IMPROVING INSTRUCTIONAL PRACTICES THROUGH TECHNOLOGY INTEGRATION: A MIXED METHODS STUDY OF ELL ACADEMIC IMPROVEMENT

A Record of Study

by

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ABSTRACT

At Grand Intermediate School, teachers work with a large population of English language learners (ELL). The teachers were all trained to use the Sheltered Instruction Observation Protocol Model (Echevarría, Vogt, and Short, 2017) to help ELL students increase their English fluency and succeed academically. The instructional strategies in place, while sound, did not sufficiently bridge the language gaps to help students identified as ELL catch up to their native English-speaking peers. The sixth-grade science teachers were provided with professional development (PD) to improve technology integration practices in instruction with the goal being improved academic success of students identified as ELL. An embedded mixed methods design was used in this study. Before the intervention, quantitative data was collected in the form of Likert-scale teacher survey and student test results. The teachers were provided with two cycles of PD, classroom observations, learning walks, and peer coaching to help implement technology in instruction. The data was collected during the intervention phase from the pre and post-tests. Before and after the intervention, the teachers completed the post Likert-scale survey. The student data was analyzed using the Mann-Whitney U test. Descriptive statistics were used to analyze the results of the pre and post teacher surveys.

DEDICATION

I would like to dedicate this culmination of work to my family, without whom I would not have been able to complete this adventure. My parents, Dr. Robert Ralph Hill and Oleta Jean Hill, have always been a source of support and comfort for me and push me to be the very best that I can. I appreciate all they have done for me and my family throughout my life. Without their unwavering support, this endeavor would have been much more difficult.

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Contributors

This record of study was completed independently by the student under the supervision of a record of study committee. The committee consisted of co-chairs Dr. Radhika Viruru and Dr. Robin Rackley, and committee member Dr. Quentin Dixon all from the Department of Teaching, Learning, and Culture, and outside committee member Dr. Yolanda Padron Professor in the Department of the College of Education and Human Development.

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NOMENCLATURE

BICS	Basic Interpersonal Communication Skills
CAI	Computer Assisted Instruction
CALP	Cognitive Academic Language Proficiency
ICT	Information and Communications Technology
LEP	Limited English Proficient
PD	Professional development
SIOP	Sheltered Instruction Observation Protocol Model
TELPAS	Texas English Language Proficiency Assessment System
TPACK	Technological Pedagogical Content Knowledge

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CHAPTER I INTRODUCTION

1.1 The Problem of Practice

1.1.1 Context setting. Grand Intermediate School (GIS) is located in Houston, Texas in Bay Knoll Independent School District (BKISD). For the 2016-17 school year, there were 943 sixth, seventh and eighth-grade students served at GIS. The population of GIS is very ethnically diverse with 11% of the students identifying as Asian, 10% black, 41% white, 32% Hispanic/ Latino, and 5% of the students identified as multi-race. Roughly 17% of our population was coded limited English proficient (LEP). This number has continued to rise each year (3.5% in 2011-2012 school year). In the 2016-17 school year, there were twenty-six languages spoken among all of the students at GIS. The population of GIS was roughly one third economically disadvantaged with 358 students identified as economically disadvantaged.

The school is a one-story building with seventy-five classrooms. There are two gymnasiums, a commons area, and a teaching theater. There are two portable buildings adjacent to the east side of the building that house six classrooms. Grand Intermediate houses three district special education classes, two of these are behavior programs, and one is an alternative academics class. All of the typical core academic courses are offered at both a regular and an advanced level. There are a variety of electives offered with four of the courses for high school credit. The school has a construction technology lab, audiovisual lab, culinary arts lab, and robotics lab to support the programs offered.

1.1.2 Initial understanding. The student population of GIS has shifted dramatically over the past five to seven years. When the school originally opened the

majority of the student body were white students from middle to upper middle-class families. The population at GIS, during the 2016- 2017 academic school year, was much more ethnically and economically diverse, and the ELL population continues to grow. The economically disadvantaged population of GIS has also grown over this time period.

1.1.3 Relevant history of the problem. Previous instructional attempts to support the ELL population were focused on Echevarría, Vogt, and Short's Sheltered Instruction Observation Protocol Model or SIOP (2017). The teachers were all trained to use the SIOP Model to help ELL students increase their English fluency and academic success. According to Echevarría, Vogt, and Short, "one of the most important aspects of the SIOP Model is the inclusion of both content and language objectives for each and every lesson" (2014, p. xvi). The teachers at GIS were in the routine of providing these objectives daily as well as scaffolding and hands on experiences (Echevarría, Vogt, and Short, 2014). Instructional strategies like these, while sound, did not sufficiently bridge the language gaps to help students identified as ELL catch up to their native English-speaking peers. Since the ELL population continued to grow, the school has asked for additional support personnel from the district. In the 2015-2016 school year, the school was granted an additional paraprofessional support unit and the principal of the campus used some of his compensatory education funds to secure an additional part-time paraprofessional unit. During the 2016-17 school year the school was also granted a second ELL teacher to work with the first-year immigrant students.

1.1.4 Stakeholder groups and values. The stakeholders of GIS are the teachers, staff, students, parents, and community members. In speaking with all of the stakeholders, it was evident the stakeholders were concerned with supporting the ELL

population. The teachers felt they were trying their best to support the students but were falling short. The ELL instructional supervisor continued to support with training and book studies as well as modeling SIOP strategies. Each year, the English Language Learner Instructional Specialist worked with teachers to improve teaching strategies to support ELL students. One of the techniques she utilized is book studies along with modeling, and instructional walks. The team would read a book together, practice the techniques described, and take turns observing each other and providing feedback to support implementation. The counseling staff felt like more support was needed for parents, in particular, providing paperwork in the student's home language on a more consistent basis. The parents felt the students needed more time and less pressure (from state testing) to be successful.

1.2 Roles and Personal Histories

1.2.1 My background. During the 2016-17 school year, I was the Assistant Principal at Grand Intermediate School. I had been the assistant principal of GIS for three years. I am currently the principal at Grand Intermediate.

Before working at GIS, I was the assistant principal at two different elementary schools. Prior to going into school administration, I taught at the elementary and intermediate levels for fourteen years. While a classroom teacher, I taught second grade, fifth grade, ESL grades kindergarten- fifth, and eighth grade algebra.

Part of my job during the 2016-17 school year, as the assistant principal at GIS, was to help teachers improve their instructional practices. I worked with the district curriculum coordinators, instructional coaches, and department chairs to create and lead professional development for teachers. One of the primary goals of professional

development was to improve instructional practices to maximize student performance. In my role as assistant principal, I was able to access all of the information that deals with student performance. This information was used to determine if the interventions put in place were successful.

1.2.2 My field-based mentor. My field-based supervisor was the principal of GIS. He had been the principal of GIS for three years and had served as an administrator for 21 years. He had also been an administrator at the district level, serving as a human resource director. Before working in this district, he served a neighboring district as an administrator and opened an intermediate school. He had been in the field of education for close to thirty years.

CHAPTER II REVIEW OF THE LITERATURE

2.1 Theories

It is important to look at theories that explain language acquisition in order to understand how teachers can support second language learners. The theory that was utilized for this study was Krashen's Theory of Second Language Acquisition. This theory posits five main hypotheses about language acquisition and variables that can contribute to or hinder the success of language learning. There are several parts to Krashen's theory. One part that is important to look at is the Input hypothesis. "The input hypothesis explains how language learners progress from one developmental stage to the next" (Echevarría & Graves, 2007, p. 44). Krashen's input hypothesis describes second language learning as first searching for meaning and then acquiring structure (Krashen, 2003).

In the Input hypothesis, Krashen contends that second language learners acquire language in a developmental sequence. This is done "by receiving abundant comprehensible input, making messages understood to the learner" (Echevarría & Graves, 2007, p. 44). The second language learner requires comprehensible input with new structures of the second language that is just outside of their current competency. Krashen describes this as moving from "*i,* our current level, to *i*+1, the next level along the natural order, by understanding input containing *i*+1" (Krashen, as cited in Echevarría & Graves, 2007, p. 44). Utilizing this hypothesis requires the teacher to know their students' present levels of functioning. For example, a teacher introducing a new term in class will provide the ELL student with limited new vocabulary and visual support to scaffold the learning of the new vocabulary. The context clues the teacher is providing

will help the student acquire the new language. This theory is important to take into account when working with ELL students.

In Krashen's *Principles and Practices for Second Language Acquisition* (1982), Krashen contends that teachers have several options for vocabulary acquisition and long-term vocabulary retention for their students. If a student has a few minutes of extra practice time at some point during the day and has three options for vocabulary practice: rote learning, reviewing a story with vocabulary embedded, or to read for pleasure, reading for pleasure would be the most optimal for vocabulary retention and learning. When reading for pleasure, the student tries to understand the message and looks up new words as necessary. Reading for pleasure relies on "comprehensible input to supply new vocabulary in enough frequency, and to help the acquirer to determine the meaning" (Krashen, 1982, p. 66). The hope with reading for pleasure is that "really important words will reoccur naturally and their meanings will be made increasingly obvious by the context" (Krashen, 1982, p. 66).

The next theory drawn from for this study is the Transformative Learning Theory. Mezirow's Transformative Learning Theory is defined by Clark (1993) as "learning that induces a more far-reaching change in the learner than other kinds of learning, especially learning experiences which shape the learner and produce a significant impact, or paradigm shift, which affects the learner's subsequent experiences" (p. 48). This theory is geared toward adult learners and is important to consider when planning professional development. Mezirow's theory describes the conditions and processes needed for a transformation in adult thinking to occur.

The Transformative Learning Theory focuses on a mental shift of an individual's worldview. Mezirow's theory is aimed at helping "individuals challenge the current assumptions on which they act and if they find them wanting, to change them" (Christie, Carey, Robertson, & Grainger, 2015, p.11). There are six central common themes for making a transformational shift. These themes are individual experience, critical reflection, dialogue, holistic orientation, awareness of context, and authentic relationships (Taylor, 2009). According to Sammut (2014) "approaches and practice of both coaching and adult learning display similarities, especially with respect to the learning environment and process of learning" (p. 39).

Krashen's Theory of Second Language Acquisition, in particular the Input hypothesis is important to keep in mind when working with students identified as ELL. In particular, supporting students acquiring academic language in a core content area such as science. Mezirow's Transformative Learning Theory is important to be mindful of when attempting to support instructional shifts from the teachers, or adult learners. The instructional coaching cycle, which was utilized in this study, fosters transformative learning. According to Sammut and Xavier (2014), the coaching process fosters transformative learning by pushing participants through critical reflection and dialogue.

2.2 Relevant Literature

2.2.1 English language learners. As the demographics of the state of Texas continue to shift to a greater percentage of English language learners (ELL), educators need to shift how they teach to meet ELL student language acquisition needs. O'Conner, Abedi, and Tung (2012) looked at the trends of growth and performance in all academic

areas of the ELL population over a seven-year period. They found the achievement of the ELL population was significantly lower than that of the non-ELL students. Keengwe and Hussein (2012) and Rupley and Slough (2010) show the ELL population as the fastest growing percentage of the student body in the past ten years. Due to the quick shift in demographics, it has been difficult for teachers to keep up with shifting instructional strategies to support the needs of the ELL students.

Rupley and Slough found five components crucial to ELL student success (2010). These components are development of reading skills, build on student strengths, connect with the culture of each student, engaging instruction, and varied assessments (p. 104). The Sheltered Instruction Observation Protocol (SIOP) model is a professional development model for teachers instructing ELL students and aims at reaching many of these components (Short, Fidelman, Louguit, 2012). The SIOP method of teaching provides teachers techniques to use with ELL students to make accessing the content more manageable, thus building on their strengths. Short et al. found after employing the SIOP techniques in both content classes and ELL classes for two years, there was a statistically significant increase in the mean scores on the English language proficiency tests for those students who had been instructed by SIOP trained teachers as opposed to those ELL students instructed by non-SIOP trained teachers (2012).

Cummins (2008) makes a distinction between basic interpersonal communication skills (BICS) and cognitive academic language proficiency (CALP). “BICS refers to conversational fluency in a language while CALP refers to students’ ability to understand and express, in both oral and written modes, concepts and ideas that are relevant to

success in school" (Cummins, 2008, p. 71). These two terms are used to "draw educators' attention to the timelines and challenges that second language learners encounter as they attempt to catch up to their peers in aspects of the school language" (Cummins, 2008, p. 71). Many teachers get frustrated because their ELL students appear to be knowledgeable of the English language, but not applying their skills. This is due to their knowledge of BICS and lacking knowledge of CALP.

Making sure ELL students can access the curriculum is the biggest hurdle to teaching these students. The SIOP model is only one way we can reach the ELL students and help them be successful (Echevarría, Frey, Fisher, 2015). Acknowledging different types of errors that occur when learning a foreign language, such as pronunciation or incorrect verb tense is another way to support ELL students (Bagheridoust & Kotlar, 2015). Making errors when learning a second language is a natural part of the process, but it is difficult for the learner to self-correct. Bagheridoust and Kotlar (2015) contend that errors need to be corrected for progress in the second language to occur. This can be difficult for both the teacher and the ELL student. Pointing out the error(s) can frustrate the student, but can also slow down the instructional process, frustrating the educator.

As ELL students get older and move through the curriculum, "the linguistic and content demands made on them increase substantially, challenging even the best intentioned and most knowledgeable teachers to bridge students' language proficiency in relation to the linguistic and content requirements of new subject matter" (Garcia, 2003, p. 250). Teachers can unintentionally simplify the content for the ELL learner in order to accommodate for their language level. The ELL learners' language proficiency can be overlooked at the upper grades due to the content demands. For this reason SIOP

strategies may not be enough to support ELL students. “So sheltered content area instruction often leads to sacrifices in learning English, as teachers tend to emphasize content acquisition over building English language abilities and inadequate time is provided for English learning” (Gersten & Baker, 2000, as cited in Garcia, 2003, p. 250). Due to these cognitive and content demands made on students at the secondary level, it is suggested “that front-loading the language required for content and content-related tasks begins to address this difficulty in the sheltered instruction model” (Garcia, 2003, p. 251). Front-loading language involves pre-teaching vocabulary for upcoming lessons so the content can be understood by the ELL student.

Teachers often flounder when implementing SIOP strategies in the classroom because they feel ineffective. According to Gersten and Baker (2000) people in supervisory roles in education “consistently indicated that sheltered content area instruction often leads to sacrifices in learning English, and that few districts have a curriculum that promotes students’ proper use of English language” (p. 459). Gersten and Baker cited several problems with sheltered content instruction (SIOP); inadequate time for English language learning instruction, unclear definition of sheltered instruction, and “failure to systematically impart the skills students need in speaking and writing standard English, even in middle school” (2000, p. 460).

English language learners needs will vary, just as with their non-ELL counterparts. Successful schools provide “differentiated instruction, teacher modeling, language supports, vocabulary development, collaborative conversations, and visual representations” (Aleman, Johnson, & Perez, 2009, p. 23). High expectations for ELL students and a school culture that values all students and their progress is the key to

success (Aleman et al., 2009; Echevarría et al., 2015). Aleman et al. (2009), Echevarría et al. (2015), and Rupley and Slough (2010) also attribute ELL success to a climate of acceptance and respect for cultural diversity to help all students feel valued.

Allowing students to make errors without repercussions or embarrassment is essential to an ELL student's willingness to attempt new learning (Bagheridoust & Kotlar, 2015). According to Bagheridoust and Kotlar (2015), when errors are the focus, the errors are welcomed, and systematically treated, and language acquisition growth can occur at a quicker rate. Aleman et al. (2009) describe ELL success as attributed to, at least in part, a focus on conceptual understanding. When teachers allow for multiple opportunities, discussion, and frequent feedback just as Bagheridoust and Kotlar (2015) and Echevarría et al. (2015) assert, ELL success is more prevalent.

2.2.2 Professional development/ instructional peer coaching. Professional development is an essential part of refining teaching practices to improve instruction for improved student outcomes. Learning from our peers is not a new approach to professional development (PD) in the world of education. Using peer coaching and learning walks as a part of the professional development cycle can be very beneficial. Peer coaching can be utilized when there is a strong degree of trust between colleagues. The teachers work together to observe and coach each other to refine and improve instructional practices. Learning walks are taken by groups of teachers and educators through a classroom or classrooms to observe instructional practices, discuss observations, reflect on the observations, and refine their own skills to improve instructional practices. Peer coaching and learning walks has been utilized for the past

three years at GIS and the level of trust amongst colleagues allows for this type of PD to be utilized routinely.

According to Loucks-Horsley (2010) "professional development does not occur as isolated strategies. Every program, initiative and professional development plan uses a variety of strategies in combination with one another to form a unique design" (Loucks-Horsley, 2010, p. 42). Taylor (2009) describes six central themes that are common when transformative learning occurs: individual experiences; critical reflection; dialogue; holistic orientation; awareness of context; and authentic relationships (as cited in Sammut, 2014, p. 39). Different strategies of PD can yield different results and have different purposes. According to Loucks- Horsley (2010) the purposes of PD are: developing awareness, building knowledge, translating into practice, practicing teaching, and reflecting. To support teacher learning, Loucks- Horsley (2010) shows coaching and mentoring yield the latter four of these, while implementation of technology yields all but practicing teaching. Goker (2006) describes reflecting with other peers as a useful practice for teacher development. Donegan, Ostrosky, and Fowler (2015) show possible outcomes of peer coaching as self-improvement, reflective thinking, and having a variety of strategies to utilize with students. Also, Goker (2006), shows outcomes of peer coaching as improved instructional practices, improved self-efficacy, and peer support.

Goker and Sammut both cited critical reflection and dialogue as crucial to the coaching process for improved instructional practices to occur. Critical reflection has three forms; content, process, and premise (Sammut, 2014, p.49). Content reflection focuses on what we perceive, think, feel, and do while process reflection focuses on how

we perform and what we are reflecting on. The last of the three types of reflection, premise reflection, is "an awareness of why we perceive" (Sammut, 2014, p. 49). Donegan et al. agree that self-reflection is critical to the peer coaching model to make changes to what we do in our instructional practices (2015).

2.2.3 Technology integration. The study of the use of technology to improve ELL student achievement is not new. In Keengwe and Hussein's study conducted in 2014, they looked at computer-assisted instruction (CAI) and its impact on the ELL students' achievement. In particular, this study examined the relationship of the achievement gap between ELL students who had the opportunity to use CAI versus ELL students who only received traditional classroom instruction. In a study conducted by Kim- Rupnow and Dowrick (2009), they also looked at technology integration to inform professional development for teachers working with ELL students. Kim-Rupnow and Dowrick explain that "teachers need research-based strategies that take advantage of new technology and other resources- and need to be prepared rapidly and effectively" (p. 241). Kim-Rupnow and Dowrick (2009) suggest that research indicates that computers can be an effective tool for ELL students because computers enable flexibility, individualized pacing, individualization, non-judgmental feedback, enjoyment, and interactive learning (p. 243).

Research in the area of technology integration in the classroom shows that our students are inundated with technology on a daily basis, yet this has still not transformed the instructional practices in our classrooms (Cuban, 1993 & 2001). In a 2007 study conducted by Gulbahar, findings indicated that students did not believe that teachers were not utilizing Information and Communications Technology (ICT) sufficiently in

classrooms. The teachers and administrators, however, felt they were competent in using the ICT but had a lack of guidelines to help them successfully integrate the technology into their instructional practices (Gulbahar, 2007). Gorder (2008) attributes teachers' perceptions as a major factor in how well-executed technology integration is in the classroom. Technology integration implemented effectively relies on many factors (Ertmer, 2005, Gorder, 2008 & Gulbahar, 2007). Gorder cites the most important of these factors as "teachers' competence and ability to shape instructional technology activities to meet students' needs" (2007, p. 63).

Personal beliefs and perceptions can be a barrier to successful technology integration (Ertmer, 2005, & Kopcha, 2012). For this reason, PD needs to be designed to account for the varying abilities and beliefs of teachers. To affect change in teachers' beliefs about technology integration for instructional purpose, Ertmer (2005) suggests using the following three strategies: take into account teachers' personal experiences, provide vicarious PD, and create social networks. These three suggestions will support teachers to sustain the work of technology integration in instructional practices (p. 32). Kopcha (2012) cites access, vision, time, beliefs, resources, and PD as barriers teachers report in the way of technology implementation in instructional practices (p. 1110). In addition to these barriers, outside of the teachers' control, Levin and Schrum (2013) cite technological, pedagogical, and content knowledge of teachers as additional barriers (p. 29). Taking these barriers into account as well Ertmer's three strategies for technology integration can help support teacher learning and instructional implementation of technology.

Technology integration in schools requires teachers to have a basic understanding of technology knowledge, content knowledge, and pedagogical knowledge. According to Herring, Mishra, and Koehler (2016) Technological Pedagogical Content Knowledge (TPACK) "is a framework for technology integration, as well as a body of knowledge of what teachers need to know to teach with technology" (p. 1). This framework explains the relationship between the three types of knowledge, technology, content, and pedagogy. "At the intersection of these three knowledge types is an intuitive understanding of teaching content with appropriate pedagogical methods and technologies" (Schmidt et al., 2009, p. 125).

To successfully integrate technology into instructional practices, Levin and Schrum suggest a clearly articulated vision and mission as well as a strategic plan for implementation (2013, p. 45). Making a plan that supports student learning is the key to successful technology integration (Gulbahar, 2007). There will be no dramatic improvements in instructional practices or student learning without a shift in the mindset of educators and educational practices. Technology integration implemented effectively relies on many factors (Ertmer, 2005, Gorder, 2008 & Gulbahar, 2008). Gorder (2008) cites the most important of these factors as "teachers' competence and ability to shape instructional technology activities to meet students' needs" (p. 63).

2.2.4 Second Language Academic Vocabulary Acquisition Understanding how students acquire vocabulary is essential to teaching students. According to Beck, McKeown, and Kucan (2013) there are three tiers of vocabulary. Tier 1 is basic words, those words used in oral conversations and are high exposure words. Tier 2 words are "high utility for mature language users and are found across a variety of domains" (Beck

et al., 2013, p. 9). A few examples of Tier 2 words would be “contradict or precede” (Beck et al., 2013). These are words that are not considered conversational, but instead found in written text and are more difficult to comprehend. Tier 3 words are words that have a “frequency of use that is quite low and often limited to specific topics and domains” (Beck et al., 2013, p. 9). These Tier 3 words are the words that are considered academic vocabulary.

Beck, McKeown, and Kucan express the idea that word knowledge is complex and not considered an all or nothing proposition, instead it is on a continuum of knowledge (2013). They further assert “rich word knowledge is built through multiple encounters with words” and that “knowledge that has not been acquired or not practiced to a high enough level” can appear as a deficit in ability (p. 13) This is good news for educators and instructional practices because it means that educators can “help students to become good comprehenders by providing the experiences to build the knowledge they are lacking and support their practice of it” (Beck et al., 2013, p. 13). Instruction needs to be appealing and interesting to students so they enjoy the activities and “develop an interest in and awareness of words in order to adequately build their vocabulary repertoires” (Beck et al., 2013, p. 14). Fasura (2009) asserts that limited vocabulary can be a primary reason for students to struggle with reading in the United States.

Vocabulary acquisition is one of the most important factors in determining academic success for reading comprehension for students. Reading comprehension is crucial to academic success in all academic areas. “In 2000, the National Reading Panel identified vocabulary instruction as one of the five essential components of reading instruction and a large body of research indicates the critical role vocabulary knowledge

plays in reading comprehension" (Manyak et al., 2016, p. 13). According to Manyak et al (2016) there are four basic premises that need to be understood when looking at student's vocabulary knowledge. First, many students enter school with a deficit in vocabulary knowledge. In particular, students from low-income families and students who are identified as ELL. Second, schools have been largely unsuccessful at reducing this deficit. Third, this deficit of vocabulary knowledge creates an obstacle for student success and achievement and fourth, "the vocabulary deficit experienced by many students is so large that it will take a multiyear approach to vocabulary instruction to substantially impact it" (Beimiller, 1999, & Nagy, 2005, as cited in Manyak et al., 2016, p. 2).

Due to the importance of vocabulary knowledge in reading comprehension, Manyak et al. (2016) have three general guidelines for vocabulary instruction. First, have a multifaceted approach that teaches individual words, word learning strategies, and fosters word consciousness. Second, there is not one way to teach vocabulary that will work for all students. Manyak, et al. recommends a varied approach that is based on the nature of the target word. Some words taught can have a goal of beginning awareness due to the complexity of the term while other words can be taught for mastery because it is a concrete noun. Third, teaching of vocabulary should "support instruction that presents words in a variety of contexts, provides multiple exposures, and promotes students' active processing of new meanings" (Beck et al., 2013 and Stahl & Fairbanks, 1986, as cited in Manyak et al., 2016, p. 3).

In a study conducted in Boston Public School by Harvard Graduate School of Education Professor Catherine Snow, a curriculum supplement called Word Generation was designed and utilized (Snow, Lawrence, & White, 2009). Word Generation was used

to support the acquisition of "'all-purpose' academic vocabulary words- words that are relevant across all disciplines, but that are infrequently used in casual conversation" (Fasura, 2009, p. 1). The program was designed for sixth-eighth grade students to pique their interest in brief and engaging texts. The program was designed to: provide frequent exposure to the all-purpose vocabulary as well as technical, content specific words, teach "new content, deep reading and comprehension skills, discussion, argumentation, and writing" through content that was of current public interest (Snow et al., 2009, p. 341). The program was conducted over 24 weeks and featured target words, repeated review, opportunities for practice in oral and written formats, explicit instruction in meaning and learning strategies and implemented in 15 minutes per instructional day (Snow et al., 2009). Snow et al. (2009) implemented their design based on prior evidence-based research of

> instructional factors that promote successful vocabulary learning. Those factors include the following:
>
> - Encountering the target word in semantically rich contexts with motivating texts, rather than in a list of words.
> - Recurrent exposure to the word, in varied contexts.
> - Opportunities to use the word orally and in writing.
> - Explicit instruction in word meaning.
> - Explicit instruction in word learning strategies, including morphological analysis, cognate use, and polysemy. (p. 327)

The results of the trial were promising when the students' vocabulary acquisition was compared to students in schools with similar demographics.

2.2.5 Repetition and Language Acquisition. Written and oral repetition are methods teachers can utilize to increase vocabulary retention. According to Candry, Deconinck, and Eyckmans (2018) "the more a learner engages in both semantic and structural elaboration, the better this learner's chances of retaining the new word are" (p. 73). Semantic elaboration is focusing on the word meaning, while structural elaboration is focusing on the structure of the word itself. Learning to pronounce a word can also help the learner to cement the word in long-term memory (Candry, 2018, p. 73).

Studies have shown that the "number of times an unknown word is met in context affects whether its meaning will be acquired" (Webb, 2007, p. 46). However, Webb points out that the studies are not conclusive as to how many times a word has to be encountered in reading before it is retained (2007). August, Carlo, Dressler, and Snow (2005) point out that when reviewing and reinforcing Tier 3 vocabulary words, preteaching may be required prior to working with the vocabulary in read-alouds and discussion. This preteaching will require review and reinforcement which is the third instructional practice August et al. recommend to benefit ELL students with vocabulary learning (2005).

2.3 Most Significant Research and Practice Studies

Table 1

Research and practice studies

Author(s)	Year	Title	Topic
Aleman, Johnson, & Perez	2009	Winning schools for ELLs	ELL
Bagheridoust, & Kotlar	2015	The impact of dynamic corrective feedback in developing speaking ability of Iranian intermediate EFL learners	ELL
Beck, McKeown, & Kucan	2013	Bringing words to life : robust vocabulary instruction	Academic Vocabulary Acquisition
Brown & Ryoo	2008	Teaching science as a language: A "content-first" approach to science teaching	Academic Vocabulary Acquisition
Christie, Carey, Robertson & Grainger	2015	Putting transformative learning theory into practice	Professional Development
Clark	1993	New Directions for Adult and Continuing Education	Professional Development
Cuban	1993	Computers meet classroom: Classroom wins	Technology
Cuban	*2001*	*Oversold and underused: Computers in the classroom*	Technology
Donegan, Ostrosky, & Fowler	2015	Peer coaching: Teachers supporting teachers	Professional Development
Echevarría, Frey, & Fisher	2015	What it takes for English learners to SUCCEED	ELL
Echevarría & Graves	2007	*Sheltered content instruction: Teaching english language learners with diverse abilities*	ELL
Ertmer	2005	*Teacher pedagogical beliefs: The final frontier in our quest for*	Technology

Table 1 continued.

Author(s)	Year	Title	Topic
		technology integration?	
Fasura	2009	Building Vocabulary to Improve Reading	Academic Vocabulary Acquisition
Gorder	2008	A study of teacher perceptions of instructional technology integration in the classroom	Technology
Gülbahar	2007	Technology planning: A roadmap to successful technology integration in schools	Technology
Herring, Mishra, & Koehler	2016	Handbook of technological pedagogical content knowledge (TPCK) for educators	Technology
Keengwe & Hussein	2014	Using computer-assisted instruction to enhance achievement of English language learners	ELL
Kim-Rupnow & Dowrick	2009	ACE for English language learners: An online professional development program	ELL
Kim	1991	*Reading and writing instruction through HyperCard*	ELL
Kopcha	2012	Teachers' perceptions of the barriers to technology integration and practices with technology under situated professional development	Technology
Krashen	2003	*Explorations in language acquisition and use: The Taipei lectures*	ELL
Levin & Schrum	2013	Using systems thinking to leverage technology for school improvement: Lessons learned from award-	Technology

Table 1 continued.

Author(s)	Year	Title	Topic
		winning secondary schools/districts	
Loucks-Horsley	2010	*Designing professional development for teachers of science and mathematics*	Professional Development
Manyak, Gunten, Autenrieth, Mastre-O'Farrell, Irvine-McDermott, Baumann, & Blachowicz	2016	Four Practical Principles for Enhancing Vocabulary Instruction	Academic Vocabulary Acquisition
Niklova	2002	Effects of students' participation in authoring of multimedia materials on student acquisition of vocabulary	ELL
O'Conner, Abedi, & Tung	2012	A descriptive analysis of enrollment and achievement among English language learner students in Delaware	ELL
Rep. USDoE	2006	Vocabulary improvement program for English language learners and their classmates	Academic Vocabulary Acquisition
Rupley & Slough	2010	Building prior knowledge and vocabulary in science in the intermediate grades: Creating hooks for learning	ELL
Sammut	2014	Transformative learning theory and coaching: Application in practice	Professional Development
Schmidt, Baran, Thompson, Mishra, Koehler, & Shin	2009	Technological pedagogical content knowledge (TPACK): The development and validation of an assessment instrument for preservice teachers	Technology
Short, Fidelman, & Louguit	2012	Developing academic language in English	ELL

Table 1 continued.

Author(s)	Year	Title	Topic
		language learners through sheltered instruction	
Snow, Lawrence, & White	2009	Generating knowledge of academic language among urban middle school students	Academic Vocabulary Acquisition
Taylor	2009	Fostering transformative learning	Professional Development

2.4 Significance of the Literature Review

The review of the literature provided information on the topics of English Language Learners, professional development, technology integration, and vocabulary acquisition for second language learners. This information helped frame the problem of how to best support teachers learning about technology integration to meet the needs of the ELL students. The literature helped me to design a solution for the problem by providing me with the background knowledge and theories that support ELL academic language acquisition, best practices for vocabulary acquisition, and adult learning.

When deciding on a solution for this problem, the culture of the school was a determining factor. The teachers, staff, and parents were open to change to support student growth. The campus had a growth mindset and was prepared to make instructional changes that would impact student growth in positive ways. Utilizing the transformative learning theory to design professional development for instructional practices and keeping in mind the input hypothesis and best practices for vocabulary acquisition were useful to the planning of the intervention.

Designing the intervention for the study took into account the information and best practices known about language and vocabulary acquisition as well as the challenges of GIS such as time constraints and varying abilities of the ELL population. The model used by Snow et al. (2009) in the vocabulary intervention called *Word Generation* utilized front-loading of vocabulary, recurrent exposure, and repetition. Each of these practices were used in the intervention put in place in this study. In Krashen's theory (1982), one of the ways described to aid comprehension is for teachers to "provide non-linguistic means of encouraging comprehension (by) providing extra-linguistic support in the form of realia and pictures" (p. 53). Pictures were a key component of the intervention utilized. August et al. (2005) describe "specialized Tier 3 words (isotope, continent) may require preteaching to build concept knowledge" (p. 55). Tier 3 words were the focus of this study and were pretaught through the intervention so when the students heard the words or read the words in class, through read alouds and text passages, they would have schema and understanding.

CHAPTER III FRAMING THE PROBLEM

3.1 The Problem Situation

3.1.1 Learning more. When conversing with various stakeholders through interviews and informal conversation, I learned the primary concern of the stakeholders was the obligation to clients (see Table 2). In this case, the clients were the students of the school. The various stakeholders interviewed consisted of an administrator, a parent, a sixth-grade science teacher, and the ELL instructional specialist. These stakeholders were familiar with the needs of the students as well as the campus initiatives. The second concern that was discussed by the stakeholders was the effectiveness of the instruction. The teachers receive yearly training and updates on SIOP strategies. However, the ELL student population continues to grow, and the needs of the students were diverse.

The conversations I had with the various stakeholders let me know that the campus is committed to providing the support needed for all of their students. The teachers wanted to do the very best for the students, but often felt they did not know how to best meet the varying needs. The campus values the diversity and appreciates all of the varying ethnic backgrounds and perspectives these differences bring. I expected the diversity of the campus to be embraced and I appreciated that the different people I interviewed understood that the cultural shift is a positive one.

It surprised me that the ELL instructional coach was so insightful about the abilities of all of the teachers. She was able to tell me which staff members used the English Language Proficiency Standards (ELPS) for their planning as well as which teachers put their learning objectives on the board for the students on a regular basis. She

valued the abilities of each teacher and plays to their strengths. She is a great resource for the campus and is a valuable resource to support the ELL students and teachers. She was be instrumental in creating an intervention that helped support academic vocabulary growth for our students.

Most importantly, I believed the overall value of the campus is that all students can learn and it is our duty to help them achieve this goal. Each person interviewed echoed this sentiment. Now it was a matter of how much support students should receive to help them move forward, but also hold them accountable for their learning. The interviewees all described a sense of urgency to support the students and the teachers to create success for all.

Table 2

Rank-Ordered Table of Values, Conversants, and Illustrative Statements

Rank	**Category and Value**	***Conversant**	**Illustrative Statement(s)**
1	Organizational Value: Effectiveness	Mrs. English	"Academically the students do not understand academic words and the teachers make assumptions that the students understand the hard content word. The foundation is not there, so the problem tends to snowball and we start to lose those students because the gaps continue to grow."
2	Professional Value: Obligation to clients	Mrs. Beaker	"The kids need more repetition with the core academic language. They need repetition and more dialogue with examples."
3	Organizational Value: Obligation to organization	Mrs. English	"We need to create intentional lessons with activities and vocabulary that supports the students. We should consider all the language

Table 2 continued.

Rank	Category and Value	*Conversant	Illustrative Statement(s)
			domains in that lesson so the students can grow. This will support all students because general education students do not throw around the academic language either and they would benefit from hearing the words multiple times also."
4	Professional Value: Obligation to clients	Mr. Charge	"That is the ultimate goal for our ELL students. The need is to help our teachers know how to support those students so they can move out of the program."
5	Organizational Value: Effectiveness	Mrs. Beaker	"I am concerned about the teaching methods that we use. We have been trained in the SIOP strategies, but I don't know if what we are doing is enough."
6	Organizational Value: Efficiency	Mrs. Bilingual	"I do not see that we are utilizing the computers. I don't really see the kids on their tablets/ laptops using them as translators and supports. We could also use our mainstream students as mentors. I think this would get them out of their "community" and more mainstream. This would help with a lot of different things- behavior, crime, academics, and friend groups."
7	Professional Value: Obligation to clients	Mr. Charge	"I think sometimes our teachers undersell what the students can do and coddle them too much, or they go to the other extreme and do not implement the 8 SIOP components they way they should."
8	Professional Value: Obligation to clients	Mrs. English	"Instructional coaches are not fully utilized. Some teachers do not welcome them into their classes. Also, teachers know what they should do, but do not always do it because it takes more time. They do not want to recreate things that they already have in their file cabinet. Even though these lessons are not proven to support academic growth for our students."

Table 2 continued.

Rank	Category and Value	*Conversant	Illustrative Statement(s)
9	Organizational Value: Effectiveness	Mr. Charge	"We regularly provide the staff with professional development to hone their instructional practices. Our instructional coaching staff will continue to work with the teachers to ensure that we improve the first time instruction to reach the needs of our ELL, economically disadvantaged, and every student on our campus."
10	Social and Political Value: Fairness	Mrs. Bilingual	"Holding them to a high standard and giving them the supports that they need. Just because they have that 'handicap' doesn't mean that they should just get by."
11	Social and Political Value: Participation	Mrs. Beaker	"One of the biggest issues facing our ELL students is support at home. Most of them come in willing to learn and wanting to learn, but do not have the support at home. They do not have someone pushing them, supporting them at home. The parents do not have the confidence to come up and ask for help or support. I know they know how important school is, but the parents are not equipped or do not know how to help."

Notes: Conversants (not their real names) have the following roles in the situation:

- Mrs. English- the ELL instructional specialist, charged with overseeing all ELL teachers, paras, and ELL paperwork
- Mr. Charge- the principal of the campus concerned with quality instruction for all students including ELL population
- Mrs. Bilingual- a bilingual parent of two students at the school who would like to see supports in place for all parents to be included
- Mrs. Beaker- a sixth-grade science teacher who has several sheltered classes with paraprofessional support for the ELL students

3.1.2 Problem or dilemma. According to Cuban (2001), a problem can be defined as "a situation in which a gap is found between what *is* and what *ought to be"* (p. 4). While a dilemma, also known as a wicked problem, is defined as "messy, complicated, and conflict-filled situations that require undesirable choices between

competing, highly prized values that cannot be simultaneously or fully satisfied" (Cuban, 2001, p. 10). The issue of ELL academic vocabulary acquisition can be identified as a problem because the ELL students ought to be as successful as the non-ELL students. The ELL instructional specialist provided training and supports for both the teachers and the paraprofessionals to support their ELL students. The teachers utilized SIOP methods to support their ELL students but feel there is something missing to help the students be successful. The administration and counselors believed supports for academic language acquisition can be tweaked to further support the ELL students. There was no conflict in this situation. All parties saw a need for additional support and were ready and willing to implement the supports for the ELL students.

3.2 My Journey in the Problem Space

3.2.1 Considering alternative viewpoints. I originally framed my problem as a campus improvement targeting instructional strategies to support our English Language Learner population. Our ELL population continues to grow at GIS and the teachers, although trained in the Sheltered Instruction Observation Protocol Model, struggled to help them increase their English fluency and be successful academically. One assumption I had was that the ELL population should be able to learn the English language and, with support, perform academically to the level of the non-ELL student population. However, in the past three years, our ELL population has not performed well on the state assessment. The gap for the ELL students continued to grow when they are not academically successful.

Previous attempts to support the ELL population have focused on the Sheltered Instruction Observation Protocol Model. The teachers are all trained to use the SIOP Model to help ELL students increase their English fluency and be successful academically. The instructional strategies in place, while sound, do not sufficiently bridge the language gaps to help ELL students catch up to their English-speaking peers. Since the ELL population continues to grow, we also asked for additional support personnel from the district. Last year, we were granted an additional paraprofessional support unit and the principal of the campus used some of his compensatory education funds to secure an additional part-time paraprofessional unit. This year we were also granted a second ELL teacher to work with the first-year immigrant students.

3.2.2 The evolution of my current understanding. The ELL students do not get the academic support needed at home to increase their English language proficiency. Lack of academic support at home is typically due to the parents speaking a language other than English and being unable to help their students due to English deficiency. This is out of the control of the school. GIS has put several things in place to provide additional supports for the students. The school offers a homework connections time twice a week. This homework support is provided by certified teachers for any student, but invitations are given to ELL students and students from low-income families.

ELL success was an important topic at GIS. Everyone I spoke with during my interviews agreed that we need additional supports for these students. The only conflict that arose was whether the supports should be during the instructional day or supports provided for families to utilize at home. The counselor and one of the teachers believe more supports should be in place to support the parents helping their student at home. For

example, letters sent in multiple languages, translations provided for homework, utilizing translators on technology for more lessons in class. The ELL instructional coach and the administrator interviewed did not believe this would ultimately support English acquisition but instead continue to help the student remain stagnant in their language acquisition. This difference of opinion is typical of second language acquisition styles. The immersion method of second language acquisition is more present in the opinions of the ELL instructional specialist and the administrator than the teacher and counselor.

CHAPTER IV PROBLEM STATEMENT

4.1 Audience

The goal of this record of study was to improve ELL student achievement, in particular the area of academic language acquisition in science, at Grand Intermediate School. Grand Intermediate School is located in Houston, Texas in Bay Knoll Independent School District. In the 2016-17 school year there were 943 sixth, seventh and eighth-grade students served at GIS. The stakeholders of GIS: teachers, parents, staff, and students, all benefited from this study. The teachers and staff benefited because they learned how to improve instructional practices for the ELL students. The ELL students benefited because they were able to understand the lessons being taught. The parents benefited because their student was better able to understand the academic terminology and was more successful at school.

4.2 Ideal Situation/ Vision

To successfully teach the students, GIS faculty needed to be able to help them access, engage, and express themselves in the classroom. To do this, the administrative and instructional coaching staff, needed to provide professional development for the teachers to give them the tools to support student learning. The provided professional development aimed to 1) prepare teachers to implement technology at high cognitive and engagement levels, 2) prepare teachers to use technology consistently in the classroom, and 3) provide teachers with multiple tools in which to support their students. Unfortunately, many of the teachers were not implementing technology in their instruction on a regular basis.

4.3 The Real Situation

Teachers at GIS got overwhelmed with the curriculum they taught and did not feel they had enough time or the skill set to implement technology on a daily basis. When teachers did utilize technology, it was often in the form of an electronic worksheet. To help the teachers implement technology, the administrators and instructional coaches needed to help them feel comfortable with the devices they had available to use. They also needed to make sure the teachers had quality professional development so the teachers could provide authentic, goal-directed experiences for their students. Dickey (2005) described using technology tools that engage students to "enhance existing curriculum and materials" (p. 68).

For this study there were 35 ELL students involved. Of these 35 students, 19 participated in the intervention and 16 were in the non-intervention group. Four of the 35 students were in their first year of U.S. schooling, three of these students were in the intervention group and one was in the non-intervention group. Three of the ELL students were in their second year of U.S. schooling, all of these student were in the intervention group. Three students were in their third year of U.S. schools and all three were in the non-intervention group. Two students were in their fourth year, one each in the intervention and non-intervention groups. One student that was in the non-intervention group was in their fifth year in U.S. schools and two from the non-intervention group were in their sixth year. The remaining twenty students were all in their seventh year of schooling in the United States. Twelve of the twenty students identified as ELL were in the intervention group and the remaining eight were in the non-intervention group. All of this information is given in Table 3, Years in U.S. Schools.

Table 3

Years in U.S. Schools

Years in U.S. Schools	Intervention	Non-Intervention	Total
1	3	1	4
2	3	0	3
3	0	3	3
4	1	1	2
5	0	1	1
6	0	2	2
7	12	8	20

Nineteen of the students involved in the study were male students and the other sixteen were female students. Thirteen of the male students were in the intervention group and six were in the non-intervention group. Eight of the female students participated in the intervention while the remaining eight did not. Two of the students were identified as receiving special education services one in each the intervention and non-intervention groups. There was also one student in the intervention group in the 504 program with a disabling condition of dyslexia.

The 35 students involved in the study were representative of four different ethnicities. One of the students in the non-intervention group was African-American, there were six Asian students, four in the intervention group and two in the non-intervention group. There were a total of twenty-five Hispanic students. Twelve of the Hispanic students were in the intervention group and the other thirteen were in the non-

intervention group. The remaining three students were White, all of these students were in the intervention group. This data is available in Table 4, *Ethnicity*.

Table 4

Ethnicity

	Intervention	Non-Intervention	Total
African- American	0	1	1
Asian	4	2	6
Hispanic	12	13	25
White	3	0	3

The campus serves a high population of students who come from economically-disadvantaged homes. Twenty-two of the thirty-five students involved in the study were labeled as economically disadvantaged. Twelve of these students were in the intervention group and the remaining ten were in the non-intervention group. This is a total of 63% of the students identified as ELL in the study being identified as economically disadvantaged. The remaining thirteen students were not identified as economically disadvantaged.

The campus served students that speak 35 different languages. Seven of these languages were represented in the study. Three students spoke Arabic, one student spoke each of the following languages: Farsi, Hindi, Mandarin, and Japanese. Two students involved in the study spoke Urdu and the remaining twenty-six students spoke Spanish.

The break-down of languages spoken by intervention and non-intervention groups can be found in Table 5, *Languages Spoken*.

Table 5

Languages Spoken

	Intervention	Non-Intervention	Total
Arabic	2	1	3
Farsi (Persian)	1	0	1
Hindi	1	0	1
Japanese	1	0	1
Mandarin (Chinese)	1	0	1
Spanish	12	14	26
Urdu	2	0	2

4.4 Consequences for the audience

Since the ELL population on the campus continued to grow, GIS staff needed to find ways to help them be successful. Academic vocabulary can be very difficult to comprehend when you speak a different language. The teachers needed support in how to best meet the needs of this population, engage them actively, and help bridge the communication gap these students experience. All of the teachers were provided professional development in sheltered instruction observation protocol (SIOP). Using these methods and providing additional training to implement personalized learning

through technology integration would help the teachers support the ELL student population.

By providing the teachers with technology tools and ways to implement technology in their instruction, GIS will be able to bridge some of these gaps and improve student success. According to Echevarría, Frey, and Fisher (2015) teachers need to provide "differentiated instruction, teacher modeling, language supports, vocabulary development, collaborative conversations, and visual representations" to support the ELL students (p. 23). Teachers often felt overwhelmed by the diverse needs in their classes and the time needed to get through the curriculum.

4.5 My Role

As the principal at GIS, one of my primary functions was curriculum support. I provided professional development and support for teachers. I worked with our ELL team leader, curriculum coaches, and instructional technology specialist to create professional development in the area of technology implementation to enhance ELL student participation and learning. I provided the teachers with an initial professional development session that was one day long. After the initial session, I provided monthly sessions to help support teacher needs. I also took learning walks throughout the year to observe the instructional practices in action and have informed conversations with the teachers. As the year progressed if the teachers were in need of additional one on one support, I provided this through a coaching model. In this way, the teachers can be in charge of their "own agenda- driven learning" (Sammut, 2014, p. 44). If a need arises for more intensive group professional development, I scheduled the training to meet the needs of the staff. I provided the teachers with a survey before the start of the

professional development and again at the end of the professional development cycle to see if their learning needs were met. I also looked at the data from the Texas English Language Proficiency Assessment System to check for ELL student growth.

CHAPTER V THE SOLUTION

5.1 Possible Solutions

5.1.2 Solution 1. English language learners are academically behind their peers at Grand Intermediate. To help increase academic vocabulary and proficiency in the science classroom, the faculty implemented a technology based vocabulary intervention. The teachers were provided training on how to implement the intervention. One week before each new unit, the students utilized the intervention for the first five minutes of class to pre-learn vocabulary. The students were given a pre-test before the intervention and post-test at the end of the unit to determine if the vocabulary was mastered.

5.1.2 Solution 2. English language learners were academically behind their peers at Grand Intermediate. A second possible solution to help increase academic vocabulary and proficiency in the science classroom was to implement a technology-based vocabulary intervention during the lesson cycle. The teachers would receive training on how to implement the intervention. The students would utilize the intervention during the independent practice portion of class each day to learn the vocabulary for the unit they were currently studying. The students would be given a pre-test before the intervention and post-test at the end of the unit to determine if the vocabulary was mastered.

5.2 Input From Others

5.2.1 Stakeholders' input. The input from the stakeholders at GIS provided a different viewpoint than what had been previously heard. The counselors believed the solution for the ELL academic deficiency lies with support given to the families. With the additional family support, they believed the students would be able to thrive at school. The campus has over 26 different languages spoken at home. The faculty at GIS did not

have the means to provide all of their information in all 26 languages. The assistant principal and licensed school psychologist both believed the addition of interventions in the classroom would support student learning among those ELL students struggling in the classroom. While the assistant principal, at the time, believed all of these ideas would benefit the ELL students, not all of them were feasible.

5.2.2 Classmates' input. Classmates provided feedback that the intervention proposed would provide the ELL students with schema before the unit. The classmates also felt that providing the PD for the teachers would sustain the intervention if it proved successful for the students. One suggestion that was given for supporting students at home was to provide vocabulary games in the student's native language. The game would be a matching game with the vocabulary provided in both the native language and English. The game was to be played at home so both parents and their students could have benefited.

5.2.3 Field advisor's input. The principal at GIS in the 2016-17 school year, was the field advisor. He agreed that the ELL students needed additional supports to help them achieve at the same level of their non-ELL peers. He felt that the academic vocabulary intervention was the most feasible solution at the time. He thought the support was both cost-effective and could be implemented with minimal disruption to the academic day. He did agree with the counselors that we should attempt to provide more supports for families in their home language, but to provide everything in 26 different languages was not manageable at the time. He also wanted to see the instructional coaching staff utilized to support the intervention, teachers, and ELL students.

5.2.4 Others' input. Two other people were interviewed for this study. The secretary was interviewed. She was also a parent at GIS. The ELL instructional coach was also interviewed. The secretary was the daughter of migrant workers. Her view about the issue was driven from this perspective. She believed more supports needed to be in place to help the parents learn English so they could support their students at home. The ELL instructional coach was frustrated by the lack of progress made by the teachers regarding the implementation of the SIOP strategies. While she believed the majority of the teachers were implementing the SIOP model, she thought there were several teachers who did not take ownership of the ELL students. She wanted to see the first solution implemented, but also wanted to continue to provide follow-up SIOP training.

5.3 The Proposed Solution

5.3.1 Informing the solution. Previous activities and data collection had led the investigator to believe the ELL students needed interventions above what they were currently being provided to make the academic progress necessary to be successful. The teachers interviewed were open to new ideas because they felt frustrated by the lack of progress the students were making. The teachers also believed the SIOP training was not adequate support for them to provide what the ELL students needed to be successful.

5.3.2 The final solution. The ELL students at GIS needed more academic support than they were currently receiving. Professional development was provided for the sixth-grade science teachers to implement the instructional intervention for vocabulary acquisition before instruction. The teachers allowed the students five to seven minutes at the beginning of each class period to utilize the vocabulary intervention. The students were given a pre-assessment, before the intervention, and a post-assessment after the unit

of instruction to determine if the student acquired the vocabulary for the unit. These assessments were made based on each unit of instruction. A favorable outcome would be that the students could comprehend the vocabulary for the unit and therefore, be more successful in science class.

CHAPTER VI METHODOLOGY

6.1 Statement Regarding Human Subjects and the Institutional Review Board

An application was submitted to the Institutional Review Board at Texas A&M University. The preliminary review of the methods for collecting information from human subjects determined that under their guidelines, the methods and research proposed for this study fell under the exempt category of a quality improvement project and was therefore not classified as human subjects research. As the proposed information gathering methods are within the general scope of activities and responsibilities associated with my current position, I was allowed to proceed with the data collection and the project. If the scope of the project changed, I would resubmit to the Institutional Review Board at Texas A&M.

6.2 Goals, Objectives, and Activities

Table 6

Goals, Objectives, and Activities Associated with the Problem Solution

Goal	Objective	Activity
I. Provide PD for all sixth-grade science teachers to support ELL student understanding of science vocabulary.	A. All sixth-grade science teachers attended two one-hour PD sessions to learn how to implement the technology based science vocabulary intervention for their ELL students.	1. Provided two one-hour PD sessions to all sixth-grade science teachers.
II. All sixth-grade teachers implement the technology based vocabulary intervention with their ELL students daily for one week before the start of the unit.	A. All sixth-grade science teachers provided their ELL students five to seven minutes at the beginning or end of each class period to utilize the vocabulary intervention.	1. Teachers pre-assessed their students' knowledge of the vocabulary for the upcoming unit of study with a quick on-line quiz. 2. Teachers explained the technology-based intervention to their students and provided them five to seven minutes each day to utilize the vocabulary intervention.
	B. All sixth-grade science teachers determined if the vocabulary intervention helped the students learn the targeted vocabulary.	1. Teachers gave the ELL students a quick on-line post assessment to assess their students' knowledge of the vocabulary for the unit of study.

6.3 Guiding Question(s), Information Collection Methods and Rationale for Methods

6.3.1 Guiding Questions. There are four questions that guided the design of the embedded mixed methods approach for this study. The first question, "*What were the sixth-grade science teachers' pre-existing interventions to support ELL students that utilized technology?",* specifically relates to the pre-existing levels of technology integration to support ELL students. The first objective of the study related to this question. The objective was to ensure all sixth-grade science teachers attended two, one-hour PD sessions to learn how to implement the technology based science vocabulary intervention for their ELL students. This objective was met by providing the training to the teachers.

The second guiding question was "*How did the sixth-grade science teachers respond during the intervention (i.e. PD, observations, learning walks, implementation of technology intervention)?".* The second objective of the study relates to this guiding question. The objective is for all sixth-grade science teachers to provide their ELL students five to seven minutes at the beginning or ending of each class period to utilize the vocabulary intervention. This objective was determined as met by accessing the student log-ins for the intervention program.

The third guiding question for this study was "*How effective was the intervention in improving teachers' instructional use of technology in the science classroom to benefit ELL student language acquisition?".* The third objective of the study relates to this guiding question. The objective was to determine if the vocabulary intervention helped the students learn the targeted vocabulary. This objective was determined as having been

met by providing the teachers the assessments and collecting the data from them when the assessments were completed.

The fourth guiding question of the study was "*How effective was the intervention in improving ELL student language acquisition?"* This relates to the fourth objective of the study to determine if the vocabulary intervention improved academic vocabulary acquisition for the ELL students. This objective was determined as having been met by looking at the scores from the pre-test and post-test of the students.

6.3.2 Collecting data. In this study, both quantitative and qualitative data were used in an embedded mixed methods design. Quantitative data was collected before and after the intervention in the form of students' scores on the pre and post-tests to determine the students' science vocabulary acquisition. Qualitative data was collected before, during, and after the intervention. This data provided information about: (1) teachers' perceptions of technology integration to meet the linguistic needs of ELL students, (2) improvement of implementation of technology in instruction as a result of PD as noted through observations (coach, ELL lead, and assistant principal observe teachers) and learning walks (teachers observe each other with the coach, ELL lead, and assistant principal to improve instructional practices), and (3) teachers' perceptions of improvement of instructional practices based on PD for technology integration.

6.3.3 Summary.

Table 7

Goals, Objectives, Activities, Guiding Questions, and Assessments Associated with the Problem Solution

Goal	Objective	Activity
I. All sixth-grade science teachers will assess the value of the PD and how it affects ELL student understanding of science vocabulary.	A. All sixth-grade science teachers attended two one-hour PD sessions to learn how to implement the technology based science vocabulary intervention for their ELL students. *Guiding Questions: What were the sixth-grade science teachers' pre-existing interventions to support ELL students?*	1. Provided two one-hour PD sessions to all sixth-grade science teachers. *Before and after the PD experience and technology based science vocabulary intervention, teachers responded to a questionnaire regarding the value of PD activities and technology integration in improving the level of ELL student vocabulary.*
II. All sixth-grade teachers will implement the technology based vocabulary intervention with their ELL students daily for one week before the start of the unit.	A. All sixth-grade science teachers provided their ELL students five to seven minutes at the beginning or end of each class period to utilize the vocabulary intervention. *Guiding Questions: How did the sixth-grade science teachers respond during the intervention (i.e. PD, observations, learning walks, implementation of technology intervention)?*	1. Teachers pre-assessed their students' knowledge of the vocabulary for the upcoming unit of study with a quick on-line quiz. 2. Teachers explained the technology-based intervention to the intervention group students and provided them five to seven minutes each day to utilize the vocabulary intervention. Those students in the control group did not get the intervention.

Table 7 continued.

Goal	Objective	Activity
	B. All sixth-grade science teachers determined if the vocabulary intervention helped the students learn the targeted vocabulary. *Guiding Questions: How effective was the intervention in improving teachers' instructional use of technology in the science classroom to benefit ELL student language acquisition?* *How effective was the intervention in improving ELL student language acquisition?*	1. Teachers gave the ELL students and non-ELL students the same quick on-line pre and post assessment to assess their students' knowledge of the vocabulary for the unit of study. (Note: Only students in the intervention group participated in the technology-based intervention, but all students took the pre and posts tests.)

6.4 Instruments and Analysis

6.4.1 Protocols and instruments. The first instrument used to collect information was a set of interview questions used to guide discussions with stakeholders about their perceptions of the needs of the ELL students at GIS. The questions focused on what the interviewee saw as the primary need to support ELL academic progress. In developing these questions, the investigator looked at the suggestions made by my Texas A&M professors. When interviewing the stakeholders, the investigator made sure to stick to the questions, so the interviewee was not led in any direction.

The second instrument was used to gather information from the teachers. The instrument was a Likert-style survey created to gather the teacher's perspective on their instructional practices used to support academic vocabulary development for their ELL students. The ELL instructional coach and science instructional coach both provided

feedback and support when this instrument was developed to ensure the questions probed for ELL instructional strategies and technology integration to support academic growth.

The intervention protocols were designed by the investigator with the support and input from the technology, ELL, and science instructional coaches. The intervention was designed to support teacher integration of technology and ELL student academic vocabulary acquisition. The intervention utilizes an online tool to provide students with visuals, auditory support for language acquisition, a definition, and a concrete example. The students took a pre-test and post-test before each unit. The tests were designed with the support of the instructional coaching team.

6.4.2 Analysis of data. During Phase I quantitative data was collected during the before phase of this study in the form of a Likert scale survey instrument for the teachers and pre-test data for the students. The teacher survey instrument was self-developed, and pilot tested on 5% of randomly selected faculty members. The data was assigned numeric values, and Excel was used to perform the calculations required for the analyses. The data was analyzed to determine if the teachers' perceptions of ELL students changed and also to determine if they felt the PD was successful. The student data was taken as a baseline for comparison during Phase III.

During Phase II qualitative data was collected during the intervention phase to track implementation of the intervention, explain the processes of the teachers and students during the intervention, and to follow up on results of the experimental trial. The qualitative data is taken in the form of observation and follow-up discussions with the teachers and instructional coaching staff.

During Phase III quantitative data was collected during the after phase of this study in the form of a survey instrument for the teachers and post-testing data for the students. The survey instrument will be the same one used in the before phase of this study. The data will be assigned numeric values, descriptive analysis of the teacher data and Mann-Whitney U tests for the student data will be performed. The data will be analyzed to determine to what extent the intervention was successful. According to Groebner, Shannon, and Fry (2014), the normal distribution is for a continuous random variable. The normal distribution is unimodal and symmetrical about its mean. The normal distribution has a property in which the mean, median, and mode are all the same value. The domain of the normal variable is minus infinity to plus infinity. The set of student scores is discrete and its domain is from zero to sixty inclusive. There is no reason to suspect that the student scores is symmetrical about its mean. The Mann-Whitney U test does not require any of these characteristics to be true.

6.5 Timeline

Table 8

Timeline

Mo	Wk	Contact/Activity	Collect	Analyze/Action	Product/Audience
Activities Before Study Begins					
Sept-Dec 2016		Meet with stakeholders	Information about perspective of ELL achievement and needs	Write up findings	Proposal
Feb 2017	1	Principal/ Assistant Superintendent –	Information sheets of study	Complete the sheets	Proposal to Principal

Table 8 continued.

Mo	Wk	Contact/Activity	Collect	Analyze/Action	Product/Audience
		Request permission – Present Overview			
	2	Return formal request to School Review Board			
	3	Wait to hear back from School Research Review Board			
	4	Receive approval			
Pre-Intervention Activities					
Feb 2017	1a	Contact teachers and request their involvement	ISD Permission slips		Communicate with principal
	1b	Create Likert-style questionnaire instrument (survey) with ELL team lead and instructional coaches			Likert-style questionnaire instrument (survey)
	2	Pilot test survey instrument on 5% of the faculty not participating in the study (chosen at random)	Likert-style questionnaire (survey)	Content analysis to ensure questions are valid	Technology coach, ELL lead, and Assistant Principal
	3	Hold first organizational meeting – pre-intervention – identify perceptions of current technology integration in instruction	Likert-style questionnaire (survey)	Content analysis	Coded list of teachers' perceptions of their instructional practices with technology integration/ Technology coach, ELL lead, and Assistant Principal
Mar 2017	1	Hold second organizational meeting -- discuss PD needs and plan for PD sessions (March, April)			Teachers, Technology coach, ELL lead, and Assistant Principal
	2	Schedule classroom observations with each teacher for March, April, and	Dates and times for observations		Calendar for PD/ Observation/ Learning walk/ Coaching cycle

Table 8 continued.

Mo	Wk	Contact/Activity	Collect	Analyze/Action	Product/Audience
		May. Assistant principal observes and takes anecdotal notes about technology integration			
	Intervention Activities				
Mar 2017	1	PD session 1- 1 hour		Provide/ Facilitate PD	Teachers, Technology coach, ELL lead, and Assistant Principal
	2-3	Classroom observations	Observation notes, anecdotal records	Content analysis	Teachers, Technology coach, ELL lead, and Assistant Principal
	4a	Classroom Learning Walks	Teacher lesson plans; my scripts and field notes	Content analysis	Teachers, Technology coach, ELL lead, and Assistant Principal
	4b	Peer Coaching and debriefing session	Anecdotal records	Content analysis	Summary of strengths and concerns
Apr 2017	1	Deliver PD session 2- 1 hour		Provide/ Facilitate PD	Teachers, Technology coach, ELL lead, and Assistant Principal
	2	Classroom observations	Observation notes, anecdotal records	Content analysis	Teachers, Technology coach, ELL lead, and Assistant Principal
	3a	Classroom Learning Walks	Scripts made by teachers; my scripts and field notes	Content analysis	Teachers, Technology coach, ELL lead, and Assistant Principal
	3b	Peer Coaching and debriefing session	Anecdotal records	Content analysis	Summary of strengths and concerns
May 2017	1	Classroom observations	Observation notes,	Content analysis	Teachers, Technology coach,

Table 8 continued.

Mo	Wk	Contact/Activity	Collect	Analyze/Action	Product/Audience
			anecdotal records		ELL lead, and Assistant Principal
	2	Classroom Learning Walks	Scripts made by teachers; my scripts and field notes	Content analysis	Teachers, Technology coach, ELL lead, and Assistant Principal
	3	Peer Coaching and debriefing session	Anecdotal records	Content analysis	Summary of strengths and concerns
	4	Classroom Learning Walks	Scripts made by teachers; my scripts and field notes	Content analysis	Teachers, Technology coach, ELL lead, and Assistant Principal
Post-Intervention Activities					
June 2017	1a	Collect Scores	Students' Scores on pre and post-tests	Data analysis	Descriptive Stats on Students' Growth from the year compared to control groups' growth
	1b	Post-Intervention questionnaire/ interview	Likert-style questionnaire (survey)	Content Analysis	Final conclusions regarding effectiveness
ROS Preparation					
Apr 2017 ↓	1-4	Write drafts of ROS, share with chair	Develop detailed schedule with chair to complete by deadlines	Complete all analyses; synthesize information	Draft copies and eventual Final Draft/share with Thematic Chair
Jun 2017	2-3	Share final copy of ROS with Chair (allow two weeks) and make corrections			
	4	Share ROS/Dissertation with Committee			Final Draft
Jul 2017	1-4	Defend by deadline Receive Thesis clerk approval			
Aug 2017		Graduate			

Table 8 continued.

Mo	Wk	Contact/Activity	Collect	Analyze/Action	Product/Audience
Sep 2017		Share final copy with stakeholders			Summary of Findings; Copy of Completed Study

6.6 Issues of Reliability, Validity, Confidentiality, and Other Ethical Concerns

To ensure validity, quantitative and qualitative data were obtained from the same populations throughout the study to make the data comparable. Four teachers and forty-five students were involved in the study. The same participants were also involved in both the qualitative and quantitative parts of the study. The survey instrument used was created for the teachers to ensure the questions were relevant and meaningful to the study purpose. The distribution of scores was examined in the before and after phase of the study using the Mann-Whitney U test.

AERA's code of ethics was reviewed and no potential ethical concerns in relation to the conduct of the study were identified. The investigator worked with teachers they did not oversee for appraisal purposes. The investigator worked with data that they were already privy to as an administrator.

This record of study fits the definition of a quality improvement project. An initiative designed to enhance teacher instructional practices to benefit ELL students was explored. The process was designed to improve future service delivery for students on the campus. The investigator looked at instructional practices aimed at improving the implementation of technology in classroom instruction to best meet the educational needs of ELL students.

CHAPTER VII RESULTS

7.1 Results

The purpose of this study was to determine if the intervention for ELL students improved their vocabulary acquisition more than the students who did not receive the intervention. In addition, we examined the teachers' perceptions of: their ability to support ELL students, their ability to integrate technology to support student learning, and their perception of whether adequate training has been provided. The number of teachers involved in the survey was small, nine teachers. The three groups of teachers are (A) those that participated in the intervention group (2 teachers), (B) those that did not participate but their students took the quizzes (1 teacher), and (C) those that did not participate and whose students did not take the quizzes (6 teachers). The research questions addressed are:

1. What were the sixth-grade science teachers' pre-existing interventions to support ELL students utilizing technology?

2. How did the sixth-grade science teachers respond during the intervention (i.e. PD, observations, learning walks, implementation of technology intervention)?

3. How effective was the intervention in improving teachers' instructional use of technology in the science classroom to benefit ELL student language acquisition?

4. How effective was the intervention in improving ELL student language acquisition?

This chapter will describe the inferential statistics of the students' improvement in scores from the pre to the post tests for the two different groups of the ELL students. These two groups of ELL students are those that received the intervention and those that

did not receive the intervention. The Mann-Whitney U test was used to perform this comparison.

A number of descriptive statistics were developed utilizing the pre and post tests for the students. Descriptive statistics were also utilized to examine the teachers' perceptions of their teaching abilities and professional learning experiences. This was done in the form of a pre and post survey.

7.2 Sample

A total of 101 sixth grade students participated in both the pre and post-tests. Of these, 56 students were involved in the intervention group. Nineteen of the 56 students in the intervention group were ELL students. Thirty-seven of the intervention group were non ELL students. A total of 45 students involved in both the pre and post-tests were not in the intervention group. Of these, 16 of the students were ELL and 29 of the students in the nonintervention group were not ELL.

7.3 Inferential Statistics Tests

The Mann-Whitney U test is a non-parametric test of statistical significance of differences between two populations. It requires that the measurements made be of the ordinal level but does not require that the populations be normal. It also does not require that the variances of the two populations be equal. This test is one of the most powerful of the non-parametric tests (Siegel, 1956). According to Siegel, the Mann-Whitney test is almost as powerful as the *t* test, the most powerful parametric test. The Mann-Whitney test approaches 95% power compared to the power of the *t* test (Siegel, p. 126).

The Mann-Whitney is a rank order test. It orders the combined two samples from smallest to largest. If the two samples come from the same population then the rank

ordered data will tend to have the two samples evenly mixed while if one population is larger than the other then the sample from that population will tend to have larger values and ranks than the sample from the other population. It can be either a one-tail or a two-tailed test. I am doing a one-tail test on my data.

The data contained in Appendix A provides the raw data for all students whose information was used in the study. All of the students were given a student ID that will be used to identify their data for the purposes of this study. Each student is also identified as participating in the intervention (1) or not participating in the intervention (0). Each student is also identified as being an English Language Learner (1) or not being identified as ELL (0). The result of each post-test and pre-test is listed and the improvement the student made from the pre-test to the post-test. The maximum score a student could receive on either the pre-test or post-test was 60. This is the number of questions on the test and a student either scored a 1, the answer was correct, or a 0, the answer was incorrect. The students are sorted in Table 6 by their improvement from the pre-test to the post-test as shown in the last column. The data from 101 students total was utilized for this study. Fifty-six of these students participated in the intervention group and 45 were in the non-intervention. Of the 56 in the intervention group, 19 were identified as ELL and the remainder were non ELL. Of the 45 in the non-intervention group, 16 were ELL and the remainder were non ELL students. Appendix A data are sorted by least improvement to most improvement in the last column.

The statistical tests were only concerned with ELL students but both ELL and non-ELL students went through the same process. In Table 9 and Table 10 the two

groups, non- ELL and ELL from Appendix A are separated. Table 9 has the scores for the non-ELL students while Table 10 has the scores for the ELL students.

Table 10 is the focus of the study of statistical inference. Table 10 has the Post-Intervention test scores and the Pre-Intervention test scores for the ELL students in the study. Of these 35 students 16 were in classes without intervention while the remaining 19 students were in classes with intervention.

Table 9

Non-ELL Student Data

ID	Intervention	ELL	Post-Test	Pre-Test	Improvement
2	1	0	29	34	-5
5	1	0	23	21	2
6	1	0	27	16	11
7	0	0	34	28	6
10	1	0	32	35	-3
12	1	0	56	37	19
13	1	0	35	15	20
14	1	0	44	27	17
15	0	0	44	24	20
16	1	0	24	21	3
19	0	0	41	29	12
21	1	0	49	25	24
22	1	0	25	32	-7
24	0	0	36	27	9
25	0	0	30	23	7
26	1	0	20	20	0
27	0	0	24	20	4
28	1	0	25	15	10
29	1	0	51	34	17
30	1	0	29	28	1
32	1	0	45	25	20
34	0	0	40	28	12
35	0	0	38	29	9

Table 9 continued.

ID	Intervention	ELL	Post-Test	Pre-Test	Improvement
37	1	0	49	28	21
38	1	0	34	17	17
41	1	0	24	16	8
42	0	0	34	20	14
43	1	0	47	29	18
44	0	0	47	20	27
46	0	0	43	24	19
48	1	0	30	28	2
51	0	0	46	34	12
53	1	0	33	24	9
54	0	0	26	25	1
55	1	0	39	25	14
56	0	0	38	23	15
57	1	0	36	25	11
58	1	0	46	27	19
60	0	0	33	25	8
63	1	0	28	26	2
64	0	0	35	18	17
66	0	0	32	25	7
68	0	0	35	26	9
69	0	0	36	29	7
70	1	0	46	35	11
71	0	0	42	29	13
72	0	0	41	25	16
73	0	0	40	14	26
75	1	0	40	30	10
76	1	0	45	23	22
77	0	0	43	23	20
78	1	0	25	14	11
79	0	0	37	24	13
81	0	0	42	26	16
85	1	0	53	30	23
86	0	0	48	35	13
88	0	0	59	37	22
90	0	0	34	24	10
91	1	0	48	25	23
93	1	0	49	26	23
94	0	0	44	26	18
95	1	0	39	28	11
96	1	0	39	20	19
98	1	0	40	29	11

Tabl 9 continued.

ID	Intervention	ELL	Post-Test	Pre-Test	Improvement
99	1	0	39	26	13
101	1	0	36	19	17

Table 10

ELL Student Data

ID	Intervention	ELL	Post-Test	Pre-Test	Improvement
1	0	1	15	19	-4
3	0	1	37	20	17
4	1	1	40	25	15
8	0	1	17	12	5
9	1	1	14	16	-2
11	0	1	38	34	4
17	1	1	36	19	17
18	1	1	25	18	7
20	0	1	10	18	-8
23	0	1	48	17	31
31	1	1	44	22	22
33	0	1	16	14	2
36	1	1	36	22	14
39	1	1	23	16	7
40	0	1	35	30	5
45	1	1	21	12	9
47	1	1	27	24	3
49	0	1	35	27	8
50	1	1	13	24	-11
52	1	1	28	18	10
59	1	1	34	19	15
61	1	1	32	21	11
62	1	1	28	22	6
65	0	1	13	16	-3
67	1	1	30	33	-3
74	1	1	35	16	19
80	1	1	39	18	21
82	0	1	25	16	9
83	0	1	28	27	1

Table 10 continued.

ID	Intervention	ELL	Post-Test	Pre-Test	Improvement
84	1	1	28	23	5
87	0	1	41	23	18
89	0	1	42	28	14
92	1	1	11	16	-5
97	0	1	45	30	15
100	0	1	33	25	8

The question then becomes, "How do we best compare the changes in test scores for the ELL students who were in the intervention group to the changes in the test scores for the ELL students who were in the non-intervention group?". This question addresses the null hypothesis that the ELL students with intervention perform equal to or less than the ELL students without intervention versus the alternate hypothesis that the ELL students with intervention perform better than the ELL students without intervention.

Non-parametric statistics are statistics that do not make assumptions about the underlying populations. Parametric statistics, such as the t statistic, requires assumptions to be made about the populations from which the data are obtained. The Mann-Whitney U test compares data from two populations without assuming that the underlying data are normal and we have no reason to believe that the improvements in test scores for the intervention and nonintervention ELL students are normal. The Mann-Whitney U test is nonparametric.

There are many methods to compare differences between two groups. One of the more common tests is the two sample t test. This test is parametric and requires normality and that the variances of the two populations be the same. Such assumptions

are often not warranted. On the other hand, the Mann-Whitney U test only requires that the data are ordinal. That is, one can say that one measurement is larger or smaller than another measurement but not by how much. It is one of the most powerful of the non-parametric tests. Power is the ability of the test to detect variation from the null hypothesis being true. The power of the Mann-Whitney U approaches that of the 2-sample t test.

The Mann-Whitney U test is a Rank Order test. The data from the two samples are joined together and then sorted from smallest to largest. The elements of the combined data are assigned a rank with the smallest observation being assigned a rank of 1 and the largest observation of the combined samples is assigned a rank of $n_1 + n_2$. The number of observations from the first population is n_1, the intervention ELL students, while n_2, the non-intervention ELL students, is the number of observations from the second population. Often ties occur, for example the 5^{th} and 6^{th} observations of the combined sample each has a value of –3. These two are each assigned a rank of 5.5 as seen in Table 12.

The logic of the Mann-Whitney U test is that if the null hypothesis of no differences in the populations is true, then the sample from the intervention population of students should be evenly spread over the combined samples and the ranks of the intervention samples should be about the same as the sample ranks of the non-intervention population of students. On the other hand if the alternative hypothesis is true then the sample from the intervention student population should mostly be larger than the sample from the non-intervention population and consequently have higher ranks. Table

11 shows data of all ELL students participating in the study. The data is rank ordered by least improvement to greatest improvement. The test "statistic

$$U = n_1 n_2 + \frac{n_1 (n_1 + 1)}{2} - R_1$$

or, equivalently,

$$U = n_1 n_2 + \frac{n_2 (n_2 + 1)}{2} - R_2$$

Where R_1 = sum of the ranks assigned to group whose sample size is n_1

R_2 = sum of the ranks assigned group whose sample size is n_2" (Siegel, 1956, p. 120). These two calculations give different values. The correct value for U is the smaller of the two.

Table 11

ELL Student Data Rank Ordered

ID	Intervention	Post-Test	Pre-Test	Improvement	Rank Order
50	1	13	24	-11	1
20	0	10	18	-8	2
92	1	11	16	-5	3
1	0	15	19	-4	4
65	0	13	16	-3	5.5
67	1	30	33	-3	5.5
9	1	14	16	-2	7
83	0	28	27	1	8
33	0	16	14	2	9
47	1	27	24	3	10
11	0	38	34	4	11
8	0	17	12	5	13
40	0	35	30	5	13

Table 11 continued.

ID	Intervention	Post-Test	Pre-Test	Improvement	Rank Order
84	1	28	23	5	13
62	1	28	22	6	15
18	1	25	18	7	16.5
39	1	23	16	7	16.5
49	0	35	27	8	18.5
100	0	33	25	8	18.5
45	1	21	12	9	20.5
82	0	25	16	9	20.5
52	1	28	18	10	22
61	1	32	21	11	23
36	1	36	22	14	24.5
89	0	42	28	14	24.5
4	1	40	25	15	27
59	1	34	19	15	27
97	0	45	30	15	27
3	0	37	20	17	29.5
17	1	36	19	17	29.5
87	0	41	23	18	31
74	1	35	16	19	32
80	1	39	18	21	33
31	1	44	22	22	34
23	0	48	17	31	35

Table 12 and Table 13 disaggregate the data from Table 11 into ELL students with intervention (Table 12) and ELL students without intervention (Table 13). Tables 12 and 13 give the average rank of the intervention group as 18.947 and the rank on the non-intervention group as 16.875. However, ranks are not of the interval level of measurement and averages may not be meaningful.

The Mann-Whitney U test calculates a statistic based on the sum of the ranks of the two samples and in this instance is equal to 134. At the $\alpha = 0.025$ level of

significance the critical value of U is 92 and any value less than or equal to 92 allows us to reject the null hypothesis while a U value greater than 92 requires us to accept the null hypothesis. At an $\alpha = 0.05$ for a one tailed test the critical value is 101 and we would also accept the null at this value. (See Appendix C for Critical Values of U.)

An examination of the tables shows that the average improvement for the ELL intervention group was 8.474. The average improvement of the non-intervention group was 7.625. When comparing the improvements, the intervention group had about 11.1% more improvement than the ELL non-intervention group.

Table 12

ELL Intervention Group Student Data Rank Ordered

ID	Intervention	ESL	Post-Test	Pre-Test	Improvement	Rank Order
50	1	1	13	24	-11	1
92	1	1	11	16	-5	3
67	1	1	30	33	-3	5.5
9	1	1	14	16	-2	7
47	1	1	27	24	3	10
84	1	1	28	23	5	13
62	1	1	28	22	6	15
18	1	1	25	18	7	16.5
39	1	1	23	16	7	16.5
45	1	1	21	12	9	20.5
52	1	1	28	18	10	22
61	1	1	32	21	11	23
36	1	1	36	22	14	24.5
4	1	1	40	25	15	27
59	1	1	34	19	15	27
17	1	1	36	19	17	29.5
74	1	1	35	16	19	32

Table 12 continued.

ID	Intervention	ESL	Post-Test	Pre-Test	Improvement	Rank Order
80	1	1	39	18	21	33
31	1	1	44	22	22	34
					Sum =161 Average= 8.474	Sum =360 Average rank= 18.947

n_1=19

Table 13

ELL Non-Intervention Group Student Data Rank Ordered

ID	Intervention	Post-Test	Pre-Test	Improvement	Rank Order
20	0	10	18	-8	2
1	0	15	19	-4	4
65	0	13	16	-3	5.5
83	0	28	27	1	8
33	0	16	14	2	9
11	0	38	34	4	11
8	0	17	12	5	13
40	0	35	30	5	13
49	0	35	27	8	18.5
100	0	33	25	8	18.5
82	0	25	16	9	20.5
89	0	42	28	14	24.5
97	0	45	30	15	27
3	0	37	20	17	29.5
87	0	41	23	18	31
23	0	48	17	31	35
				Sum= 122 Average= 7.625	Sum= 270 Average Rank= 16.875

$n_{2=}$16

When reviewing the data from the Texas English Language Proficiency Assessment System (TELPAS) scores compared from fifth grade to sixth grade, there were twelve students who had no data to compare. Some of these students were not in the United States for their fifth grade year, some were not in the state of Texas, and some were not in school during the testing window. Twelve students fell in this category of no data available. Six in each the intervention and non-intervention category. Four students in the intervention group improved their TELPAS Composite score by one rating, while one student in the non-intervention group improved their score. Nine students in the intervention group had the same TELPAS Composite score from fifth to sixth grade while eight students in the non-intervention group remained steady. There was one student whose Composite score showed regression by one rating from fifth to sixth grade. That student was in the non-intervention group. This data can be found in Table 14, *TELPAS Composite Scores Change from 5th Grade to 6th Grade*.

Table 14

TELPAS Composite Scores Change from 5th Grade to 6th Grade

	Improvement	No Improvement	Regression	No Data Available
Intervention	4	9	0	6
Non-Intervention	1	8	1	6

The TELPAS data also provides a percent score, scale score, and raw score for the reading exam. Again, the same students did not have data to compare due to not taking one or both of the exams. The remaining data is reflected in Table 15, *Average Improvement on TELPAS Reading*. The intervention group students scored on average 2.615% more on the percent score, 16.25 points on the scale score, and 2.375 points on the raw score. The Non-Intervention group students scored on average 1% more on the percent score, 6.375 points on the scale score, and 1.375 points on the raw score.

Table 15

Average Improvement on TELPAS Reading

	Percent Score	Scale Score	Raw Score
Intervention	2.615	16.25	2.375
Non-Intervention	1.000	6.375	1.375

7.4 Descriptive Statistics

Table 16 and Table 17 show the averages of the students' pre-tests and post-tests broken down by intervention or non-intervention groups. The average score of all students on the pre-test was 23.91 out of a total of 60 questions. The pre-test and post-test questions are the same and are attached in Appendix B. The intervention group scored an average of 23.55 on the pre-test while the non-intervention group scored a total of 24.35.

The average score on the post-test was 34.88 with the intervention group average score being 34.34 and the non-intervention group average 35.55. The intervention group improved their score, on average, 10.79 points while the non-intervention group improved their score, on average, 11.20 points. The averages of both groups are very similar.

Table 16

Pre-Test Total Sample Intervention Versus Non-Intervention

Pre-Test	No. of students	Average Score
Total	101	23.91
Intervention Group	56	23.55
Non-Intervention Group	45	24.35

Table 17

Post-Test Total Sample Intervention Versus Non-Intervention

Post-Test	No. of students	Average Score
Total	101	34.88
Intervention Group	56	34.34
Non-Intervention Group	45	35.55

Table 18 and Table 19 compare the ELL students' scores versus the Non-ELL students' scores of the pre-test and post-test. These tables do not separate the scores based on intervention or non-intervention. The ELL students scored an average of 21.14 on the pre-test, while the Non-ELL students scored an average of 25.38 points as shown on Table 18. The ELL students scored an average score of 29.20 on the post-test while the Non-ELL students score 37.89 as shown in Table 19. The ELL students raised their scores an average of 8.06 and the Non-ELL students raised their scores an average of 12.51 points on the test.

Table 18

Pre-Test Total Sample ELL Versus Non-ELL

Pre-Test	No. of students	Average Score
Total	101	23.91
ELL	35	21.14
Non-ELL	66	25.38

Table 19

Post-Test Total Sample ELL Versus Non-ELL

Post-Test	No. of students	Average Score
Total	101	34.88
ELL	35	29.2
Non-ELL	66	37.89

Nine teachers were surveyed both before the intervention and after the intervention to determine their thoughts about working with ELL students. The questions for the survey are attached in Appendix D. The teachers were asked eighteen questions and were provided a Likert scale in which to respond, shown in Table 20. The survey is both balanced, meaning the distance between each value is the same, and symmetrical, meaning that the categories have a midpoint value of neither agree nor disagree. For the teacher survey, question five is a reverse scaled question and questions 6 and 17 are similar to check for internal consistency.

Table 20

Likert Scale Response for Teacher Survey

1	2	3	4	5
Strongly Agree	Agree	Neither Agree or Disagree	Disagree	Strongly Disagree

Nine teachers were selected to participate in the teacher survey in order to get an overall feel of teachers' perceptions on the campus. Of these, three teachers participated in the study (T4, T8, and T9). Two of the three teachers (T4 and T8) participating in the study received professional learning and also participated in a coaching cycle to be able to better meet the needs of their ELL students. These two teachers' students had classes with intervention as well as classes without intervention. Teacher T9 only had students without intervention. The remaining teachers who took the survey were randomly selected from the faculty to gather teacher perceptions.

Table 21 shows the scores from the teachers' survey. A good score on the survey would be between 20 and 36, keeping all of the responses between agree and strongly agree except for question 5 which would be between neither agree nor disagree and strongly disagree. Question 5 is a reverse scale question. A score of up to 54 would be considered an average score and anything 55 or above would be considered in the poor range. On the pre-survey two teachers score in the good range while six teachers scored in the average range and one teacher scored in the poor range. On the post survey, four teachers scored in the good range and five teachers scored in the average range.

On the pre-survey for questions 6 and 17 only one teacher, T4, did not score the same on both questions. While on the post-survey, three teachers, T4, T7, and T8, did not score the same on questions 6 and 17.

Table 21

Teacher Survey Scores

Teacher Code	Pre-Survey	Post-Survey	Difference
T1	36	30	6
T2	26	26	0
T3	55	45	10
T4	37	32	5
T5	47	39	8
T6	48	41	7
T7	48	39	9
T8	40	32	8
T9	41	37	4

7.5 Research Questions

Research Question 1

What were the sixth-grade science teachers' pre-existing interventions to support ELL students utilizing technology?

Research question 1 examined the sixth grade teachers pre-existing interventions to support ELL students that utilized technology. All of the students in our district are provided with an individual laptop for instructional purposes. This can be considered an instructional intervention for students when used to translate instructional content or support learning. The sixth grade teachers did utilize other technology in the classroom to

support student learning. However, they did not utilize technology as an intervention. Their technology use was mainly for instructional purposes such as projection devices, ItsLearning platform to share content or turn in content, online quizzes, quizlet, etc. There were no specific interventions for ELL students to front load academic vocabulary. This information was gained through conversations with the sixth grade science teachers and other conversants during the framing of the problem situation (Table 2).

Research Question 2

How did the sixth-grade science teachers respond during the intervention (i.e. PD, observations, learning walks, implementation of technology intervention)?

The pre and post-surveys the teachers participated in did show that their perceptions of technology integration, expectations for ELL students, and professional development did improve. The teachers participated in two rounds of learning walks and coaching with the ELL, science, and technology instructional specialists. These sessions were met with active participation, discussion, and quality questions to support learning. However, when conducting walkthroughs and learning walks both the administration and instructional specialists observed instances of nonconformance with the study protocol.

Research Question 3

How effective was the intervention in improving teachers' instructional use of technology in the science classroom to benefit ELL student language acquisition?

The intervention did not show that a statistically significant improvement in the students' language acquisition occurred. Looking at the quantitative data from the teachers' pre and post-surveys, the perception of the teachers' ability to provide interventions for ELL students did improve. However, utilizing the field notes from the observations, the teachers did not provide the intervention on a daily basis with fidelity. The teachers also did not always provide an opportunity for the students to utilize

headphones so they could hear the words and definitions in English and associate that word with the visual provided.

Research Question 4

How effective was the intervention in improving ELL student language acquisition?

The intervention did not show a statistically significant improvement in the students' language acquisition.

Looking at Table 9 and Table 10, the ELL students who had the intervention applied had an average rank of 18.947 while the non-intervention ELL students had an average rank of 16.875. The average improvement score of the ELL intervention group was 8.474 and the average improvement in scores of the ELL non-intervention group was 7.625. The test performed, the Mann-Whitney U test, did not show a statistically significant difference, but the data did show a trend toward improvement for the students' average scores of about 11.1%. The sample size for the study was small and a larger sample might show statistically significant improvements.

7.6 Summary

In this chapter the inferential statistics for the participants of the intervention were presented and explained. The statistics of the students' pre-test and post-test were also examined. The Mann-Whitney U statistical test did not show a significant improvement of the scores of the ELL students in the intervention group compared to the ELL students in the non-intervention group. The statistics from the teacher surveys were presented as they relate to the overall perceptions of the teachers that participated in the study and a random sampling of the teachers on the campus. The results showed that teachers' perceptions did improve with the post survey having all of the teachers score in the good

to average range and two times the teachers scoring in the good range (four teachers) compared to the pre survey. No teachers scored in the poor range on the post-survey. The ELL students who participated in the intervention did show about an 11% improvement in academic vocabulary acquisition over the ELL non-intervention students.

CHAPTER VIII CONCLUSIONS AND IMPLICATIONS

This chapter will summarize the record of study, procedures used for data analysis, discuss the conclusions from the study, and findings from the data analysis. In order to complete this study, two different groups of students were observed; ELL students utilizing the intervention and ELL students not utilizing the intervention. This chapter will also delve into implications and recommendations for further study.

8.1 Summary

The purpose of this mixed methods study was to explore ways to bridge the language gaps to help ELL students catch up to their English-speaking peers. In order to do this, professional development to improve technology integration practices for instruction was provided to the sixth grade science teachers. An embedded mixed methods design was used for this study. Quantitative data from the teachers in the form of Likert-scale teacher survey and quantitative student test data was collected before the intervention. Professional development was provided to the teachers and classroom observations, learning walks, and peer coaching were utilized to support the implementation of technology in instruction. Ordinal data was collected during the intervention phase from the pre and post-tests given to the students. The ordinal data was analyzed using the Mann-Whitney U test. After the intervention, the Likert-scale survey was repeated with the teachers and this data was analyzed using descriptive statistics. This record of study will help the campus and teachers to make decisions about interventions for ELL students.

An embedded mixed methods design was selected for this study because both quantitative and qualitative data was collected. Quantitative data was collected from the pre and post-tests given to the sixth grade science students in both the intervention and non-intervention classrooms. All students in the selected sixth grade science classrooms participated in the pre and post-tests regardless of whether the student participated in the intervention and regardless of whether the student was identified as ELL.

This study consisted of 101 sixth grade students who participated in both the pre and post-tests. Out of these students, 56 were in the intervention group and 45 were in the non-intervention group. The focus of this study was the thirty-five ELL students. Of these ELL students, 19 were in the intervention group and 16 were in the non-intervention group.

Qualitative data was taken in the form of a Likert scale survey given to the selected teachers. Three teachers participated in this study. Two teachers provided the intervention in their class while one teacher taught the control group that only participated in the pre and post-tests. These three teachers, along with six other teachers participated in the Likert scale survey. The survey was given to the teachers prior to the study and again after the study was completed. The survey included nine teachers in order to get an overall feel of professional development designed to support technology integration, ELL academic support, and ELL expectations from teaching staff. The survey consisted of 18 questions that were ranked on a scale of strongly agree to strongly disagree. (This survey is in Appendix D.)

The research questions that were addressed in this record of study are:

1. What were the sixth-grade science teachers' pre-existing interventions to support ELL students utilizing technology?
2. How did the sixth-grade science teachers respond during the intervention (i.e. PD, observations, learning walks, implementation of technology intervention)?
3. How effective was the intervention in improving teachers' instructional use of technology in the science classroom to benefit ELL student language acquisition?
4. How effective was the intervention in improving ELL student language acquisition?

These research questions were addressed through the interpretation of the qualitative and quantitative data. The Mann-Whitney U test did not show a significant improvement of the ELL students in the intervention group versus the ELL students in the non-intervention group. However, the ELL students who participated in the intervention did show about an 11% improvement in academic vocabulary acquisition over the ELL non-intervention students. The qualitative statistics from the Likert-Scale survey showed that teachers; perceptions did improve from the start of the semester to the end of the study.

8.2 Conclusions

In this semester long study, the teachers, instructional coaches, and administration worked together to implement instructional practices to support student learning. It is apparent that the teachers want to help the students be successful. The needs of the campus and students at Grand Intermediate School are diverse. Meeting the specific learning needs of each student can be a cumbersome task for the teachers.

This record of study showed that the intervention group, while not showing statistically significant improvement compared with the non-intervention group, did show gains over the non-intervention group. The majority of the students who participated in the study reported to the teachers that they enjoyed the intervention and liked the use of technology. Some of the questions that arose during this study were:

1. Did discipline issues play a role in the lack of improvement for some students?
2. Was work avoidance a key in student academic improvement?
3. What percentage of the students who participated in the study are also identified as learning disabled?
4. What percentage of the students participating in the study are also identified as low income?
5. What percentage of the students participating in the study have attendance issues?
6. How can it be determined that the teachers implemented the study with fidelity?

8.3 Implications

The implications of this record of study show that further study is needed. The campus does need to look at implementing various instructional strategies to support ELL students to close the achievement gaps. English language learners come with many instructional gaps. Many of these students have interrupted formal education and come to intermediate school with no English language or limited English language. There are also ELL students whom qualified for special education services. These students' needs must be addressed through accommodations or modifications for the intervention to level the playing field and make the intervention more accessible.

The teachers reported that it was difficult to implement the intervention on a daily basis due to academic pressure and the timeframes for the units of study. Additionally, the teachers reported there were times that the students did not utilize their headphones or in some instances there were not enough headphones available for all students. For the intervention to be implemented with fidelity, all students needed to participate daily and utilize headphones so they could hear the words pronounced and become familiar with the vocabulary.

Parent participation is limited on the campus. This may be attributed to several factors including non-native English speaking parents not understanding the information. The campus provides communication with parents in English and Spanish, but these families speak many more languages in addition to English and Spanish. Students in this age group do not typically encourage or appreciate parental participation in school activities. This age group is striving to be more independent and frequently get embarrassed by their parents. Many parents comment about wanting to allow their students to assert their independence and give them autonomy, a task often difficult while still maintaining a connection with the school. This school serves a thirty-four square mile radius and many of the families do not have reliable transportation to get to and from the school. Many of the families also do not have internet service at home so their student could not access the intervention from home to practice after hours with their parent. Due to these reasons, parent participation with their students during the intervention was limited.

The performance of the ELL students on the post-intervention vocabulary test had exceeded the average performance of the non-ELL students on the pre-intervention test.

The non-ELL students scored an average of 25.38 on the pre-test and the ELL students scored an average of 29.2 on the post test. These scores include both the intervention students and the non-intervention students as seen in Tables 14 and 15. This shows that the students made gains in the academic vernacular for science which is essential for learning the curriculum. If a future study is conducted, the questions that arose during this study need to be considered.

8.4 Recommendations for Further Study

The recommendations for further study are:

1. Recreate the study with a larger sample size. As the sample size becomes larger, it becomes easier to detect small differences in the effect of the intervention.
2. Recreate the study and complete the study over a longer period of time to allow the ELL students an opportunity to grasp the language.
3. Have a dedicated person to implement the intervention with fidelity each day.
4. Train parents on the intervention so they can support their students at home.
5. Make the intervention be downloadable so students without internet access at home can still practice outside of school if they so choose.
6. Provide accommodations and/ or modifications for students with special education needs when utilizing the intervention.
7. Bolster parent participation through informational outreach events, communication in multiple languages, and providing bus transportation for families to attend these events.

This study would have benefitted from doing several things differently. First, I would have looked at the makeup of the students in each class. It would have been

beneficial to determine what percentage of the students were in the special education program and make allowances and modifications for them in the utilization of the intervention. Second, have a parent informational meeting to explain the intervention and study. In doing this, the parents can have a better understanding of the intervention and provide support by being able to discuss it with their student and potentially promote the program so the students take it seriously. This would also provide the parents with an opportunity to be more involved in their child's school and education.

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APPENDIX A

ALL STUDENT RAW DATA SORTED BY IMPROVEMENT

All Students Raw Data Sorted by Improvement

ID	Intervention	ELL	Post-Test	Pre-Test	Improvement
50	1	1	13	24	-11
20	0	1	10	18	-8
22	1	0	25	32	-7
2	1	0	29	34	-5
92	1	1	11	16	-5
1	0	1	15	19	-4
65	0	1	13	16	-3
10	1	0	32	35	-3
67	1	1	30	33	-3
9	1	1	14	16	-2
26	1	0	20	20	0
54	0	0	26	25	1
83	0	1	28	27	1
30	1	0	29	28	1
33	0	1	16	14	2
5	1	0	23	21	2
48	1	0	30	28	2
63	1	0	28	26	2
16	1	0	24	21	3
47	1	1	27	24	3
11	0	1	38	34	4
27	0	0	24	20	4
8	0	1	17	12	5
40	0	1	35	30	5
84	1	1	28	23	5
7	0	0	34	28	6
62	1	1	28	22	6
25	0	0	30	23	7
66	0	0	32	25	7
69	0	0	36	29	7
18	1	1	25	18	7
39	1	1	23	16	7
49	0	1	35	27	8

ID	Intervention	ELL	Post-Test	Pre-Test	Improvement
60	0	0	33	25	8
100	0	1	33	25	8
41	1	0	24	16	8
24	0	0	36	27	9
35	0	0	38	29	9
68	0	0	35	26	9
82	0	1	25	16	9
45	1	1	21	12	9
53	1	0	33	24	9
90	0	0	34	24	10
28	1	0	25	15	10
52	1	1	28	18	10
75	1	0	40	30	10
6	1	0	27	16	11
57	1	0	36	25	11
61	1	1	32	21	11
70	1	0	46	35	11
78	1	0	25	14	11
95	1	0	39	28	11
98	1	0	40	29	11
19	0	0	41	29	12
34	0	0	40	28	12
51	0	0	46	34	12
71	0	0	42	29	13
79	0	0	37	24	13
86	0	0	48	35	13
99	1	0	39	26	13
42	0	0	34	20	14
89	0	1	42	28	14
36	1	1	36	22	14
55	1	0	39	25	14
56	0	0	38	23	15
97	0	1	45	30	15
4	1	1	40	25	15
59	1	1	34	19	15
72	0	0	41	25	16
81	0	0	42	26	16
3	0	1	37	20	17
64	0	0	35	18	17
14	1	0	44	27	17
17	1	1	36	19	17

ID	Intervention	ELL	Post-Test	Pre-Test	Improvement
29	1	0	51	34	17
38	1	0	34	17	17
101	1	0	36	19	17
87	0	1	41	23	18
94	0	0	44	26	18
43	1	0	47	29	18
46	0	0	43	24	19
12	1	0	56	37	19
58	1	0	46	27	19
74	1	1	35	16	19
96	1	0	39	20	19
15	0	0	44	24	20
77	0	0	43	23	20
13	1	0	35	15	20
32	1	0	45	25	20
37	1	0	49	28	21
80	1	1	39	18	21
88	0	0	59	37	22
31	1	1	44	22	22
76	1	0	45	23	22
85	1	0	53	30	23
91	1	0	48	25	23
93	1	0	49	26	23
21	1	0	49	25	24
73	0	0	40	14	26
44	0	0	47	20	27
23	0	1	48	17	31

APPENDIX B

6TH GRADE SCIENCE VOCABULARY QUIZ (PRE AND POST TEST)

6th Grade Science Vocabulary Quiz (Pre and Post Test)

1. The sum of all living matter on earth.

ecosystem

biosphere

environment

abiotic factors

2. All of the living and nonliving factors in an area.

environment

community

population

biotic factors

3. Factors that are neither living nor produced by living things.

abiotic factors

biotic factors

ecosystem

environment

4. Factors that are living or produced by living things.

abiotic factors

ecosystem

biotic factors

environment

5. A system comprising all the biotic and abiotic factors in an area and all the interactions among them.

ecosystem

environment

Habitat

Niche

6. The place where an organism naturally lives and grows.

Niche

Habitat

ecosystem

environment

7. The function or position of an organism or a population within an ecological community.

Niche

Habitat

ecosystem

environment

8. A group of organisms with similar characteristics that are able to interbreed or exchange genetic material.

population

community

Relative

Species

9. A group of interacting individuals of the same species located in the same area.

Species

Relative

population

Family

10. All of the populations of different species in a particular area.

ecosystem

community

organisms

Species

11. The branch of science that formally names and classifies organisms by their structure, function, and relationships.

classification

Structure

taxonomy

Domains

12. The arrangement of parts that form a living thing.

Structure

taxonomy

Domains

Cells

13. What something does.

Domain

Kingdom

Structure

Function

14. An organism that obtains its nutrition from simple, inorganic compounds

heterotrophic organism

Domains

autotrophic organism

Kingdoms

15. Unable to make its own food from simple inorganic molecules.

autotrophic organism

heterotrophic organism

Domains

Kingdoms

16. The process by which organisms produce more of their own kind.

Organism

Reproduction

Taxonomy

Domains

17. The reproductive process involving two parents whose genetic material is combined to produce a new organism different from themselves.

asexual reproduction

Taxonomy

Domain

sexual reproduction

18. A method of reproduction that requires only one parent.

asexual reproduction

Taxonomy

Domain

sexual reproduction

19. The highest level of the taxonomic hierarchy; includes three groups: Archaea, Bacteria, and Eukarya.

Kingdom

taxonomy

Domains

Structure

20. One of the three taxonomic domains; includes prokaryotic, single-celled organisms that lack a membrane-enclosed nucleus and that can be classified by shape.

Domain Archaea

Domain Eukarya

Domain Bacteria

Domain Fungi

21. One of the three taxonomic domains; includes unicellular organisms that are prokaryotic like bacteria, but also share characteristics with eukaryotes.

Domain Archaea

Domain Eukarya

Domain Bacteria

Domain Fungi

22. One of the three taxonomic domains of organisms; cells contain a membrane-enclosed nucleus.

Domain Archaea

Domain Bacteria

Domain Fungi

Domain Eukarya

23. The second highest level in the taxonomic hierarchy; contains six groups: Archaea, Bacteria, Protista, Fungi, Plantae, and Animalia.

Domains

kingdoms

organelles

Classify

24. Kingdom of prokaryotic, single-celled organisms that lack a membrane-enclosed nucleus and can be classified by shape.

Kingdom Fungi

Kingdom Archaea

Kingdom Protista

Kingdom Bacteria

25. Kingdom of unicellular organisms that are prokaryotic like bacteria, but also share characteristics with eukaryotes.

Kingdom Fungi

Kingdom Archaea

Kingdom Protista

Kingdom Bacteria

26. Kingdom of single-celled and simple multiple-celled eukaryotic organisms.

Kingdom Plantae

Kingdom Archaea

Kingdom Protista

Kingdom Bacteria

27. Kingdom of autotrophic eukaryotes that includes all plants.

Kingdom Archaea

Kingdom Animalia

Kingdom Plantae

Kingdom Bacteria

28. Kingdom of heterotrophic eukaryotes that includes all animals.

Kingdom Archaea

Kingdom Animalia

Kingdom Bacteria

Kingdom Plantae

29. Kingdom of heterotrophic eukaryotes that reproduce through asexual spores and have chitin in their cell walls.

Kingdom Fungi

Kingdom Animalia

Kingdom Protista

Kingdom Bacteria

Protista

Fungi

plant cell

Animalia

30. A kingdom made up of nongreen, eukaryotic organisms that have no means of movement, reproduce by using spores, and get food by breaking down substances in their surroundings and absorbing the nutrients.

31. A kingdom of unicellular prokaryotes whose cell walls do not contain peptidoglycan.

Archaeabacteria

Eubacteria

Bacteria

Archaea

32. A kingdom that contains all prokaryotes except archaebacteria.

Archaeabacteria

Archaea

Bacteria

Eubacteria

33. The arrangement of animals and plants in groups according to their similarities.

classification

Coding

Grading

Rank

34. An instrument used for viewing very small objects.

microscope

Vacuole

Organism

Cylinder

35. Contains the ocular lens. (microscope)

Eyepiece

nosepiece

objective lenses

arm support

36. Holds the high and low power objective lenses; can be rotated to change magnification. (microscope)

Eyepiece

nosepiece

arm support

fine adjustment knob

37. Magnification ranges from 10X to 40X. (microscope)

fine adjustment knob

Stage

objective lenses

arm support

38. Holds the slide in place. (microscope)

Base

Arm

Eyepiece

stage clips

39. Supports the slide being viewed. (microscope)

stage clips

Arm

Stage

nosepiece

40. Used to support the microscope when carried.

Arm

Base

nosepiece

objective lenses

41. Moves the stage up and down for focusing. (microscope)

Base

coarse adjustment knob

fine adjustment knob

Stage

42. Moves the stage slightly to sharpen the image. (microscope)

Base

coarse adjustment knob

fine adjustment knob

Eyepiece

43. Supports the microscope.

Arm

Stage

nosepiece

Base

44. A self-contained living thing.

Organism

Cell

DNA

membrane

45. The smallest unit of an organism; it is enclosed by a membrane and performs life functions.

Organism

Cell

membrane

Nucleus

46. The goop like substance that holds everything together.

cytoplasm

organelles

Nucleus

eukaryotic

47. A small body in a cells cytoplasm that was built to do a specific thing and can do nothing else but that specific thing.

cytoplasm

organelle

DNA

cell membrane

48. The genetic material that makes the blueprints for all of the cells.

chloroplast

Nucleus

ribosomes

DNA

49. A cell with a nucleus and membrane-bound organelles.

chloroplast

cell membrane

prokaryotic cell

eukaryotic cell

50. A cell lacking a nucleus or any other membrane-enclosed organelle.

cell membrane

eukaryotic cell

prokaryotic cell

organelles

51. Found outside the cell membrane, made mostly of cellulose. Found in plant cells, but not animal cells.

chloroplast

membrane

cytoplasm

cell wall

52. An organelle found in plant and algae cells where photosynthesis occurs.

chloroplast

cell wall

cell membrane

Nucleus

53. Regulates the amount of pressure in the cell, stores nutrients, waste products and water without it the cell would dry out.

chloroplast

mitochondria

cell membrane

Vacuole

54. A eukaryotic cell in which all organelles are contained in membranes.

plant cell

animal cell

chloroplasts

fungi cell

55. A membrane-bound structure in eukaryotic cells that contain DNA.

organelle

chloroplast

ribosomes

Nucleus

56. Each organism is one cell, many cells may live together in a colony.

unicellular

multicellular

Asexual

Sexual

57. Each organism is composed of two or more cells that work together.

unicellular

Asexual

multicellular

Sexual

58. The two different types of cells are:

cytoplasm and ribosomes

eukaryotic and prokaryotic

organelles and chloroplast

nuclear membrane and cell membrane

59. A wall like substance that covers the cell. It maintains things like oxygen and water that move in and out of the cell.

cytoplasm

organelles

cell membrane

nuclear membrane

60. The powerhouses of the cell. They are organelles that act like a digestive system which takes in nutrients, breaks them down, and creates energy rich molecules for the cell.

mitochondria

Nucleus

chloroplasts

organelle

APPENDIX C

CRITICAL VALUES OF U FOR A ONE OR TWO-TAILED TEST

Critical Values of U for a One-Tailed Test at $\alpha = 0.025$ or for a Two-Tailed Test at $\alpha = 0.05$

n_1 \ n_2	9	10	11	12	13	14	15	16	17	18	19	20
1												
2	0	0	0	1	1	1	1	1	2	2	2	2
3	2	3	3	4	4	5	5	6	6	7	7	8
4	4	5	6	7	8	9	10	11	11	12	13	13
5	7	8	9	11	12	13	14	15	17	18	19	20
6	10	11	13	14	16	17	19	21	22	24	25	27
7	12	14	16	18	20	22	24	26	28	30	32	34
8	15	17	19	22	24	26	29	31	34	36	38	41
9	17	20	23	26	28	31	34	37	39	42	45	48
10	20	23	26	29	33	36	39	42	45	48	52	55
11	23	26	30	33	37	40	44	47	51	55	58	62
12	26	29	33	37	41	45	49	53	57	61	65	69
13	28	33	37	41	45	50	54	59	63	67	72	76
14	31	36	40	45	50	55	59	64	67	74	78	83
15	34	39	44	49	54	59	64	70	75	80	85	90
16	37	42	47	53	59	64	70	75	81	86	92	98
17	39	45	51	57	63	67	75	81	87	93	99	105
18	42	48	55	61	67	74	80	86	93	99	106	112
19	45	52	58	65	72	78	85	92	99	106	113	119
20	48	55	62	69	76	83	90	98	105	112	119	127

Note. Critical values of U for a One-Tailed Test at α = 0.025 or for a Two-Tailed Test at α = 0.05

Reprinted from Groebner, Shannon, and Fry (2014).

APPENDIX D

TEACHER SURVEY ON ELL INSTRUCTIONAL SUPPORT

Teacher Survey on ELL Instructional Support

1=Strongly Agree 2=Agree 3=Neither Agree Nor Disagree 4=Disagree 5=Strongly Disagree

1. I feel adequately trained to support my ELL students.

1 2 3 4 5

2. The instructional needs of the ELL students are met through the use of technology.

1 2 3 4 5

3. I feel adequately trained in technology implementation for instructional purposes.

1 2 3 4 5

4. I employ technology for interventions in my classroom.

1 2 3 4 5

5. I need more training to support the needs of my ELL students.

1 2 3 4 5

6. Teachers have the same expectations for ELL students as they do non-ELL students.

1 2 3 4 5

7. Training is provided for all teachers in English Language Learner (ELL) instructional strategies.

1 2 3 4 5

8. The coaching cycle is utilized to support ELL strategies in the classroom.

1 2 3 4 5

9. Instructional support is provided by the teachers to meet the needs of ELL students.

1 2 3 4 5

10. Teachers utilize technology to appropriately support ELL students academically.

1 2 3 4 5

11. Professional development is appropriate to my needs in the area of technology integration.

1 2 3 4 5

12. Technology is utilized on a regular basis in my class.

1 2 3 4 5

13. Teachers have high expectations for the ELL students.

1 2 3 4 5

14. Sufficient training has been provided for me to integrate technology in instruction.

1 2 3 4 5

15. Peer coaching is utilized effectively.

1 2 3 4 5

16. All teachers incorporate instructional strategies to support ELL students.

1 2 3 4 5

17. Expectations of the ELL students is the same as the expectations of non-ELL students.

1 2 3 4 5

18. The coaching cycle is used to support technology integration.

1 2 3 4 5