding a solution to the problem using theory and research, and then determining whether that solution was effective for the purpose of solving the problem. This study was a prime example of how the action research process can be implemented within a public-school setting and shows the potential impact that research can have within the setting to improve educational outcomes for all students. Through this process, I was able to provide teacher participants with vocabulary strategies to teach ELLs in obtaining academic vocabulary acquisition. After implementing the strategies, I realized the ease of adding literacy strategies to content-specific secondary classrooms through cycles of interventions that aided teachers and students in achieving success.

As an educator, discovering ways to impact my school, students, and faculty positively is always at the forefront of my mind. In this research study, I addressed one specific topic - that of providing general education biology teachers with vocabulary strategies for teaching the ELL students in their classrooms. This area of focus, is, unfortunately, only one of many areas of growth that our school and district seek to address with our ELL population, especially on a secondary level. This research experience has provided me with the tools necessary to approach other areas of concern and systematically set about providing solutions to these issues. I go forth in the process of working through concerns with students and teachers within my building with confidence as one of the student participants (student one) from this study reported through translation:

> I was helped so much in biology this year and I now understand more in school here. I was afraid to come to high school this year from my country, but you and my teachers made it better because you helped me to learn. Thank you for helping me and encouraging me.

Jose was able to gain confidence and understand how learning English and working hard in school would pay off for him in helping support his family. After three years of hard work, Jose will graduate from high school in June. He said that he is so glad he did not listen to his cousins when they encouraged him to drop out of school. Jose has plans to go to technical school in the fall.

References

Ardasheva, Y. & Tretter, T. (2012). Perceptions and use of language learning strategies among ESL teachers and ELLs. *TESOL Journal, 3*(4), 552-585.

Artiles, A. J., Kozleski, E. B., Trent, S. C., Osher, D., & Ortiz, A. (2010). Justifying and explaining disproportionality, 1968-2008: A critique of underlying view of culture. *Exceptional Children, 76*(3), 279-299.

August, D., Artzi, L., Barr, C., & Francis, D. (2018). The moderating influence of instructional intensity and word type on the acquisition of academic vocabulary in young English language learners. *Reading and Writing, 31*(4), 965-989. http://doi.org/10.1007/s11145-018-9821-1

Batalova, J., Fix M., & Murray, J. (2007). *Measures of change: The demography and literacy of adolescent English learners—A report to Carnegie Corporation of New York.* Washington, DC: Migration Policy Institute. https://www.migrationpoliy.org/pubs/Measures_of_Change.pdf

Bolos, N. (2012). Successful strategies for teaching reading to middle grades English language learners. *Middle School Journal (3), 44*(2), 14-20.

Brandes, D.R. & McMaster, K. L. (2017). A review of morphological analysis strategies on vocabulary outcomes with ELLs. *Insights into Learning Disability, 14*(1), 52-72.

Bryk, A. S., Gomez, L. M., Grunow, A., & LeMahieu, P. G. (2017). *Learning to improve how America's schools can get better at getting better.* Cambridge, Massachusetts: Harvard Education Press.

Calderon, M., Slavin, R., & Sanchez, M. (2011, Spring). Effective instruction for English

learners. *Future of Children, 21*(1), 103-127.

Callahan R, Gautsch L, Hopkins M, Unda M. (2022 July).*Equity and State Immigrant Inclusivity: English Learner Education in ESSA*, *36*(5), 1011-1053. https://doi.org/10.1177/0895904820925819

Carlo, M.S, August, D., McLaughlin, B., Snow, C. E., Dressler, C., Lippman, D. N., Lively, T.J., & White, C. E. (2004). Closing the gap: Addressing the vocabulary needs of English language learners in bilingual and mainstream classrooms. *Reading Research Quarterly, 39*(2), 188-215.

Chen, C. H., Hung, H. T., & Yeh, H. C. (2021). Virtual reality in problem-based learning contexts: Effects on the problem-solving performance, vocabulary acquisition and motivation of English language learners. Journal of Computer Assisted Learning, 37(3), 851-860. https://doi.org/10.1111/jcal.12528

Cole, M. W., Dunston, P. J., Butler, T. (2017). Engaging English language learners through interactive read-alouds: a literature review. *English Teacing: Practice and Critique, 16*(1), 97-108.

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches*. Sage.

Crosson, A. C. & Moore, D. (2017). When to take up roots: The effects of morphology instruction for middle school and high school English learners. *Reading Psychology, 38*(3), 262-288. https:///doi.org/10.1080/02702711.2016.1263699

Crosson, A. C., McKeown, M. G., Moore, D. W., & Ye, F. (2019). Extending the bounds of morphology instruction: Teaching Latin roots facilitates academic word learning for English learner adolescents. *Reading and Writing, 32*(3), 689-727.

https://doi.org/10.1007/s11145-018-9885-y

Counts, J. Katsiyannis, A., & Whitford, D. K. (2018). Culturally and linguistically diverse learners in special education: English learners. *National Association of Secondary School Principals, 102*(1), 5-21.

Cummins, J. (1979). Cognitive/academic language proficiency, linguistic interdependence, the optimum age question and some other matters. *Working Papers on Bilingualism, No. 19*, 121-129.

Cummins, Jim (1985). *Bilingualism and special education: Issues in assessment and pedagogy.* San Diego: College Hill.

Cummins, Jim (2016). Reflections on Cummins (1980), "The cross-lingual dimensions of language proficiency: Implications for bilingual education and the optimal age issue," *TESOL Quarterly, 50*(4), 940—944.

https://doi.org.librpoxy.clemson.edu/10.10.1002/tesq.339

DeCapua, A., Marshal, H. W., & Tang, L. F. (2020). *Meeting the needs of SLIFE: A guide for educators.* University of Michigan Press.

Deng, Q., Kiramba, L. K., & Viesca, K. M. (2021). Factors associated with novice general education teachers' preparedness to work with multilingual learners: A multilevel study. *Journal of Teacher Education,72*(4), 489-503.

Denton, C. A., Anthony, J. L., Parker, R. & Hasbrouk, J. E. (2004). Effects of two tutoring programs on the English reading development of Spanish-English bilingual students. *The Elementary School Journal, 104*(4), 289-305.

Denton, C. A., Wexler, J., Vaughn, S., & Bryan, D. (2008). Intervention provided to linguistically diverse middle school students with severe reading difficulties. *Learning*

Disability Research & Practice, 23(2), 79-89.

https://doi.org.libproxy.clemson.edu/10.1111/j.1540-5826.2008.002266.x

Doll, J.J., Eslami, Z., & Walters, L. (2013). Understanding why students drop out of high school, according to their own reports: Are they pushed or pulled, or do they fall out? A comparative analysis of seven nationally representative studies. *SAGE Open.* https://doi.org/10.1177/2158244013503834

Duran, B. J., Dugan, T., & Weffer, R. (1997). Language minority students in high school: the role of language in learning biology concepts. *Science Education*, *82*, 311-341.

Dussling, T. (2020) English language learners' and native English-speakers' spelling growth after supplemental early reading instruction. *International Journal of Education and Literacy Studies, 8*(1), 1-7.

Echevarria, J., Vogt, M. E., & Short, D. (2008). *Making content comprehensible for English language learners: The SIOP Model*. (3rd ed.). Boston, MA: Pearson Education, Inc.

Echevarría, J., Vogt, M., & Short, D. J. (2017). *Making content comprehensible for English Learners. The SIOP Model* (5th ed.). Upper Saddle River, NJ: Pearson, Education, Inc.

Education Commission of the States. (2020, May). *Education Commission of the States: a resource for state policy makers.* https://reports.ecs.org/comparisons/50-state-comparison-english-learner-policies-07

Febriani, S. R., Wargadinata, W., Arifin, Z. (2021). The philosophy of language acquisition in Stephen Krashen's theory based on multiple intelligences classrooms. *International Journal of Arabic Language Teaching.* https://repository.uin-malang.ac.id/8443/1/8443.pdf

Feiman-Nemser, S. (2001). From preparation to practice: Designing a continuum to strengthen and sustain teaching. *Teachers College Record, 103*(6), 1013-1055. https://bir.brandeis.edu/bitstream/handle/10192/33196/From%20Preparation%20to%20Practice-Feiman-Nemser-2.pdf

Ferlazzo, L. & Sypnieski, K. H. (2018). *The ELL Teacher's Toolbox: Hundreds of Practical Ideas to Support Your Students.* John Wiley & Sons.

Galloway, E. P. & Lesaux, N. (2015). Reading comprehension skill development and instruction for adolescent English language learners: A focus on academic vocabulary instruction. In *Improving Reading Comprehension of Middle and High School Students, 153-178.* Springer, Cham.

Gersten, R. & Baker, G. (2000). What we know about effective instructional practices for English language learners. *Exceptional Children, 66*(4), 454-470.

Gibson, C. (2016). Bridging English language learner achievement gaps through effective vocabulary development strategies. *English Language Teaching, 9*(9), 134-138.

Goodrich, J. M., Thayer, L., & Leiva, S. (2021). Evaluating achievement gaps between monolingual and multilingual students. *Educational Researcher, 50*(7), 429-441.

Graves, M. F., Baumann, J. F., Blachowicz, C. L., Manyak, P., Bates, A., Cieply, C., Davis, J. R., & Von Guten, H. (2014). Words, words everywhere, but which ones do we teach?. *The Reading Teacher, 67*(5), 333-346.

Grillo, R. J., & Dieker, L. A. (2013). A new twist on vocabulary instruction for students with learning disabilities in biology. *The American Biology Teacher, 75(*4), 264-267. https://doi.org/10.1525/abt.2013.75.4.7

Haager, D. & Osipova, A. V. (2017). Enhancing academic instruction for adolescent English language learners with or at risk for learning disabilities. *Insights into Learning Disabilities, 14*(1), 7-26.

Harmon, J. M., Wood, K. D., & Kiser, K. (2009). Promoting vocabulary learning with the interactive word wall. *Middle School Journal, 40*(3), 58-63.

Harry, B. & Klingner, J. (2006). *Why are so many minority students in special education? Understanding race and disability in schools.* Teachers College Press, Columbia University.

Hawkins, R. O., Hale, A. D., Sheeley, W., & Ling, S. (2011). Repeated reading and vocabulary-previewing interventions to improve fluency and comprehension of struggling high-school readers, *Psychology in the Schools, 48*(1), 59-77.

Herrera, L. J. (2018). ESOL urban high school teachers' perceptions of their instructional strengths and challenges: A qualitative multi-case study. *Dialogues: An Interdisciplinary Journal of English Language Teaching and Research, 2*(1), 1-21.

Hill, J. D., & Flynn, K. M. (2007). *Classroom instruction that works with English language learners.* Association for Supervision and Curriculum Development.

Hovey, K. A., Miller, R. D., Kiru, E. W., Gerzel-Short, L., Wei, Y., & Kelly, J. (2019). What's a middle school teacher to do? Five evidence-based practices to support English learners and students with learning disabilities. *Preventing School Failure, 63*(3), 220-226.

Irby, B. J., Lara-Alecio, F., Tong, F., & Guerrero, C (2018). Implementation of research-based ell strategies with lower grade middle school ELLs in the science classroom: findings from an experimental study. *The Electronic Journal for English as a Second Language, 22*(1), 1-25.

Irvin, V., Zhang, J., Wang, X., Hein, S., Wang, K., Roberts, A., York, C., Barmer, A., Bullock
Mann, F., Dilig, R., & Parker, S. (2021). Report on the Condition of Education 2021
(NCES 2021-144). U.S. Department of Education. Washington, DC: National Center for
Education Statistics. https://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2021144

Ivankova, N. (2015). *Mixed methods applications in action research: From methods
to community action*. Thousand Oaks, CA: Sage.

Jackson, J. (2018). Building an interactive word wall. *The Science Teacher, 85*(1), 42-46.

Jackson, J. S. & Ash, G. (2012). Science achievement for all: Improving science performance
and closing achievement gaps. *Journal of Science Teacher Education, 23*(7), 723-744.

Jackson, J. & Narvaez, R. (2013). Interactive word walls. *Science and Children, 51(*1), 42.

Jackson, J. & Durham, A. (2106). Put your walls to work: Planning and using interactive word
walls to support science and reading instruction. *Science and Children, 54*(3), 78-84.

Jackson, J., Wise, E., Zurbuchen, K., & Gardner, N. (2017). Interactive word walls: Visual
scaffolds that transform vocabulary instruction. *Science Scope, 40*(9), 72.

Jimenez-Johnson, C. (2021). *Teachers' perspectives on how one-to-one devices influence their
English language learners' academic experience*. [Doctoral dissertation, Seton Hall
University]. ProQuest Disserations and Theses Global.

Kieffer, M. J. & Vukovic, R. K. (2012). Components and Context: Exploring Sources of Reading
Difficulties for Language Minority Learners and Native English Speakers in Urban
Schools. *Journal of Learning Disabilities, 45*(5), 433-452. https://doi-
org.libproxy.clemson.edu/10.1177/0022219411432683

Kim, W. & Linan-Thompson, S. (2013). The effects of self-regulation on science vocabulary
acquisition of English language learners with learning difficulties. *Remedial and Special*

Educatio, 34(4), 225-236.

https://doi.org.libproxy.clemson.edu/10.1177/0741932513476956

Klingner, J. K., Artiles, A. J., & Barletts, L. M. (2006). English language learners who struggle

with reading: Language acquisition or LD? *Journal of Learning Disabilities, 39* (2), 108-

128. https://doi.org.libproxy.clemson.edu/10.1177/00222194060390020101

Krashen, S. (1982). *Principles and practice in second language acquisitio*n (1st ed.,

Language teaching methodology series). Oxford; New York: Pergamon.

Krashen, S.D. (1994). Bilingual education and second language acquisition theory. In bilingual

Education Office (ed.) Schooling and language-minority students: A theoretical

framework (2nd ed., pp. 47-75). Los Angeles: Evaluation Dissemination and Assessment

Center, California State University.

Krashen, S. D. (2015). Remarks on language acquisition and literacy: Language acquisition and

teaching, free reading, test-prep" and its consequences, the use of the first language,

writing, and the great native speaker teacher debate. Indonesian JELT, 10(1), 1-17.

https://doi.org/10.25170/ijelt.v10i1.1505

Lesaux, N. K. & Geva, G. (2006). Synthesis: Development of literacy in language-minority

students. In August, D. & Shanahan, T. (Eds.), *Developing reading and writing in

second-language learners* (75-123).

Linan-Thompson, S., Vaughn, S., Prater, K., & Cirino, P. T. (2006). The response to intervention

of English learners at risk for reading problems. *Journal of Learning Disabilities, 39,*

390-398.

Malone, J. (2018). Incidental academic vocabulary learning in SLA: Effects of frequency, aural, enhancement, and working memory. Studies in Second Language Acquisition, 40(3), 651-675. https://doi.org/10.1017/S0272263117000341

Mertler, C. (2016). *Action research:Improving schools and empowering educators* (Fifth ed.). Thousand Oaks, CA: Sage.

Menken, K., Kleyn, T., & Chae, N. (2007). *Meeting the needs of long-term English language learners in high school* (A report for the Office of English Language Learners on the New York City Department of Education). New York: Research Institute for the Study of Language in an Urban Society. https://katemenken.files.wordpress.com/2011/10/ltell-report-phase-i-final.pdf

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative data analysis: A methods sourcebook* (3rd ed.). Sage.

Miller, R. D. (2016). Contextualizing instruction for English language learners with learning disabilities. *Teaching Exceptional Children, 49*(1), 58-65.

Miller, R. D. & Katsiyannis, A. (2014). Students with limited English proficiency: Legal considerations. *Intervention in School and Clinic, 50*(2), 121-124.

Miller, R. D., Mackiewicz, S. M., Correa, V. I. (2017). A multi-modal intervention for English language learners: Preliminary results. *Education and Treatment of Children, 40*(2), 209-232.

Milner, R. H., IV (2020). *Start where you are, but don't stay there: Understanding diversity, opportunity gaps, and teaching in today's classrooms* (2nd ed.). Harvard Education Press.

Moser, K., Zhu, D., Nguyen, H., & Williams, E. (2018). Teaching English language learners: A mainstream response to rural teacher preparation. *International Journal of Teacher Education and Professional Development (IJTEPD), 1*(1), 58-75.

National Center for Education Statistics (2000). *The condition of education*. United States Department of Education, Office of Educational Improvement and Research. https://nces.ed.gov/pubs2000/2000062.pdf

National Center for Education Statistics (2022). *Nation's report card*. https://www.nationsreportcard.gov/reading/nation/groups

No Child Left Behind Act of 2001, P.L. 107-110, 20 U.S.C. § 6319 (2002). https://www.congress.gov/bill/107th-congress/house-bill/1

Office of English Language Acquisition (September 2018). *English Learner (EL)Trends from the Nation's Report Card*. https://ncela.ed.gov/files/fast_facts/ELs-NAEP_Card.pdf.

Office of English Language Acquisition (September 2018). *National and State-Level High School Graduation Rates for English Language Learners.* https://ncela.ed.gov/files/fast_facts/GraduationRatesFactSheet.pdf

Office of English Language Acquisition (February 2020). *English Learners: Demographic Trends*. https://www.ncela.ed.gov/files/fast_facts/19-0193_Del4.4_ELDemographicTrends_021220_508.pdf

Office of English Language Acquisition (January 2021). *Profile of English Learners in the United States.* https://ncela.ed.gov/sites/default/files/fast_facts/DEL4.4_ELProfile_508_1.4.2021_OELA.pdf

Office of Elementary and Secondary Education (May 2020). *Title III Language Instruction for English Learners and Immigrants. https://oese.ed.gov/offices/office-of-formula-grants/school-support-and-accountability/essa-legislation-table-contents/title-iii-part-a/#TITLE-III-PART-A*

Oliver, R. & Azkarai, A. (2017). Review of child second language acquisition (SLA): Examining theories and research. *Annual Review of Applied Linguistics, 37*, 62-76.

Olsen, L. (2014). *Meeting the unique needs of long-term English language learners: A guide for administrators.* National Education Association.

file:///Users/vperry/Downloads/LongTermEngLangLearner-NEA.pdf

Plano Clark, V. & Creswell, J. (2015). *Understanding research: A consumer's guide.* Upper Saddle River, NJ. Pearson Education.

Prince, J. (2017). English language learners in a digital classroom. CATESOL Journal, 29(1), 51-73. https://eric.ed.gov/?id=EJ1144336

Quintero, D. & Hansen, M. (2017). English learners and the growing need for qualified teachers. *Brown Center Chalkboard.*

Raju, N. & Joshith, V. P., (2018). Krashen's theory of second language acquisition: A practical approach for English language classrooms. *International Journal of Innovative Knowledge Concepts, 6*(12), 186-291.

Rasinski, T., Padak, N., & Newton, J. (2017). The roots of comprehension. Literacy, 74(5), 41-45.

https://www.wagnerhigh.net/ourpages/auto/2015/2/2/52792377/THE%20ROOTS%20OF%20COMPREHENSION.pdf

Richards-Tutor, C., Baker, D. L., Gersten, R., Baker, S. K., & Smith, J. M. (2016). The effectiveness of reading interventions for English learners: A research synthesis. *Exceptional Children, 82*(2), 144-169.

Ripperger, A. (2021, February 2). *The power of PDSA in education.* The W. Edwards Deming Institute. https://deming.org/the-power-of-pdsa-in-education/

Robertson, K. & Lafond, S. (2008). How to support ELL students with interrupted formal education (SIFEs). https://www.colorincolorado.org/article/how-support-ell-students-interrupted-formal-education-sifes?theme=print

Rodriguez, D., Carrasquillo, A., Garcia, E., & Howitt, D. (2020). Factors that challenge English learners and increase their dropout rates: recommendations from the field. *International Journal of Bilingual Education and Bilingualism,* 1-17. https://doi.org/10.1080/13670050.2020.1722059

Rosenshine, B. (1995). Advances in research on instruction. *The Journal of Educational Research, 88*(5), 262-268.

Ross, D.B. & Ziemke, L. (2016). Promising literacy practices for students with interrupted formal education in achieving competence with academic language across disciplines. *The Florida Reading Journal, 51*(3), 48-56.

Saldaña, J. (2013). *The coding manual for qualitative researchers* (2nd ed.). SAGE.

Shanahan, T. & Beck, I. L. (2006). Effective literacy teaching for English-language learners. In August, D., & Shanahan, T., (Eds.), *Developing reading and writing in second-language learners* (415-489). Mahwah, New Jersey; Lawrence Erlbaum Associates.

Shim, J. M., & Shur, A. (2018). Learning from ELLs perspectives: Mismatch between ELL and teacher perspectives on ELL learning experiences. English Language Teaching, 11(1),

21-32. https://files.eric.ed.gov/fulltext/EJ1162483.pdf 151 http://doi.org/:10.5539/ elt.v11n1p21

Short, D. J., & Fitzsimmons, S. (2007). *Double the work: challenges and solutions to acquiring language and academic literacy for adolescent English language learners.* A report to Carnegie Corporation of New York. Alliance for Excellent Education

Sibold, C. (2011). Building English language learners' academic vocabulary: strategies and tips. *Multicultural Education, 18*(2), 24-28.

Snow, C. (2006). Cross-cutting themes and future research directions: In August, D., & Shanahan, T., (Eds.). *Developing reading and writing in second-language learners* (631-653). Mahwah, New Jersey: Lawrence Erlbaum Associates.

Snow, C. E., Lawrence, J. F., & White, C. (2009). Generating knowledge of academic language among urban middle school students. *Journal of Research on Educational Effectiveness*, 2(4), 325–344.

Snyder, E. Witmer, S. E., & Schmitt, S. (2017). English language learners and reading instruction: A review of the literature. *Preventing School Failure, 61*(2), 136-145.

Solari, E. J., Petscher, Y., & Sidler Folsom, J. (2012). Differentiating literacy growth of ELL students with LD from other high-risk subgroups and general education peers: Evidence from grades 3-10. *Journal of Learning Disabilities,* XX, 1-20. https://doi-org.libproxy.clemson.edu/10.1177/0022219412463435

South Carolina Department of Education (2012). South Carolina and the common core state standards initiative. https://media.clemson.edu/education/common-core-documents/SC_and_CCSS_Parent_Information_Pamphlet.pdf

South Carolina Department of Education. (2016-2020). *Student counts with disability by district for five years.* [Unpublished raw data].

South Carolina Department of Education (2017-2018). https://ed.sc.gov/data/test-scores/state-assessments/sc-ready/2018/

South Carolina Department of Education (2022). https://ed.sc.gov/tests/elementary/access-for-ells/

South Carolina Department of Education (2022). https://ed.sc.gov/tests/middle/sc-ready/performance-levels/

South Carolina Schools K-12 Technology Initiative (2022). https://sck12techinit.sc.gov/about-us/profile-south-carolina-graduate

Syrja, R. C. (2011). *How to reach & teach English language learners*. Jossey-Bass.

Tam, K. Y., Heward, W. L., & Heng, M. A. (2006). A reading instruction intervention program for English-language learners who are struggling readers. *The Journal of Special Education, 40*(2), 79-93. https://doi-org.libproxy.clemson.edu/10.1177/00224669060400020401

Thompson, S. (2019). Perspectives on English language learner programs: A case study. Linwood University. https://search.proquest.com/openview/c3923907e92d23668ca29be7e6d22e77/1?p q-origsite=gscholar&cbl=18750&diss=y

Trahey, M. & Spada, N. (2020). Focusing on language and content with adolescent English language learners in the mainstream classroom. *Canadian Modern Language Review, 76*(3), 218-242.

Tufford, L., & Newman, P. (2012). Bracketing in Qualitative Research. *Qualitative*

Social Work, *11*(1), 80–96.

Turkan, S., & de Jong, E. J. (2018). An exploration of preservice teachers reasoning about teaching mathematics to English language learners. Teacher Education Quarterly, 45(2), 37-60. https://files.eric.ed.gov/fulltext/EJ1175525.pdf

Umansky, I. M., & Dumont, H. (2021). English language labeling: how English learner classification in kindergarten shapes teacher perceptions of student skills and the moderating role of bilingual instructional settings. *American Education Research Journal, 58*(5), 993-1031.

United States Department of Education (2015). *Every Student Succeeds Act*. https://www.ed.gov/essa?src=rn

Uribe, S. N. (2019). Curriculum-based readers theatre as an approach to literacy and content area instruction for English language learners. *Reading and Writing Quarterly, 35*(3), 243-260.

Vaughn, S., Mathes, P. G., Linan-Thompson, S., & Francis, D. J. (2005). Teaching English learners at risk for reading disabilities to read: putting research into practice. *Learning Disabilities Research & Practice, 20*(1), 58-67.

Villegas, A. M. (2018). Introduction to "Preparation and development of mainstream teachers for today's linguistically diverse classrooms." *Educational Forum, 82*(2), 131-137.

Vintinner, J. P., Harmon, J., Wood, K., & Stover, K. (2015). Inquiry into the efficacy of interactive word walls with older adolescent learners. *The High School Journal, 98*(3), 250-261.

Vogt, M. (2020). Academic language and literacy development for English Learners. In A. S. Dagen & R. M. Bean (Ed.), *Best Practices of Literacy Leaders, Second Edition: Keys to School Improvement.* The Guildford Press. Co-published by International Literacy Association.

Weisner-Groff, A. (2021). [Lecture notes on SIOP teaching strategies]. https://study.com/academy/lesson/siop-teaching-strategies.html

Winters, R. (2009). Interactive frames for vocabulary growth and word consciousness. *The Reading Teacher, 62*(8), 685-690.

Zarifi, A. & Taghavi, A. (2016). The impact of cooperative learning on grammar learning among Iranian intermediate EFL learners. *Theory and Practice in Language Studies, 6*(7), 1429.

Zwiers, J. (2008). *Building academic language: Essential practices for content classrooms*. San Francisco: Jossey-Bass.

Appendix A

Table 1 - *Average Reading Scores and Achievement Levels of 4th, 8th, 12th grade Students on NAEP*

Demographic	School Year	Average - Reading Score	NAEP Achievement Level
4th grade ELL	2014-2015	189	Below Basic
4th grade non-ELL	2014-2015	226	Between Basic and Proficient
4th grade ELL	2016-2017	189	Below Basic
4th grade non-ELL	2016-2017	226	Between Basic and Proficient
4th grade ELL	2018-2019	191	Below Basic
4th grade non-ELL	2018-2019	224	Between Basic and Proficient
8th grade ELL	2014-2015	223	Between Basic and Proficient
8th grade non-ELL	2014-2015	268	Between Basic and Proficient
8th grade ELL	2016-2017	226	Between Basic and Proficient
8th grade non-ELL	2016-2017	269	Between Basic and Proficient
8th grade ELL	2018-2019	221	Between Basic and Proficient
8th grade non-ELL	2018-2019	266	Between Basic and Proficient
12th grade ELL	2014-2015	240	Below Basic
12th grade non-ELL	2014-2015	289	Between Basic and Proficient
12th grade ELL	2016-2017	No Data Available	—-------------
12th grade non-ELL	2016-2017	No Data Available	—-------------
12th grade ELL	2018-2019	235	Below Basic
12th grade Non-ELL	2018-2019	288	Between Basic and Proficient

Appendix B

Table 2 - *Biology 1 End of Course Distribution of Scores Across South Carolina- Demographics*

Demographic	Year	# of students	Mean Score	% A	% B	% C	% D	% F
LEP	2014-2015	2550	75.8	16.6	14.8	17.1	16	35.5
Non-LEP	2014-2015	52253	82.6	33.5	16.6	16.2	12.1	21.7
LEP	2015-2016	2971	75.7	17.1	12.4	17.8	15.5	37.3
Non-LEP	2015-2016	54393	81.9	33.4	14.1	16.3	12.5	23.6
LEP	2016-2017	3301	67.3	17.6	11.5	13.5	17.3	40.1
Non-LEP	2016-2017	56083	75.7	33	13.1	14.2	14.2	25.5
LEP	2017-2018	3788	63.1	7.9	10.9	14.9	19.8	46.6
Non-LEP	2017-2018	52950	70.0	16.8	16.6	16.8	18.1	31.6
LEP	2018-2019	4672	65.43	11.86	10.19	16.87	21.32	39.77
Non-LEP	2018-2019	52849	69.05	16.5	13.34	17.91	20.06	32.19

Appendix C

Table 3 - *Biology 1 EOC scores 2020-2021 (scores did not count towards final grade)*

	Year	# of students	Mean Score	% A	% B	% C	% D	% F
State LEP	2020-2021	2766	52.22	2.28	3.25	6.44	13.92	74.11
State Non-LEP	2020-2021	48763	66.01	14.87	10.77	15.23	18.27	40.87
District LEP	2020-2021	113	49.75	0	3.54	2.65	10.62	83.19
District Non-LEP	2020-2021	2595	62.35	8.29	9.36	15.49	19.04	47.52
School LEP	2020-2021	26	52.88	0	3.85	7.69	19.23	69.23
School Non-LEP	2020-2021	576	67.60	14.24	13.89	17.01	20.66	34.20

Appendix D

Table 3 - *Biology 1 End of Course Distribution of Scores Across the Bluff Falls School District and Green Valley High School*

	Year	# of students	Mean Score	% A	% B	% C	% D	% F
District LEP	2014-2015	72	79.0	21	20	10	20	29
District Non-LEP	2014-2015	1750	86.1	44.6	15.9	14.6	8.7	16.2
School LEP	2014-2015	25	81.7	32	12	16	20	20
School Non-LEP	2014-2015	473	88.5	50.5	17.1	12.7	9.1	10.6
District LEP	2015-2016	57	77.1	26.3	8.8	14	8.8	42.1
District Non-LEP	2015-2016	1697	88	49.7	16.1	14.1	8.9	11.2
School LEP	2015-2016	7	81.5	3	0	0	0	4
School Non-LEP	2015-2016	356	92.9	68.5	12.9	10.4	3.7	4.5
District LEP	2016-2017	77	66.1	10.4	14.3	13.0	23.4	39.0
District Non-LEP	2016-2017	1926	79.4	40.0	13.7	14.0	13.0	19.3
School LEP	2016-2017	12	71.8	8.3	16.7	25.0	41.7	8.3
School Non-LEP	2016-2017	485	82.0	44.5	14.8	13.2	11.3	16.1
District LEP	2017-2018	105	63.2	7.6	8.6	17.1	20.0	46.7
District Non-LEP	2017-2018	1902	73.0	19.8	18.5	20.3	18.6	22.8
School LEP	2017-2018	27	67.1	14.8	11.1	11.1	25.9	37.0

School Non-LEP	2017-2018	478	76.1	23.2	20.5	21.3	19.9	15.1
District LEP	2018-2019	100	67.62	13.0	18.0	11.0	19.0	39.0
District Non-LEP	2018-2019	1769	73.79	21.48	16.17	20.92	20.86	20.58
School LEP	2018-2019	38	70.87	15.79	23.68	10.53	23.68	26.32
School Non-LEP	2018-2019	506	73.32	17.79	15.61	24.11	24.31	18.18

- NOTE: During the years of 2015-2016 and 2016-2017, data did not reflect the accurate number of students that were listed as participating in ESOL classes

Appendix E

Fishbone Diagram

Instructional Strategies
- Lack of literacy skills taught (teacher)
- Lack of teacher knowledge of strategies to implement
- Time to teach lit skills & content

2nd lang acquisition
- Amount of time in American schools
- Amount of time for CALP
- Content overload - English only instruction on sec level

ELLs
- Lack of motivation
- Frustration in content classes due to CALP

Low achievement for ELLs on Bio EOC
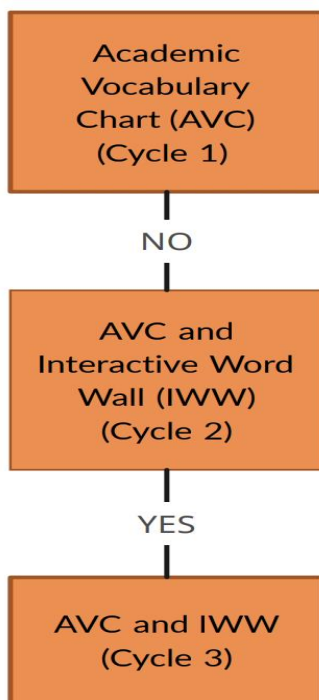
Appendix F

Flow Chart for Intervention Cycles 1-3

AVC = Academic Vocabulary Chart
IWW = Interactive Word Wall

The first cycle of intervention began with implementing an Academic Vocabulary Chart (AVC). Students took a pre-test for vocabulary knowledge prior to the implementation of the first strategy and a post-test of vocabulary knowledge after the first biology unit is taught. The students were successful with the implementation of the AVC. However, teachers did not feel their ELL students gain great academic vocabulary knowledge with the first biology unit. Therefore, the use of an AVC in addition to an Interactive Word Wall (IWW) will be implemented for the second cycle of intervention.

Continuing with the cycle two of intervention, the IWW plus the AVC proved to be successful for the ELLs gaining in vocabulary knowledge. Five of the seven ELL student participants increased their scores from the pre- to the post-test to determine their vocabulary knowledge. Therefore, the IWW along with the AVC will continue to be paired for use into cycle three of intervention.

The third cycle of intervention continued with the use of the AVC and IWW being implemented simultaneously. Both of these strategies proved successful as six of the seven ELL students increased their pre- to post-test scores for vocabulary knowledge acquisition.

Appendix G

Teacher Consent Form

USE OF VOCABULARY STRATEGIES IN A HIGH SCHOOL SCIENCE CLASSROOM WITH ENGLISH LANGUAGE LEARNERS

KEY INFORMATION ABOUT THE RESEARCH STUDY

Voluntary Consent: Virginia Perry is inviting you to volunteer for her dissertation research study. Mrs. Perry is a doctoral student at Clemson University. Mrs. Perry is conducting this study to examine what strategies can be utilized in the general education classroom to help English language learners increase their academic language proficiency skills and performance on state examinations. This study is being conducted under the direction of Dr. Reginald Wilkerson, assistant professor at Clemson University and chair of Mrs. Perry's dissertation committee.

You may choose not to participate and if you do choose to participate you may also choose to stop participating at any time. You will not be punished in any way if you decide not to participate in this study or if you stop participating in the study. Participation is voluntary and the only alternative is to not participate in the study.

Study Purpose: The purpose of this dissertation research study is to examine if the strategies employed in a general education science classroom aid English language learners in academic language proficiency and increase performance on state standardized assessments.

Activities and Procedures: Your part in the study will be to consent to participating in individual interviews with the Principal Investigator as well as participating in classroom observations. These interviews will be conducted at your convenience and will be directed by a set of interview questions referred to as an interview guide. You will also be asked to verify your portion of the interview(s) to determine the accuracy of any transcribed data.

Participation Time: It will take approximately 9 months or the majority of the 2022-2023 school year to participate in this study.

Risks and Discomfort: The researcher is not aware of any risks or discomforts to you as you participate in this research study.

Possible Benefits: You may not benefit directly from taking part in this study; however, the knowledge that you contribute and gain may enhance the achievement of English language learners by aiding in the academic language proficiency process. In addition, your contribution may further benefit the educational community at a local level, the state level, and the national level as we seek to understand English language learners, their challenges, and the ways that we can affect their academic success in American public schools.

AUDIO/VIDEO RECORDING/PHOTOGRAPHS

Interviews will be audio-recorded and transcribed. You will receive a copy of all transcribed documents to verify for accuracy. These recordings will be securely kept for 5 years and then paper documents will be shredded and electronic documents will be erased.

EQUIPMENT AND DEVICES THAT WILL BE USED IN THE RESEARCH STUDY

The ZOOM platform will be used to record interviews. I do not foresee any risk to you, the participant, by using these devices however, care will be taken to ensure your comfort. If you experience any discomfort alternative measures will be employed.

PROTECTION OF PRIVACY AND CONFIDENTIALITY

The results of this study may be published in scientific journals, professional publications, or educational presentations.

All study participants will be assigned a pseudonym to mask their identity during interviews and observations.

- Identifiable information collected during the study will be removed and the de-identified information could be used for future research studies or distributed to another investigator for future research studies without additional informed consent from the participants or legally authorized representative.

COUNSELING INFORMATION

In the event that you experience a negative reaction from participating in this study, notify the researcher immediately. Should you need to connect with someone, consider the following confidential resources:

- Mental Health America of Greenville County's CRISIS line: 864) 271-8888. Free, 24/7
- crisis phone line.
- Crisis Chat: http://www.crisischat.org/, free chat line available 2PM to 2AM, 7
- days/week.
- Crisis Text Line: Text "START" to 741-741, service is free through most major phone
- service carriers and available 24/7.
- National Sexual Assault Online Hotline: http://apps.rainn.org/ohl-bridge/, free, 24/7
- online chat service.
- Contact a mental health professional of your choice, at your own expense.

CONTACT INFORMATION

If you have any questions or concerns about your rights in this research study, please contact the Clemson University Office of Research Compliance (ORC) at 864-656-0636 or irb@clemson.edu. If you are outside of the Upstate South Carolina area, please use the ORC's toll-free number, 866-297-3071. The Clemson IRB will not be able to answer some study-specific questions. However, you may contact the Clemson IRB if the research staff cannot be reached or if you wish to speak with someone other than the research staff.

If you have any study-related questions or if any problems arise, please contact Mrs. Virginia Perry at 828-242-XXXX or vsperry@g.clemson.edu

CONSENT

By participating in the study, you indicate that you have read the information written above, been allowed to ask any questions, and you are voluntarily choosing to participate in this research. You do not give up any legal rights by taking part in this research study.

A copy of this form will be given to you.

    Participant's signature: _____   Date:_____

    Print name: _____

    A copy of this form will be given to you.

Appendix H

Active Informed Consent for Student Participation in Research Studies

August 19, 2022

Dear Parent or Guardian:

I am conducting a study titled **USE OF VOCABULARY STRATEGIES IN A HIGH SCHOOL SCIENCE CLASSROOM WITH ENGLISH LANGUAGE LEARNERS** and am requesting permission for your child to participate in this study. I included a brief description of the study, as well as any anticipated risks, below.

You should know that participation in this study is completely optional. Any data collected as part of this study, including your child's name and other identifiable information, is kept strictly confidential and used only for the purposes of this research study.

Please read the study information carefully and return the permission form as soon as possible. Completed forms should be returned to Virginia Perry at school.

Study Description, Potential Risks, and Timeline

KEY INFORMATION ABOUT THE RESEARCH STUDY

Voluntary Consent: Virginia Perry is inviting your child to volunteer for her dissertation research study. Mrs. Perry is a doctoral student at Clemson University and a school psychologist at your child's school. Mrs. Perry is conducting this study to examine what vocabulary strategies can be utilized in the general education classroom to help English language learners increase their academic language proficiency skills and performance on state examinations.

You may choose for your child not to participate and you may choose for your child to stop participating at any time. Your child will not be punished in any way if he/she decides not to participate in the study or if you would like for he/she to stop participating in the study. Participation is voluntary and the only alternative is to not participate in the study.

Study Purpose: The purpose of this dissertation research study is to examine if the vocabulary strategies employed in a general education science classroom aid English language learners in academic language proficiency and increase performance on state standardized assessments.

Activities and Procedures: Your part in the study will be to consent for your child to participate in focus group interviews with other English language learners with Mrs. Perry. These focus group interviews will be conducted at your child's convenience and will be directed by a set of interview questions referred to as an interview guide.

In the group discussion, we will ask your child not to share any information that may be personal or embarrassing if other participants in the group repeated what was said after the discussion ends. Your child may refuse to answer any questions or leave the discussion at any time if he/she becomes uncomfortable.

Classroom observations will take place throughout the study but will focus on the strategy being implemented within the classroom, not on your student's performance. Interventions will be implemented throughout the school year paired with the science units taught. Each science unit will include different literacy interventions for implementation.

At the beginning and end of each science unit, I will ask your student to complete a short vocabulary formative assessment. These assessments will not be used to calculate your child's grade in his/her science class.

Participation Time: It will take approximately 9 months or the majority of the 2022-2023 school year to participate in this study.

Risks and Discomfort: The researcher is not aware of any risks or discomforts to your child as he/she participates in this research study.

Possible Benefits: Your child may not benefit directly from taking part in this study; however, your child's participation in this study may enhance his/her achievement in the academic language proficiency process. In addition, your child's contribution may further benefit the educational community at his/her school as they seek to understand English language learners, their challenges, and the ways that they can affect academic success in American public schools.

S.C. MANDATORY REPORTING LAW
The research team includes individuals who are mandatory reporters. Your family's personal information may be disclosed if required by law. This means that there may be rare situations that require us to release personal information about your family, e.g., in case a judge requires such release in a lawsuit or if your child tell us of their intent to harm themselves or others (including reporting behaviors consistent with child abuse or neglect). In accordance with S.C. Code §63-7-310, we are required to report child abuse or neglect.

AUDIO/VIDEO RECORDING/PHOTOGRAPHS

Focus group interviews at the beginning and ending of the study will be audio-recorded and transcribed. Your child will receive a copy of all transcribed documents to verify for accuracy. These recordings will be securely kept for not more than two years and then paper documents will be shredded and electronic documents will be erased. Transcriptions will not be identifiable by name. All identifiable information will receive a code. Data collected from the audio recordings may be used in conference presentations or journal publications and will also be shared with the school district in written form. Data collected from audio recordings will not be identified by name. Information shared with the school district will include results of the completed research study. The data collected in this process will not be identifiable by name or location.

EQUIPMENT AND DEVICES THAT WILL BE USED IN THE RESEARCH STUDY

The ZOOM platform will be used to record focus groups. I do not foresee any risk to your child, the participant, by using these devices, however, care will be taken to ensure his/her comfort. If your child experiences any discomfort alternative measures will be employed.

PROTECTION OF PRIVACY AND CONFIDENTIALITY

The results of this study may be published in scientific journals, professional publications, or educational presentations.

All study participants will be assigned a pseudonym to mask their identity during interviews and observations.

- Identifiable information collected during the study will be removed and the de-identified information could be used for future research studies or distributed to another investigator for future research studies without additional informed consent from the participants or legally authorized representative.

COUNSELING INFORMATION

In the event that your child experiences a negative reaction from participating in this study, notify the researcher immediately. Should your family need to connect with someone, consider the following confidential resources:

- Mental Health America of Greenville County's CRISIS line: 864) 271-8888. Free, 24/7 crisis phone line.
- Crisis Chat: http://www.crisischat.org/, free chat line available 2PM to 2AM, 7 days/week.
- Crisis Text Line: Text "START" to 741-741, service is free through most major phone service carriers and available 24/7.
- National Sexual Assault Online Hotline: http://apps.rainn.org/ohl-bridge/, free, 24/7 online chat service.
- Contact a mental health professional of your choice, at your own expense.

CONTACT INFORMATION

If you have any questions or concerns about your child's rights in this research study, please contact the Clemson University Office of Research Compliance (ORC) at 864-656-0636 or irb@clemson.edu.

If your student has any study-related questions or if any problems arise, please contact Mrs. Virginia Perry at 803-821-XXXX.

CONSENT
By allowing your child to participate in the study, you indicate that you have read the information written above, been allowed to ask any questions, and you are voluntarily choosing for your child to take part in this research. You do not give up any legal rights by having your child take part in this research study.

Print child's name: _____

Print parent/guardian's name: _____

Parent/guardian's signature: _____ Date: _____

Thank you for your consideration.

Sincerely,

_____

Virginia Perry

Appendix H Continued

Consentimiento informado activo para la participación del estudiante en estudios de investigación

19 de agosto de 2022

Estimado padre o tutor:

Estoy realizando un estudio titulado **USE OF VOCABULARY STRATEGIES IN A HIGH SCHOOL SCIENCE CLASSROOM WITH ENGLISH LANGUAGE LEARNERS** y solicito permiso para que su hijo participe en este estudio. Incluí una breve descripción del estudio, así como los riesgos anticipados, a continuación.

Debe saber que la participación en este estudio es completamente opcional. Todos los datos recopilados como parte de este estudio, incluido el nombre de su hijo y otra información identificable, se mantienen estrictamente confidenciales y se utilizan únicamente para los fines de este estudio de investigación.

Lea atentamente la información del estudio y devuelva el formulario de autorización lo antes posible. Los formularios completos deben devolverse a Virginia Perry en School.

Descripción del estudio, riesgos potenciales y cronograma

INFORMACIÓN CLAVE SOBRE EL ESTUDIO DE INVESTIGACIÓN

Consentimiento voluntario: Virginia Perry está invitando a su hija a ser voluntaria en su estudio de investigación de tesis. La Sra. Perry es estudiante de doctorado en la Universidad de Clemson y psicóloga escolar en la escuela de su hijo. La Sra. Perry está realizando este estudio para examinar qué estrategias de vocabulario se pueden utilizar en el salón de clases de educación general para ayudar a los estudiantes del idioma inglés a aumentar sus habilidades académicas de dominio del idioma y su rendimiento en los exámenes estatales.

Puede elegir que su hijo no participe y puede elegir que su hijo deje de participar en cualquier momento. Su hijo no será castigado de ninguna manera si decide no participar en el estudio o si desea que deje de participar en el estudio. La participación es voluntaria y la única alternativa es no participar en el estudio.

Propósito del estudio: El propósito de este estudio de investigación de tesis es examinar si las estrategias de vocabulario empleadas en un salón de clases de ciencias de educación general ayudan a los estudiantes del idioma inglés en el dominio del idioma académico y aumentan el rendimiento en las evaluaciones estandarizadas del estado.

Actividades y procedimientos: Su parte en el estudio será dar su consentimiento para que su hijo participe en entrevistas de grupos focales con otros estudiantes del idioma inglés con la Sra. Perry. Estas entrevistas de grupos focales se llevarán a cabo según la conveniencia de su hijo y estarán dirigidas por un conjunto de preguntas de entrevista denominadas guía de entrevista.

En la discusión grupal, le pediremos a su hijo que no comparta ninguna información que pueda ser personal o vergonzosa si otros participantes en el grupo repiten lo dicho después de que termine la discusión. Su hijo puede negarse a responder cualquier pregunta o abandonar la discusión en cualquier momento si se siente incómodo.

Las observaciones en el aula se llevarán a cabo durante todo el estudio, pero se centrarán en la estrategia que se está implementando dentro del aula, no en el desempeño de su estudiante. Las intervenciones se implementarán a lo largo del año escolar junto con las unidades de ciencia enseñadas. Cada unidad de ciencias incluirá diferentes intervenciones de alfabetización para su implementación.

Al principio y al final de cada unidad de ciencias, le pediré a su estudiante que complete una breve evaluación formativa de vocabulario. Estas evaluaciones no se utilizarán para calcular la calificación de su hijo en su clase de ciencias.

Tiempo de participación: Tomará aproximadamente 9 meses o la mayor parte del año escolar 2022-2023 para participar en este estudio.

Riesgos e incomodidad: El investigador no tiene conocimiento de ningún riesgo o incomodidad para su hijo mientras participa en este estudio de investigación.

Posibles beneficios: Es posible que su hijo no se beneficie directamente de participar en este estudio; sin embargo, la participación de su hijo en este estudio puede mejorar su rendimiento en el proceso de dominio del idioma académico. Además, la contribución de su hijo puede beneficiar aún más a la comunidad educativa de su escuela, ya que buscan comprender a los estudiantes del idioma inglés, sus desafíos y las formas en que pueden afectar el éxito académico en las escuelas públicas estadounidenses.

LEY DE NOTIFICACIÓN OBLIGATORIA DE S.C.

El equipo de investigación incluye personas que son informantes obligatorios. La información personal de su familia puede divulgarse si así lo exige la ley. Esto significa que puede haber situaciones excepcionales que requieran que divulguemos información personal sobre su familia, por ejemplo, en caso de que un juez requiera dicha divulgación en una demanda o si su hijo nos dice su intención de dañarse a sí mismo o a otros (incluido informar comportamientos consistentes con abuso o negligencia infantil). De acuerdo con el Código S.C. §63-7-310, estamos obligados a denunciar el abuso o la negligencia infantil.

GRABACIÓN DE AUDIO/VIDEO/FOTOGRAFÍAS

Las entrevistas de los grupos focales al principio y al final del estudio se grabarán en audio y se transcribirán. Su hijo recibirá una copia de todos los documentos transcritos para verificar su exactitud. Estas grabaciones se mantendrán de forma segura durante no más de dos años y luego se triturarán los documentos en papel y se borrarán los documentos electrónicos. Las transcripciones no serán identificables por su nombre. Toda la información identificable recibirá un código. Los datos recopilados de las grabaciones de audio se pueden usar en presentaciones de conferencias o publicaciones periódicas y también se compartirán con el distrito escolar por escrito. Los datos recopilados de las grabaciones de audio no se identificarán por su nombre. La información compartida con el distrito escolar incluirá los resultados del estudio de investigación completado. Los datos recopilados en este proceso no serán identificables por nombre o ubicación.

EQUIPOS Y DISPOSITIVOS QUE SE UTILIZARÁN EN EL ESTUDIO DE INVESTIGACIÓN

Se utilizará la plataforma ZOOM para grabar los grupos focales. No preveo ningún riesgo para su hijo, el participante, al usar estos dispositivos, sin embargo, se tendrá cuidado para garantizar su comodidad. Si su hijo experimenta alguna molestia, se emplearán medidas alternativas.

PROTECCIÓN DE LA PRIVACIDAD Y LA CONFIDENCIALIDAD

Los resultados de este estudio pueden publicarse en revistas científicas, publicaciones profesionales o presentaciones educativas.

A todos los participantes del estudio se les asignará un seudónimo para enmascarar su identidad durante las entrevistas y observaciones.

- La información identificable recopilada durante el estudio se eliminará y la información anonimizada podría usarse para futuros estudios de investigación o distribuirse a otro investigador para futuros estudios de investigación sin el consentimiento informado adicional de los participantes o el representante legalmente autorizado.

INFORMACIÓN DE CONSEJERÍA

En caso de que su hijo experimente una reacción negativa por participar en este estudio, notifique al investigador de inmediato. Si su familia necesita conectarse con alguien, considere los siguientes recursos confidenciales:

- Línea CRISIS de Mental Health America of Greenville County: 864) 271-8888. Gratis, 24/7 línea telefónica de crisis.
- Crisis Chat: http://www.crisischat.org/, línea de chat gratuita disponible de 2 p. m. a 2 a. m., 7 días/semana.

- Línea de texto de crisis: envíe un mensaje de texto con la palabra "START" al 741-741; el servicio es gratuito a través de la mayoría de los teléfonos principales. transportistas de servicio y disponible 24/7.
- Línea Directa Nacional de Agresión Sexual en Línea: http://apps.rainn.org/ohl-bridge/, gratis, 24/7 servicio de chat en línea.
- Comuníquese con un profesional de la salud mental de su elección, a su cargo.

INFORMACIÓN DE CONTACTO

Si tiene alguna pregunta o inquietud sobre los derechos de su hijo en este estudio de investigación, comuníquese con la Oficina de Cumplimiento de la Investigación (ORC) de la Universidad de Clemson al 864-656-0636 o irb@clemson.edu.

Si su estudiante tiene alguna pregunta relacionada con el estudio o si surge algún problema, comuníquese con la Sra. Virginia Perry al 803-821-XXXX.

CONSENTIR
Al permitir que su hijo participe en el estudio, usted indica que ha leído la información escrita anteriormente, se le ha permitido hacer cualquier pregunta y está eligiendo voluntariamente que su hijo participe en esta investigación. Usted no renuncia a ningún derecho legal al permitir que su hijo participe en este estudio de investigación.

Escriba el nombre del niño: _____

Escriba el nombre del padre/tutor: _____

Firma del padre/tutor: _____ Fecha: _____

Gracias por su consideración.

Atentamente,

_____

Virginia Perry

Appendix I

Pre-Test/Post-Test Formative Assessment
Unit 1

WORD BANK:

Hypothesis	Control	Constant
Greenhouse Effect	Biogeochemical Cycle	Limiting Factors
Natural Selection	Homologous Structures	Carrying Capacity
Speciation	Vestigial Structures	Divergent Evolution
Convergent Evolution		

1. A _____ is a guess you make based on information you already know.
2. The part that does not change during an experiment is called the _____.
3. The _____ is the part of the experiment that stays the same.
4. When the Earth's surface and the air above it warms up it is known as the
   _____.
5. A pathway where a chemical element or molecule moves through both biotic ("bio-") and abiotic ("geo-") compartments of an ecosystem is known as
   _____.
6. _____ are anything that slow or stops a population's size ability to grow.
7. The process where organisms that are best suited for their environment survive and pass on their genetic traits in increasing numbers to successive generations is known as
   _____.
8. _____ are similar physical features in an organism shard with an ancestor but the features serve completely different functions.
9. The maximum number of organisms of a particular species that can live there is called
   _____.
10. _____is about how species are formed.
11. Organs of the body which are smaller and simpler than those in related species are called
    _____.
12. _____ is the process by where groups from the same ancestors evolve and accumulate differences, resulting in the formation of new species.
13. A process that occurs when two species from unrelated lines develop the same traits and features is known as _____.

SC Biology Standards: Unit 1 B-LS4-1 through B-LS4-6
https://ed.sc.gov/instruction/standards-learning/science/standards/south-carolina-college-and-career-ready-science-standards-2021-approved/#page=175

Appendix I continued

Pre-Test/Post-Test Formative Assessment
Unit 2

WORD BANK:

Cellular Respiration	Photosynthesis	Chloroplast
Mitochondria	Monomer	Polymer
Carbohydrate	Glucose	ATP

1. The process of breaking down sugar and producing energy is called _____.

2. The process by which plants use sunlight, water, and carbon dioxide to create oxygen and energy in the form of sugar is known as _____.

3. _____ are plant cell organelles that convert light energy into relatively stable chemical energy via the photosynthetic process.

4. _____ are membrane-bound cell organelles that generate most of the chemical energy needed to power the cell's biochemical reactions.

5. _____ are small building blocks of organic compounds that can be linked together by covalent bonds.

6. When two or more monomers are hooked together by covalent bonds (starches, plastics, proteins) it is known as a _____. SEP

7. The main function of a _____ is to store short-term energy with the elements of C, H, and O. It is also the main source of energy used by living cells.

8. _____ is produced at the end of the glycolysis process (C_3, H_3, O_3).

9. An energy molecule that transfers energy to cells by releasing its phosphate groups is known as _____. It is mostly produced when sugar (glucose) is broken down.

SC Biology Standards: Unit 1 B-LS2-2 through B-LS2-7
https://ed.sc.gov/instruction/standards-learning/science/standards/south-carolina-college-and-career-ready-science-standards-2021-approved/#page=175

Appendix I continued

Pre-Test/Post-Test Formative Assessment
Unit 3

Prokaryote	Eukaryote	Organelle
Cellular Membrane	Semi-Permeable	Cytoplasm
Fluid Mosaic Model	Diffusion	Active Transport
Osmosis	Hypertonic	Hypotonic
Isotonic		

1. A _____ is the simplest type of cell (such as bacteria) and is always unicellular.
2. The more complex cell (such as plants, animals, fungi, and algae) that can be unicellular or multicellular is called the _____.
3. An _____ is the small structure in a cell that is surrounded by a membrane and has a specific function.
4. The semi-permeable membrane surrounding cytoplasm of the cell which is also the barrier between the inside and outside of the cell is called _____.
5. _____ means that it allows certain molecules to pass through a cell by diffusion.
6. _____ is the place in a cell where all organelles are located. It is also the semi-fluid that is on the outside of the nucleus.
7. The model where bilayers behave more like a fluid that a solid whereas lipids and proteins in bilayer can move laterally is known as _____.
8. _____ is the movement of individual molecules of a substance through a semi-permeable barrier from an area of higher concentration to an area of lower concentration.
9. The movement in vesicles is called _____.
10. The movement of water molecules from a solution of a high concentration to a solution with a lower concentration of water molecules is known as _____.
11. _____ is where water will ENTER the cell until homeostasis.
12. _____ is where water will LEAVE the cell until homeostasis.
13. _____ is where water will ENTER and LEAVE the cell at the same rate.

Appendix J

Teacher Interview Guide
Beginning of Study

Thank you for taking the time to speak with me today. Before we start, I would like to provide a little background on the purpose of my dissertation and what I hope to achieve at the end of the study. Also, I would like to answer any questions you may have prior to the interview.

As you already know, my dissertation topic surroundings our English language learners and their struggles in content area classes at the high school level. As part of the effort to increase our English language learners' academic language proficiency skills, I am conducting interviews with teachers, focus groups with students, classroom observations, and implementing specific interventions. I want to get your perspective on teaching English language learners from prior and current experiences and the types of supports you provide in your classroom.

These interviews are a part of a large effort in collecting and analyzing data from many sources to create a composite picture of the intervention strategies implemented and their success in increasing English language learners' academic language proficiency skills in biology.

Everything you say here will be kept confidential. There are several interviews that will take place and the notes from these will be aggregated and studied for emerging patterns within the text. Also, your participation is voluntary, and you can pass on any questions that I may ask.

If you don't mind, I would like to record this interview simply for note-taking purposes. No one outside of myself will hear the tape; it will just help to check my notes.

Are each of you okay with this?

Do you have any questions about this process before we begin?

QUESTIONS:

1. Can you tell me a bit about yourself - what subject you teach, how long you have been a teacher.
2. Can you tell me a bit about the students in your classes? For example, described the cultures represented, the levels of prior education and the language backgrounds.
3. I'd like to get a better sense of how you address the instructional needs of the English language learners in your classroom?
4. Can you tell me about your approach to teaching ELLs? [Encourage them to describe their practice.]
   a. To what extent do you integrate content-specific language development within content-area instruction? What does that look like?
   b. How do you go about deciding what you'll teach and how you'll teacher it? Is there a specific approach you are expected to use for serving ELL students? (e.g.,

use of native language, planned scaffolds, productive group work, pairing with more English-proficient peers, etc.)?What strategies do you implement to help support English language learners? How do you plan for, modify lessons for and accommodate ELL students who do not speak English?

5. How do you encourage ELL participation and learning in group work and discussions?
6. How do you assess students' progress in your class?

   a. How do you respond to emerging evidence of student learning while teaching?
   b. What evidence do you use to assess the effectiveness of your strategies and the quality of your program for ELLs?

7. What challenges, if any, do you face with regard to improving the academic outcomes of your ELL students?
8. Is there anything else about your practices with ELL students that you believe is important to mention?

Thank you for sharing your thoughts with me today! You have each been extremely valuable in helping me understand more about your students and teaching.

Appendix K

Teacher Interview Guide
End of Study

Thank you for taking the time to speak with me today. Before we start, I would like to remind you of the background on the purpose of my dissertation and what I had hoped to achieve by the end of the study. Also, I would like to answer any questions you may have prior to the interview.

As you already know, my dissertation topic surroundings our English language learners and their struggles in content area classes at the high school level. As part of the effort to increase our English language learners' academic language proficiency skills, I am conducting interviews with teachers, focus groups with students, classroom observations, and implementing specific interventions. I want to get your perspective on how you felt about the interventions that were implemented and the success of your English language learners.

These interviews are a part of a large effort in collecting and analyzing data from many sources to create a composite picture of the intervention strategies implemented and their success in increasing English language learners' academic language proficiency skills in biology.

Everything you say here will be kept confidential. The notes from all of the interviews will be aggregated and studied for emerging patterns within the text. Also, your participation is voluntary, and you can pass on any questions that I may ask.

If you don't mind, I would like to record this interview simply for note-taking purposes. No one outside of myself will hear the tape; it will just help to check my notes.

Are each of you okay with this?

Do you have any questions about this process before we begin?

QUESTIONS:

1. Tell me about your experience in this research process.
2. How did you feel about implementing the intervention for the English language learners in your biology classroom? Did you find it easy or did you find it difficult?
3. How did your students respond to the intervention that you implemented (even though they did not know it wasn't regularly scheduled instruction)?
4. Do you feel that your English language learners were more engaged with the interventions implemented? Do you feel like they were able to increase their academic skills after the implementation of the interventions?
5. Did your ELL students show an increase in knowledge of each unit presented based on formative assessments? If so, do you feel that that intervention was solely responsible for the increase in scores or do you feel that several components helped your ELL students

achieve higher scores on formatives? What additional components were included in your classroom practice that proved beneficial or helpful for ELL students' increase in scores?

6. Is there anything else about your practices with ELL students that you believe is important to mention?

Thank you for sharing your thoughts with me today! You have each been extremely valuable in helping me understand more about your students and teaching.

Appendix L

Student Focus Group Guide
Beginning of Study

Thank you for taking the time to speak with me today. The purpose of this discussion is to find out about your school experience in America, what has been challenging for you, and what ways you have found that have helped you learn best. I want to get your perspective on what each of you believes based on your experiences so far in school.

Everything you say here will be kept confidential. There are several focus groups that will take place and the notes from these will be aggregated and studied for emerging patterns within the text. Also, your participation is voluntary, and you can pass on any questions that I may ask.

If you don't mind, I would like to record this interview simply for note-taking purposes. No one outside of myself will hear the tape; it will just help to check my notes.

Are each of you okay with this?

Do you have any questions about this process before we begin?

QUESTIONS:

1. Can you tell me a bit about yourself - What grade are you in? What is your first language?
2. How old were you when you moved to the United States or were you born in the United States?
3. Tell me about your school experiences in America so far?
    a. What has it been like?
    b. Has it been hard for you? Why?
    c. Has anything at school been easy for you? Why?
    d. How do you feel about being in school and learning?
    e. Tell me how you feel about taking Biology this school year? Do you know what you will be learning in this class?
4. What can your Biology teachers do to help you be successful in their class this year?
5. Is there anything else you would like to share about your experiences in school, what you hope for this school year, and ways that your teachers can help you in their classes?

Thank you for sharing your thoughts with me today! You have each been extremely valuable in helping me understand more about your students and teaching.

Appendix M

Student Focus Group Guide
End of Study

Thank you for taking the time to speak with me today. The purpose of this discussion is to find out about your experience in biology this year, what has been challenging for you, and what ways you have found that have helped you learn best. I want to get your perspective on what each of you believes based on your experiences in biology.

Everything you say here will be kept confidential. There are several focus groups that will take place and the notes from these will be aggregated and studied for emerging patterns within the text. Also, your participation is voluntary, and you can pass on any questions that I may ask.

If you don't mind, I would like to record this interview simply for note-taking purposes. No one outside of myself will hear the tape; it will just help to check my notes.

Are each of you okay with this?

Do you have any questions about this process before we begin?

QUESTIONS:

1. Tell me about your experience in biology this school year. Was it easy or hard? Why?
2. What did your teachers do to help you learn biology this school year?
3. Tell me your thoughts about the interactive word wall that was created during your class?
4. Do you feel that the interactive word wall was helpful in learning vocabulary words for each unit? Why or why not?
5. Would you recommend the use of an interactive word wall for other classes at school as well? Why or why not?
6. Is there anything else you would like to share about your experiences in biology this year or what your teachers implemented that you found helpful in learning the biology content in your classes?

Thank you for sharing your thoughts with me today! You have each been extremely valuable in helping me understand more about your students and teaching.

Appendix N

Observation Protocol

About this observation tool:
This observation tool was developed and modified based on The Sheltered Instruction Observation Protocol (SIOP) (Echevarria, Vogt, Short, 2000, 2004, 2008, 2013-2017). The observations will be conducted in the biology classrooms to ensure the fidelity of the selected intervention(s).

	Yes	No

Comprehensible Input

1. **Clear Explanation** of
   academic tasks   ☐   ☐
   Explain: _____
   _____

2. **Speech** appropriate for students'
   proficiency level (e.g., slower rate,
   enunciation, and simple sentence
   structure for beginners)   ☐   ☐
   Explain: _____
   _____

3. **A variety of techniques** used to
   make content concepts clear
   (e.g., modeling, visuals, hands-on
   activities, demonstrations, gestures,
   body language)   ☐   ☐
   Explain: _____
   _____

Practice/Application

1. **Hands-on materials and/or
   manipulatives** provided for students
   to practice using new content knowledge ☐   ☐
   Explain: _____
   _____

2. Activities provided for students to
   apply content and language
   knowledge in the classroom   ☐   ☐
   Explain:_____
   _____

3. Activities integrate all **language
   skills** (i.e., reading, writing, listening,
   and speaking)   ☐   ☐
   Explain: _____

_____

General Observations

   1. The selected intervention(s) is/are being
      implemented in the classroom as
      designed   ☐   ☐

   2. Teacher appears adequately prepared
      to deliver instruction or intervention   ☐   ☐

   3. Teacher demonstrates knowledge of
      content and intervention strategy   ☐   ☐
      Explain: _____

_____

Appendix O

*Unit 1 pre-test and post-test vocabulary formatives (using AVC only)***:**

Student	Pre-Test	Post-Test	Difference	Summative Test Score
1	4	3	-1	76
2	1	3	+2	77
3	2	7	+5	84
4	2	5	+3	78
5	1	4	+3	18
6	0	2	+2	21
7	7	7	0	79

*Unit 2 pre-test and post-test vocabulary formatives (using AVC & IWW)***:**

Student	Pre-Test	Post-Test	Difference	Summative Test Score
1	1	2	-1	72
2	0	1	+1	45
3	1	3	+2	52
4	4	5	+1	60
5	1	4	+3	66
6	1	1	0	62
7	4	6	+2	62

Appendix O continued

*Unit 3 pre-test and post-test vocabulary formatives (using AVC & IWW)***:**

Student	Pre-Test	Post-Test	Difference	Summative Test Score
1	3	4	+1	82
2	0	3	+3	71
3	2	3	+1	63
4	2	6	+4	71
5	0	2	+2	60
6	2	4	+2	62
7	5	5	0	60