An Integrated Literacy/Science Intervention for English Language Learners in Third Grade

by

Amy D. Davis

B.S., Jacksonville University, 1995
M.S., Newman University, 2012

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Curriculum and Instruction
College of Education

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Abstract

English language learners (ELLs) are expected to meet the same academic standards as those of their fluent English-speaking peers while simultaneously acquiring a second language. When content area instruction is embedded with literacy-based tasks, ELLs' achievement is both the acquisition of content area knowledge and English language skills can be anticipated. Science is a content area that can provide a deep context for ELLs to develop academic language because students must use their literacy skills to gather information about scientific concepts. The purpose of this study was to investigate the impact of an instructional intervention integrating literacy-based practices in science on third grade ELLs' science achievement and English language development. The mixed methods study was conducted at an elementary school in the Midwest, United States. There were 12 participants, eight identified as ELL and four fluent English speakers. Four of eight identified as ELL received the intervention while the remaining four ELL and fluent English speakers were instructed by the classroom teacher. The intervention was based on the systematic and repeated practice of language strategies and explicit vocabulary instruction. Authentic communication was used during scientific inquiry, discussions, and the reading of expository science text. Both quantitative and qualitative data was collected from pre and posttest data from five *FOSS* I-Check assessments, researcher's observations and field notes, participants' artifacts such as science journal entries and reflections, classroom teacher interview, and recorded session videos. The data was coded and analyzed identifying major themes which are noted in the findings. The results concluded the four participants who received the intervention outperformed their ELL peers not receiving the intervention but were still slightly behind their English-speaking peers. Overall, the participants receiving the intervention showed gains in their productive language as reflected in their utilization of domain-specific vocabulary in their speaking and writing. The conclusions drawn from this study included ELLs can benefit from receiving an integrated literacy/science intervention in both their acquisition of scientific knowledge and language development.

Keywords: English language learners, literacy/science intervention, science achievement for ELLs, vocabulary instruction, scientific inquiry, language strategies.

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Approved by:

Major Professor
F. Todd Goodson

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English language learners (ELLs) are expected to meet the same academic standards as those of their fluent English-speaking peers while simultaneously acquiring a second language. When content area instruction is embedded with literacy-based tasks, ELLs' achievement is both the acquisition of content area knowledge and English language skills can be anticipated. Science is a content area that can provide a deep context for ELLs to develop academic language because students must use their literacy skills to gather information about scientific concepts. The purpose of this study was to investigate the impact of an instructional intervention integrating literacy-based practices in science on third grade ELLs' science achievement and English language development. The mixed methods study was conducted at an elementary school in the Midwest, United States. There were 12 participants, eight identified as ELL and four fluent English speakers. Four of eight identified as ELL received the intervention while the remaining four ELL and fluent English speakers were instructed by the classroom teacher. The intervention was based on the systematic and repeated practice of language strategies and explicit vocabulary instruction. Authentic communication was used during scientific inquiry, discussions, and the reading of expository science text. Both quantitative and qualitative data were collected from pre and posttest data from five *FOSS* I-Check assessments, researcher's observations and field notes, participants' artifacts such as science journal entries and reflections, classroom teacher interview, and recorded session videos. The data was coded and analyzed identifying major themes which are noted in the findings. The results concluded the four participants who received the intervention outperformed their ELL peers not receiving the intervention but were still slightly behind their English-speaking peers. Overall, the participants receiving the intervention showed gains in their productive language as reflected in their utilization of domain-specific vocabulary in their speaking and writing. The conclusions drawn from this study included ELLs can benefit from receiving an integrated literacy/science intervention in both their acquisition of scientific knowledge and language development.

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Dedication

This body of work is dedicated to the strongest woman I know. She's survived growing up in poverty, countless broken bones, gave birth to five babies, met the Light and returned to tell about it, and relented to the wrath of a tornado.   Despite life's challenges, her light continues to shine brightly spreading joy and laughter to everyone she meets. It was her unwavering love, faith, grace, strength, intelligence, and wisdom, that I've persevered through the past three years to reach this goal.   She taught me to be kind, polite, humble, respect God's word, and always maintain my integrity. This is for you my dear Mother, Emmalene Cindrity, I hope I've made you proud.

Chapter 1 - Introduction

My introduction into the world of English as a second language (ESL) began at home listening to my father's heavily accented English and him speaking *Bunjevac*, a Serbo-Croatian dialect. It was 1954 when he escaped out of his Soviet-occupied country of southern Hungary into what was Yugoslavia at that time. He was captured, placed in a refugee camp, and enlisted in the U.S. Army. After settling in the Los Angeles area, he met my mother, a U.S. citizen, and started his family. I grew up in northern San Diego county approximately 70 miles from the border of Mexico. My town consisted of avocado, lemon, lime, and orange groves which were harvested by migrant workers. I attended school with many of their children so listening to Spanish became a part of my everyday life. It was through these experiences, my father's struggle to escape oppression and the determination of the migrant workers to create a better life that inspired me to give second language learners the gift of English.

It was a natural progression, I would pursue a degree in education to help others. I began as a classroom teacher where my love of working with those acquiring a second language grew and I became an English as a second language (ESL) teacher and an ESL learning coach. Based on these observations and experiences, I concluded these students needed a combination of whole and small group instruction, interaction with fluent English speakers, and individual attention to language needs. In whole groups, classroom and ESL teachers have an opportunity to work together to and this student population can interact with fluent English speakers. At times, those acquiring a second language can be quiet and withdrawn because they may not feel comfortable in their abilities to express themselves in English. In small groups, ESL teachers can individually assess and encourage language production from students. Likewise, students may feel increased motivation to engage in speaking opportunities with the ESL teacher and peers.   This dissertation was conceptualized from these experiences, I wanted to create a systematic routine and structure that would integrate literacy-based tasks in science while simultaneously developing participants' English language skills. The routine itself is based on authentic language and systematic and repeated practice of language strategies. When students become familiar with the routine, the instruction becomes much more efficient and beneficial to their conceptual understanding of science and language growth.

Overview of the Issues

This section will provide an overview of the issues surrounding literacy and science achievement gaps between second language learners and their fluent English Speakers speaking peers. Identified as English language learners (ELLs), the population of students currently enrolled in a language assistance program comprises 21% of the nation's public-school population. This statistic translates into one in five students in a public-school classroom is an English language learner. The expectation for ELLs is to acquire English language proficiency while also meeting the same academic standards as those of their English-speaking peers. Because language development is a slow and gradual process as ELLs acquire the necessary skills to interact with content knowledge, the achievement gap widens (Caravita & Hallden, 1994). According to recent statistics, ELLs consistently score lower on both literacy and science assessments.

The National Assessment of Educational Progress (NAEP) 2017 Nation's Report Card discloses a 37-point achievement gap between ELLs and non-ELLs in fourth grade average literacy scores and the gap increases to 43 points in eighth grade (NAEP, 2017). During the last decade, this gap has remained constant with an average difference of 38 points in fourth grade and 44 points in eighth grade (NCES, 2017, 2015, 2013, 2011, 2009, 2007, 2005, 2003, 2002, 2000, 1998).

On national science assessments, ELLs have consistently scored lower than Non-ELLs. For the years 2006 and 2015 on the fourth -grade science assessment, the average gap between ELLs and Non-ELLs has been an average of 38.5 point for both years (NAEP, 2009, 2015).

With the initiation of the Common Core State Standards (CCSS) English Language Arts (ELA) and Literacy in 2009, there has not been a significant decrease in the ELL/non-ELL achievement gap (Common Core State Standards Initiative, 2010b). Coleman and Goldenberg (2012) emphasize "Content is certainly important, but so are the oral and written language skills. Without those oral and written language skills, it is virtually impossible for students to have access to CCSS content" (p. 48).

There is an important link between science and literacy, students use their literacy skills to gather information as well as communicate their understanding of scientific concepts (Zwiep, Straits, Stone, Beltran, & Furtado, 2011). Given the close relationship between these two content areas, Yore and colleagues recommended literacy instruction be embedded in scientific inquiry so that students may construct new science learning the same way a novice scientist is guided by a supervisor (Yore, Florence, Pearson, & Weaver, 2006). Even though science is a content area that encompasses both challenging discourse strategies and academic vocabulary, it can provide a deep context for developing ELLs' academic language (Lee & Fradd, 1998; Rosebury, Warren, & Conant, 1992). Tong, Irby, Lara-Alecio, and Koch (2014) suggested "At elementary grade levels, English language/reading literacy should be the primary focus and with science embedded to support ELLs' acquisition of reading skills and comprehension" (p. 411). The integration of literacy and language skills in science goes beyond conducting inquiry-based scientific experiments, it requires teachers to provide individualized scaffolds, engage students in meaningful dialogue, and build on existing knowledge and skills.

Statement of the Problem

The Next Generation Science Standards (NGSS) were adopted in 2013 to ensure science education was accessible and equitable for all students including ELLs. The meaning of *inquiry-based science* is redefined in the standards as a set of science and engineering practices so that students can understand the nature of science (NGSS, 2013). Lee, Quinn, and Valdés (2013) argues "For all students, the emphasis should be on making meaning, on hearing and understanding the contributions of others, and on communicating their own ideas in a common effort to build understanding of the phenomenon or to design solutions of the system being investigated and discussed" (p. 225).

In working with ELL students, classroom and ESL teachers' attempt to make scientific content comprehensible while simultaneously developing their English language proficiency. Zwiep and Straits (2013) suggest language development and science instruction are not distinct forms of instruction. In fact, the researchers state "when using inquiry-teaching methods, science can provide a learning environment where collaboration and peer-to-peer talk is a natural part of how students make meaning" (p. 1316). The NGSS standards are interrelated and language intensive which requires shifts in the way teachers instruct ELLs in science.

This shift can be characterized as more attention to specific instruction in the complex and specialized language of science which requires inquiry-based instructional techniques (Zwiep & Straits, 2013; Kieffer, Lesaux, Rivera, & Francis, 2009). Additionally, teachers must provide scaffolds to support academic language development so that it can become a part of students' vocabulary repertoire. Furthermore, Gee (1990) described how competent language users adopt certain communicative practices to evaluate claims and represent scientific principles. As means of making sense of science, the teacher plays an essential role in encouraging and supporting language (Lee et al., 2013).

Working as an ESL Learning Coach and observing teachers instructing ELLs in small and whole group settings, I noticed instructional inconsistencies in their delivery of content instruction and language development. While some were excellent at facilitating a student-centered approach promoting language production, others opted for a more teacher-centered method. Consequently, I witnessed many ELL students sitting quietly, not producing language with their peers, and their engagement levels were low.

Research Questions

The purpose of this study was to evaluate how an integrated literacy/science intervention would impact third grade ELLs' science achievement and English language development. The study addressed the following research questions:

1. How will an integrated literacy/science intervention impact third grade English language learners' (ELLs') conceptual understanding of scientific concepts as compared to ELLs and fluent English-speaking peers not receiving the intervention?
2. What effect will the addition of listening, speaking, reading, and writing strategies to an integrated literacy/science intervention have on third grade ELLs' receptive and productive language abilities?

Significance of the Study

The importance of this study was to promote active listening in participants, develop general and domain-specific academic vocabulary in both their speaking and writing, and deepen their conceptual understanding of science. Through the implementation of a small group literacy/science intervention, participants could attain the necessary oral and written skills to access scientific content.

Methodology

The mixed methods study investigated the efficacy of an integrated literacy/science intervention delivered to four, third-grade students identified as English language learners. Their conceptual understanding of scientific concepts was compared to ELLs and fluent English-speaking peers not receiving the intervention. This study was conducted in two phases at an elementary school in the Midwest, United States. The first phase was administered for eight weeks which at that time, quantitative data was collected from three *FOSS* I-Check assessments. The second phase consisted of an additional six weeks of the intervention being administered to the same four participants. At that time, additional quantitative data from two *FOSS* I-Check assessments and qualitative data was collected. With the addition of the qualitative data, the research design became mixed methods with an in-depth case study of the treatment group participants. Each session was centered around scientific inquiry or reading of expository science text with systematic and repeated practice of language strategies and explicit vocabulary instruction. All communication was authentic with an emphasis on developing participants' oral and written skills to access scientific content.

Quantitative and qualitative data was collected simultaneously and combined from both phases to address the two research questions. The blending of collection methods is referred to as mixed methods. Denzin (1978) defined it as "the combination of methodologies in the study of the same phenomenon" (p. 291). Analyzing a study from multiple viewpoints allows for greater accuracy which captures a more complete portrayal of the phenomenon under investigation (Jick, 1979). In this study, quantitative data was collected from pre/posttest *FOSS* I-Check assessment scores from five investigations, averaged for each group, and compared to address the acquisition of science knowledge. Qualitative data was collected through observations from recorded videos of all sessions, researcher's field notes, artifacts, and classroom teacher interviews. All collected data was carefully transcribed, coded, and analyzed as to uncover any recurring themes and the data was condensed into a case study of the treatment group participants to note any development in their English language abilities. According to Creswell and Poth (2016), *case study* is an approach in which the researcher explores a *bounded system* over time and collects in-depth data from multiple sources of information and reports a case description on case-based themes (p. 73).

Limitations of the Study

While this study added to the existing body of research demonstrating the integration of literacy in science has the potential to develop content knowledge and language skills in ELLs, there are several limitations. First, the sample size was relatively small with only four participants receiving the intervention. Because there was no randomization in the selection of these participants, it did not allow for an accurate representation of the ELL population. Given a larger sample size and randomization as demonstrated in other intervention studies, the power of a statistically significant relationship could have been increased. Second, the analysis of qualitative data to measure receptive and productive language acquisition was subjective and dependent on the researcher's expertise and knowledge working with ELLs. While my subjectivities were identified, they did not interfere with the collection and analysis of data or the presentation of the findings. Lastly, participants' science knowledge was assessed using *FOSS* I-Check pre and posttest assessments which measured the attainment of curricular material covered in the five investigations. The state of Kansas participates in the National Assessment of Educational Progress (NAEP) however the science assessment is not administered until fourth grade.

Definition of Key Terms

The following terms are directly related and will be used throughout the study:

1. English language learner (ELL): Students who are unable to communicate fluently or learn effectively in English. These students come from non-English-speaking homes and require specialized or modified instruction in both the English language and content areas (edglossary.org, 2013).
2. Integrated literacy/science intervention: Small group intervention for ELLs integrating literacy-based tasks such as reading and writing, with scientific inquiry as the foundation for instruction.
3. Productive language skills: These are skills learners need to produce language such as speaking and writing. They are described as the "active" language skills (British Council, 2006).
4. Receptive language skills: These are skills learners need to receive language such as listening and reading. They are described as the "passive" language skills (British Council, 2006).
5. Conceptual Understanding of Science: A student's ability to construct and express their understanding of scientific concepts through the utilization of domain-specific vocabulary in their speaking and writing.

6. Listening, Speaking, Reading, and Writing Strategies: Instructional strategies and routine strategies to promote active listening in reading and opportunities for students to express themselves through speaking and writing.

Organization of the Study

Chapter One introduces the study and the issue of the achievement gap between ELLs and fluent English speakers in both literacy and science content areas. The chapter describes the background and overview of the issue, statement of the problem, research questions, and definition of key terms utilized in the study. Additionally, this chapter highlights the significance of the study, methodology, and potential limitations.

Chapter Two reviews the current research studies of integrated literacy/science interventions conducted within the past six years. It explores scientific inquiry as the foundation for the intervention and the importance of explicit vocabulary instruction. Lastly, chapter two describes the function of receptive and productive language usage in acquiring a second language and the present study's theoretical framework.

Chapter Three describes the methodology and design of the mixed methods study which includes a description of the integrated literacy/science intervention procedures, participants and research site, data collection and analysis, and the researcher's role and subjectivities.

Chapter Four highlights the findings of the research based on the analysis and comparison of *FOSS* I-Check pre/posttest individual gain scores and open-response questions from the treatment and control groups. Additionally, a classroom teacher interview is included to compare classroom instruction to the literacy/science intervention practices. The chapter concludes with an in-depth description and analysis of participants' language progression as noted in their pre/posttest *FOSS* I-Check open-responses, science journal entries, six-grid organizers, and *SWIVL* videos. Common themes revealed in the data collection are presented and described in this chapter.

C*hapter Five* provides a summary of the study, findings, and a discussion section providing answers to the two research questions. Additionally, the conclusion portion of this chapter describes the implications for practitioners and a detailed plan for future research.

Chapter 2 - Review of the Literature

The expectation for English language learners (ELLs) is to acquire English language proficiency and meet the same content area standards as those of their fluent English- speaking peers. Because they consistently score lower on literacy and science assessments, a contributing factor may be the time it takes to acquire a second language. Content area instruction should foster a meaningful learning environment for English language and literacy development; improving English skills should provide the context for understanding science content (Amaral, Garrison, & Klentschy, 2002; Fathman & Crowther, 2006; Lee & Fradd, 1998). Garza, Huerta, Lara-Alecio, Irby, and Tong (2017) noted the amount of scaffolding a teacher provided may have an effect on student achievement. Within the time frame for second language acquisition, teachers can plan and implement explicit and targeted instruction to focus on language development and content knowledge.

Integrated Literacy/Science Interventions

An integrated literacy/science intervention for ELLs is grounded in best practices to meet their linguistic needs. Coleman and Goldenberg (2009) recommended a separate English language development (ELD) time which "appears to be somewhat more effective than relying exclusively on 'integrating' ELD with other parts of the curriculum (p. 13). This study aimed to authentically instruct and assess ELLs' conceptual understanding of science with a separate block of time designated for the development of receptive and productive language skills. Saunders, Foorman, and Carlson (2006) examined the effects of a separate block of time designated for English-language and literacy development for ELLs. Their findings concluded ELLs who received this time performed moderately better than students who received an integrated English-language development (Saunders et al., 2006).

A literacy-content integrated approach is often used to provide ELL students the opportunity to develop oral language while simultaneously teaching literacy and content material (Richards-Tutor, Aceves, & Reese, 2016). When the subject area and language learning are integrated and aligned with the standards, a strong and positive effect can be anticipated (Amaral, Garrison & Duron-Flores, 2006; Klentschy, 2005; Lindholm-Leary & Borsato, 2006; Palumbo & Sancore, 2009; Snow, Met, & Genesee, 1989; Watkins & Lindahl, 2010). Content area instruction can provide ELLs a context for language learning and authentic communication (Llosa, Lee, Jiang, Hass, O'Connor, Van Booven, & Kieffer, 2016). Llosa et al. (2016) argues that authentic communication should be the goal for an integrated intervention. Science is a content area that encompasses challenging discourse strategies such as cause-effect, problem-solution, and claims-evidence (Yore, Hand, Goldman, Hildebrand, Osborne, Treagust, & Wallace, 2004). Furthermore, it can provide a deep context for developing ELLs' academic language while promoting higher-order thinking (Lee & Fradd, 1998; Rosebury et al., 1992; Stoddart, Pinal, Latzke, & Canaday, 2002).

Within the last six years, there have been limited experimental and quasi-experimental studies conducted to examine the efficacy of content-language integrated interventions in science for ELLs. This chapter will be an extensive review of the literature and research related to (a) scientific inquiry in integrated literacy/science interventions, (b) science vocabulary instruction, (c) receptive and productive language, and (d) the theoretical framework for the proposed study.

Scientific Inquiry

Scientific inquiry is defined as the environment that allows students to construct knowledge and develop English language skills through a process of active investigation and evaluation (Descristan, Hondrich, Buttner, Hertel, Klieme, Kunter, Luhken, Adl-Amini, Djakovic, Mannel, Naumann, & Hardy, 2015). Furtak , Seidel, Iverson, and Briggs (2012) suggested inquiry should be cognitively challenging utilizing authentic tasks, materials, evidence, questioning, discussion, and argumentation. Recent studies have found that students are responsible for making connections as the teacher guides the discussion by questioning, hypothesizing, and asking her students to draw inferences. While performing a science investigation, students use a range of language skills (reading, writing, listening, and speaking) which ultimately provides a foundation for establishing background knowledge and vocabulary which promotes academic achievement for ELLs (August, Branum-Martin, Cardenas-Hagan, & Francis, 2009).

Multiple Learning Modalities. Bravo and Cervetti (2014) conducted an intervention study with a balanced, multiple learning approach to literacy and science integration. Their study was designed for fourth and fifth grade ELLs based on first-hand inquiry of thematically-driven investigations followed by reading, discussions, and writing. The researchers believed using the multiple learning modalities based on scientific inquiry might be beneficial for ELLs as they would hear, have modeled, listen, and practice the academic register of science. According to Bravo et al. (2014), "we probe the premise of whether these repeated multi-modal experiences with science concepts builds depth of understanding, allowing students to more easily recall key concepts and apply their understandings to new contexts" (p. 235). While their findings concluded with the treatment group receiving the intervention showed higher gains on posttest science understanding and vocabulary, but not in science reading.

Project Middle School Science for English Language Learners (MSSELL). An integrated intervention based on scientific inquiry can lead ELL students to develop their academic English throughout a science investigation. Lara-Alecio, Tong, Irby, Guerrero, Huerta, and Fan (2012) studied the effects of an inquiry-based intervention, Project Middle School Science for English Language Learners (MSSELL), to develop fifth grade ELLs' conceptual understanding of science while scaffolding language skills. The 85-minute daily intervention consisted of inquiry-based learning, direct and explicit vocabulary instruction, integration of reading, writing, and technology, take-home science activities, and mentoring by university scientists. Their results highlighted a significant intervention effect in favor of the treatment students and higher performance in district wide benchmark tests of science and reading and measure of oral reading fluency. There was, however, no significant difference between the treatment and control groups on the state science assessment.

Similarly, Garza et al. (2017) study was derived from the Lara-Alecio et al. (2012) MSSELL larger study and added to the existing study an in-depth analysis of pedagogical practices contributing to ELL students' science and language achievements. The purpose of the study was to compare and examine eight fifth-grade classrooms' observational data on the frequency of pedagogical practices for ELLs. The quasi-experimental study utilized the Transitional Bilingual Observation Protocol (TBOP), a classroom observation instrument consisting of four domains: activity structure, communication mode, language of content, and language of instruction. Bravo et al. (2014) utilized scientific inquiry as a foundation for receptive and productive language development and assessed students directly. Likewise, Garza et al. (2017) intervention consisted of science notebooks, instructional inquiry-based activities blending science content and language, reading strategies, and oral language building. The researchers did, however, use the TBOP as means to assess teachers' pedagogical practices. Their findings resulted in a statistical significance between groups with language of content having a medium effect size. As for frequency counts for each subdomain, there was also a statistical significance between groups. In the treatment classrooms, there were more occurrences of student-centered activities aligned to science inquiry and language usage, cooperative learning, a combination of writing, verbal, and reading activity, and denser cognitive language than the control classrooms. Conversely, the control classrooms had more occurrences of teacher-centered activities, verbal and aural forms of communication between the teacher and students which resulted in more silence than communication between teacher and students. While both studies were grounded in scientific inquiry as the foundation for language development, they both had two distinctly different outcome measures. Nevertheless, the studies emphasized the importance of scientific inquiry as the foundation for receptive and productive language usage and development in ELLs.

P-SELL Intervention. The P-SELL intervention was an experimental study with a randomized controlled trial design to investigate the impact of P-SELL, a year-long standalone fifth grade science curriculum based on scientific inquiry, on all students including those s of varying levels of English proficiency (Llosa et al., 2016). During the inquiry phase, students were encouraged to design their own extension activities and apply concepts understanding, promoting higher levels of thinking, and developing their receptive and productive language skills. Outcome measures included the high-stakes state science assessment and a researcher-developed pre/posttests science assessment. The results were conclusive, ELLs in the treatment group outperformed ELLs in the control group on the researcher-developed assessment and significant intervention effects were found on the state science assessment. Even though Bravo et al. (2014) and Garza et al. (2017) tested different facets of their interventions, Bravo et al. (2014) tested students' understanding of scientific concept, vocabulary and reading, and Garza et al. (2017) measured the frequency of teachers' pedagogical practices for ELLs, both studies focused on oral language development. Likewise, Llosa et al. (2016) study resulted in positive gains for ELLs in scientific knowledge. The overall trend in findings from Bravo et al. (2014), Lara-Alecio et al. (2012), Garza et al. (2017), and Llosa et al. (2016) is increased academic language development in those ELL students participating in the integrated intervention.

Five-E Model Approach. The Five-E model approach to scientific inquiry was developed by Bybee (2006) of the Biological Science Curriculum Study and was noted as a framework to teach science inquiry. There are a series of steps beginning with *Engage*, students are engaged with a science concept then they are asked to *Explore* the concept through guided inquiry, and finally they explicitly *Explain* scientific concepts. The final two phases, *Elaborate* and *Evaluate,* participants elaborate on their findings and evaluate their importance.   Zweip and Straits (2013), Tong et al., (2014), and Lara-Alecio et al. (2012), all incorporated the Five-E Model approach with the specific purpose of authentically developing language. The steps of the Five-E Model create a framework for scientific inquiry and assure ELL students are receiving in-depth instruction which leads to conceptual understanding and language development.

Zweip and Straits (2013) intention was to blend inquiry science with English language development and state "During implementation of this new approach, it was decided that student thinking needed to be the priority and needed to be supported with authentic language development within the lessons" (p. 1318). Tong et al. (2014) focused on student thinking by infusing their academic science intervention with additional leveled comprehension questions based on Bloom's Taxonomy to further conceptual understanding. Lastly, Lara-Alecio et al. (2012) incorporated an 85-minute daily routine spending a specific amount of time on each of the five steps. Within the routine, teachers demonstrated science concepts and taught science vocabulary, students worked in cooperative groups reading expository text, and demonstrated their learning in writing. Lara-Alecio et al. (2012) approach to surveying each of the steps in a time slot since assured each step was being developed in depth to address student thinking and language development.

Science Vocabulary Instruction

Zwiep and Straits (2013) argue the academic register of science is highly technical and complex, students need opportunities to explore, discuss, and develop their own understandings. Teachers' pedagogical practices such as proceeding in small steps while checking for student understanding will achieve active and successful engagement from all students (Rosenshine, 1987). Simply stated, it's a plan for a logical sequence to decrease confusion of the complexity of science discourse to a clear, comprehensible expression.

Effective vocabulary instruction provides multiple exposures through rich, varied, relevant, and meaningful activities for ELLs (Marzano, 2004). According to researchers, vocabulary instruction should be intensive, systematic, and explicit while also providing students frequent opportunities for expression through reading, writing, listening, and speaking (Moje, Collazo, Carrillo, & Marx, 2001; Beck, McKeown, & Kucan, 2002; Fang & Schleppegrell, 2008; Francis, Riversa, Lesaux, Kieffer, & Rivera, 2006; Snow, Lawrence & White, 2009; Green, 2004; Lee & Buxton, 2013). While there are different approaches to vocabulary instruction, themes noted in existing integrated literacy/science interventions include the use of pronunciation, attachment of visual scaffolds, accessing students' prior knowledge, implicit and explicit vocabulary instruction, timing of word introduction, and the co-construction of word meanings.

Science has two types of academic discourse, general academic vocabulary and domain-specific academic vocabulary. General academic vocabulary includes words like *compare,* *analyze,* and *adapt* while domain-specific academic vocabulary includes words like *integer, photosynthesis,* and *colony* (Richards-Tutor et al., 2016). In the selection of words to teach, Baker, Lesaux, Jayanthis, Dimino, Proctor, and Morris (2014) suggested teachers gauge the words' usefulness for comprehension and the frequency they occur within the text and other content areas. Baker et al. (2014) expressed that careful thought and consideration should be given to the selection of vocabulary words.

Tong et al. (2014) infused their integrated literacy/science intervention for fifth grade and kindergarten through third grade students with vocabulary building strategies. In both interventions, participants were provided with direct vocabulary instruction with the attachment of visuals, repeated exposures, and pronunciation of science vocabulary. Additionally, participants entered the new vocabulary in the glossary section of their science journals which was used to help them process and write about the science lessons. Likewise, Lara-Alecio et al. (2012) focused on direct vocabulary instruction through the incorporation of word pronunciation and participants entering terms into the glossary section of their science notebooks. Their findings concluded those receiving the intervention did outperform those not receiving in both word meanings and science content.

In contrast, Zwiep and Straits (2013) *Blended Program* intervention trained teachers to carefully analyze which terms would be taught prior to the lesson (frontloaded) to students based on their English proficiency level, and which would unfold naturally through engagement in scientific inquiry (embedded). Domain-specific were not introduced until students had developed a conceptual understanding and could describe it in their own words and/or pictures. In other words, Zwiep and Straits (2013) noted "Narrowing of vocabulary and language forms and functions within a lesson resulted in more purposeful language support" (p. 1318).

Moreover, Lara-Alecio et al. (2012) frontloaded general academic and domain-specific vocabulary before participants began reading, however, there was no discernment between which words to teach. In the same fashion as Lara-Alecio et al. (2012), introduced five to eight general and domain-specific vocabulary before scientific inquiry as to reinforce connections throughout the investigation and allow repeated practice.

Bravo et al. (2014), science vocabulary was an instructional target. Teachers constructed definitions with students of ten general academic terms (e.g. evidence, model, and classify) and 18 domain-specific words (e.g.sphere, gravity, and orbit). The definitions and synonyms were recorded on the "Science/Everyday Word Chart" and displayed for students to refer to when needed. Findings revealed ELLs in the treatment group had significantly higher posttest scores in science vocabulary than the control group. Likewise, Lara-Alecio (2012) co-created student friendly definitions with participants.

Current research has found the importance of scaffolded vocabulary instruction for ELLs during scientific inquiry with overall positive results. While there appears to not be one particular way to teach vocabulary, the research has found it a necessary component for conceptual understanding and language development.

Receptive and Productive Language

Acquiring a second language is a slow and gradual process which requires focused instruction and scaffolds to assure the process is completed in a timely manner. Language acquisition theorist, Dr. Jim Cummins (1979) introduced the distinction between Basic Interpersonal Communication Skills (BICS), conversational discourse, and Cognitive Academic Language Proficiency (CALP), the language specific to the context of school. Academic language proficiency is defined as "the extent to which an individual has access to and command of the oral and written academic registers of schooling" (Cummins, 2000, p. 67). Furthermore, Coleman and Goldenberg (2009) described academic language as "more abstract and cognitively demanding" (p. 15). While BICS can take only two years to acquire, mastery of CALP can take five to seven years. Conceptual understanding of scientific inquiry places a high demand on the expression of language because it involves analyzing, summarizing, and presenting science information in oral or written formats (Lee & Fradd, 1998). Huerta and Jackson (2010) argue, "In working with ELL students in particular, we need to push toward intellectual development while also working on giving them the basic skills and purpose to develop a second language" (p. 207). Given the amount of time it takes to acquire a second language, the adaptations and modifications teachers incorporate can push ELLs towards language acquisition in a timely manner.

Lee et al. (2013) claimed "Language serves as the vehicle to perform analytical tasks and ultimately construct knowledge" (p. 230). Klentschy (2005) emphasized that language becomes the primary avenue students use to arrive at scientific understanding. Lee et al. (2013) and Klentschy (2005) both claimed the importance of language development, ELLs' are dependent upon a teacher's instructional routines, activities and strategies created and implemented to foster that development. The intervention studies reviewed for this chapter used scientific inquiry as the foundation for the incorporation of reading, listening, writing, and speaking to learn science content and acquire English simultaneously.

Receptive Language. Receptive skills, reading and listening, are referred to as the "passive" language skills because they require a person to comprehend and process internally, therefore, there is no production involved. As a result, it can be difficult to assess an ELLs' ability to comprehend unless you ask them to express their level of understanding through their productive language skills. In the studies reviewed, all were based on scientific inquiry as means of developing reading comprehension, however, there was no mention of developing listening skills in participants.

Bravo et al. (2014) designed a space science unit incorporating (a) first-hand inquiry, (b) reading support of inquiry, (c) discussing investigations and text, and (d) writing about investigations. The researchers believed the balance between science and literacy had the potential to support science understanding and language development. Bravo et al. (2014) highlighted the importance of "wait time" when questioning ELLs, a teacher's rate of speech and modeling correct pronunciation of science terms for students. Lara-Alecio et al. (2012) integrated study also focused on providing adequate wait time for students to process content through timed thinking, write a quick write response to prompts, and pair-share their thinking with a partner. Students were held accountable for their answers and not allowed to respond with "I don't know." If unable to answer, they had the option to request more think time or the question was rephrased. Tong et al. (2014) inquiry-based intervention followed the Five-E model and reading comprehension was supported by participants partner reading expository text and asking scripted comprehension questions. Tong et al. (2014) utilized partner reading in which participants asked each other scripted questions and rested upon the questionable assumption that the researchers matched participants' ability levels and closely monitored the partnerships. Coleman and Goldenberg (2009) argue ELLs should be grouped carefully and not segregated by their language proficiency level.

Productive Language. Productive skills, speaking and writing, are referred to as the "active" language skills because they require a person to produce language. Lesaux and Geva (2006) found a strong link between oral language proficiency and text-level skills such as reading comprehension. Oral language proficiency is critical to an ELL student's learning achievement (Coleman & Goldenberg, 2009).

Speaking. During scientific inquiry, ELLs must be given the opportunity to engage in meaningful and authentic communication with their teacher and peers (Coleman & Goldenberg, 2009; Ellis, 2005; Spada & Lightbown, 2008). Coleman and Goldenberg (2009) advocate for learning the elements of language through extensive use so ELLs can acquire higher levels of language proficiency. Teachers are responsible for structuring the interactions and modeling strategies for successful interactions between ELLs and English speakers (Coleman & Goldenberg, 2009).

Peer-Assisted Tutoring Strategies (PALS). Peer-assisted learning strategies (PALS) allows ELLs to participate in peer-mediated learning which can provide opportunities for structured opportunities to practice their newly acquired vocabulary with fluent English-speaking peers in a nonthreatening environment (Coleman & Goldenberg, 2009; Baker, Lesaux, Jayanthi, Dimino, Proctor, Morris, & Newman-Gonchar, 2014; Gersten, Baker, Shanahan, Linan-Thompson, Collins, & Scarcella, 2007). According to Richards-Tutor et al. (2016), "PALS uses structured activities that provide ELLs with needed oral language and reading practice that fosters overall reading development" (p. 10). Because PALS can foster conceptual understanding, it is most effective when students have varied levels of understanding and teachers and students regularly supervise social processes (Tolmie, Howe, Mackenzie, & Greer, 1993).

Decristan et al. (2015) studied the student-centered approach, PALS to see if it would beneficial for third grade students with poor language proficiency. The treatment group focused on how to form peer dyads, instruct students in reciprocal peer tutoring, and supervise and reflect on social issues during PALS. The students in each dyad had a different level of prior conceptual understanding and teachers instructed students on reciprocal teaching. The researchers did not find a moderating effect of PALS which may have been attributed to the teachers' ability to effectively implement the approach to the treatment group. Descristan et al. (2015) studied the effects of PAL to promote oral language development in low-language students was correct in theory, however, implementation was unreliable.

Writing. Research has found that when people write about what they have learned, they retain 70% of the content, but when they write about they have learned and talk about it, they retain 90% of the content (Daniels, Zemelman, & Steineke, 2007). Writing is a process of making meaning in our lives, a tool for constructing knowledge and a purpose for learning and thinking (Calkins, 1994). Huerta and Spies (2016) claimed, "When writing is incorporated with scientific inquiry, ELLs can make gains in their conceptual understanding and academic language in science" (p. 25). In integrated literacy/science interventions, writing is a crucial component because it allows students to express their conceptual understanding using academic register. In the integrated intervention studies reviewed, all incorporated writing as an assessment and reflective piece to understanding how their participants were interpreting scientific content.

Science Notebooks. **"**The act of writing by its very nature may enhance thinking and demands a student to organize their thinking" (Klentschy, 2005, p. 25). A science notebook is a "central place" where language, data, and experience work together to form meaning for the student from their science instruction and exploration (Klentschy, 2005). According to Klentschy and Molina-De La Torre (2004), there are six components in which students can create meaning during science inquiry: (a) question, problem, purpose, (b) prediction, (c) planning, (d) observations/claims-evidence, (e) what have you learned? and (f) next step/new questions. They believed there are key components to science notebooks such as relating science investigations to "real world" problems so students can make real-world connections and frame richer questions. When a student made a prediction, it gave the teacher insight into their thinking, background knowledge, and existing misconceptions. Students should record their observations to develop voice and construct meaning while reflecting on their existing knowledge and learning processes (Klentschy & Molina-De La Torre, 2004).

Llosa et al. (2016) and Tong et al. (2014) 85-minute daily integrated interventions utilized science notebooks as an interactive study guide. Students recorded their vocabulary in the glossary section to help them process the content in their writing. Participants were asked to write and record their predictions, observations, illustrate and label diagrams, and reflections from science investigations and field trip. The purpose of the daily writing sessions was to create perspective-based writing entries which also included postcards, newspaper articles, foldables, and graphic organizers. Teachers were trained to provide science content and writing feedback. As a result, both intervention had a positive impact on reading and those receiving the intervention mastered science concepts (Llosa et al., 2016; Tong et al., 2014).

On the other hand, Garza et al. (2017) study was in line with other science and language studies and was derived from a larger study, Project Middle School Science for English language learners (MSSELL). The purpose of their study was an in-depth analysis of pedagogical practices contributing to ELL students' science and language achievements. The quasi-experimental study utilized the Transitional Bilingual Observation Protocol (TBOP), a classroom observation instrument consisting of four domains: activity structure, communication mode, language of content, and language of instruction. Treatment classrooms used the Science

Enhanced Instructional (SEI) model which encompassed weekly professional development sessions for teachers and monthly trainings for paraprofessionals. There were scripted lessons, use of science notebooks, instructional inquiry-based activities blending science content and language, reading strategies, and oral language building. The control classrooms used the district mandated science curriculum which may or may not have included language development. The TBOP findings resulted in a statistical significance between groups with language of content having a medium effect size. As for frequency counts for each subdomain, there was also a statistical significance between groups. In the treatment classrooms, there were more occurrences of student-centered activities aligned to science inquiry and language usage, cooperative learning, a combination of writing, verbal, and reading activity, and denser cognitive language than the control classrooms. Conversely, the control classrooms had more occurrences of teacher-centered activities, verbal and aural forms of communication between the teacher and students which resulted in more silence than communication between teacher and students. ELLs.

Theoretical Framework

The theoretical framework for this study was conceptualized from the Communicative Language Approach (CLA). The approach emphasizes interaction and the creation of authentic opportunities for ELLs develop receptive and productive language. CLA is a student-centered, broadly based theoretical approach which moves beyond the teaching of grammatical rules, patterns, and definitions to helping ELLs communicate in authentic, spontaneous, and meaningful contexts (Brown, 2007; Banciu & Jireghie, 2012; Syarief, 2005). When second language learners are heavily focused on learning grammatical strategies, it can impede their natural communication (Thompson, 1996). In second language learning, Ellis (1992) argues that explicit grammar instruction may not lead to immediate learning, however, it will facilitate learning when the student is ready. Syarief (2005) claims, "CLA is one of the approaches that views language as a socially-embedded phenomenon" (p. 12). Syarief is surely right about the social component of language because Savignon (1987) also supports learners' involvement in the interactive process of communication (p. 237). CLA stresses that learners must have sufficient practice with language which translates to the reduction of teacher talking time and the increase of student talking time. Students are encouraged to participate and reflect on communication in a variety of contexts (Thompson, 1996).

An essential component is *communicative competence* which is defined as the "ability to negotiate meaning of language; to successfully combine a knowledge of linguistic, sociolinguistic, and discourse rules in communicative interactions" (Savignon, 1987, p. 235).

Brown (2007) described the four characteristics of CLA as: (a) goals are communication and not restricted to grammatical competence, (b) language techniques are designed to engage students in authentic, functional use of language for meaningful purposes, (c) fluency and accuracy are viewed as complimentary principles, and (d) students use language productively and receptively in unrehearsed contexts. Based on their students' linguistic needs, teacher need to design lessons based that will emphasize the meaning of language.

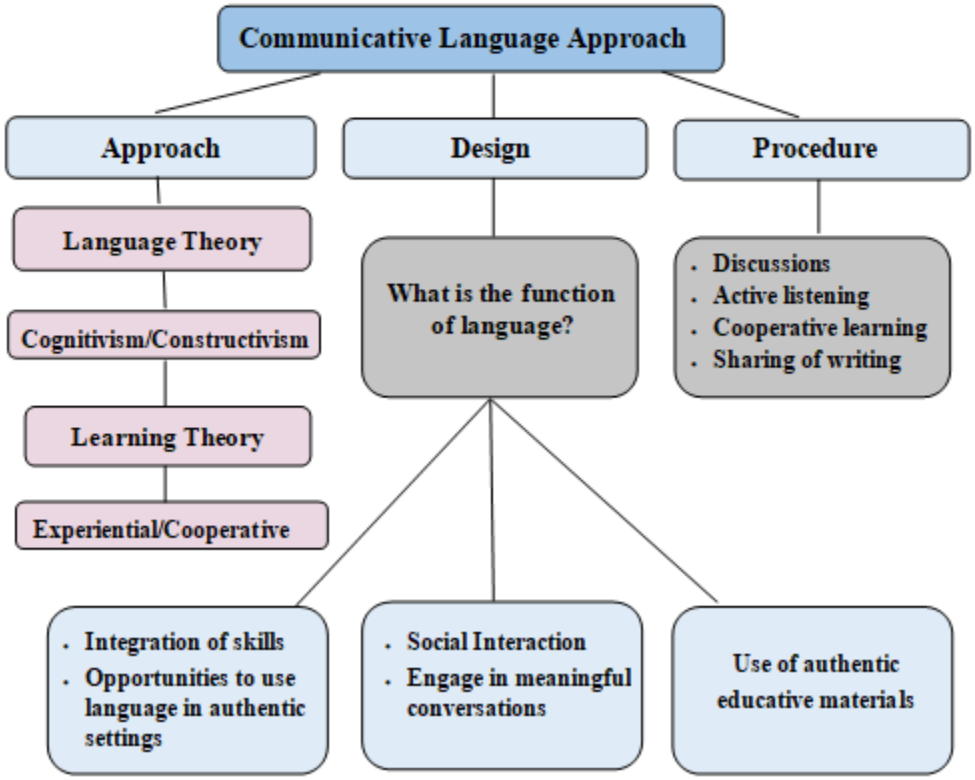


Figure 2.1. Communicative Language Approach adapted from Hymes (1972)

acquisition of language knowledge and ability.

Chapter 3 - Methodology

ELLs consistently score lower on literacy and science assessments hence the achievement gap widens as they acquire the necessary skills to effectively communicate in English and access scientific content. This study was designed to evaluate the impact of integrating literacy-based tasks into scientific inquiry to develop science content knowledge and develop language in spontaneous and meaningful contexts.

Initially, the four participants received eight weeks of the intervention and preliminary data was collected from three *FOSS* I-Check assessments from modules, *Climate and Weather* and *Motion and Matter.* They received an additional six weeks covering two investigations from the module, *Structures of Life.* The control groups consisted of eight students, four identified as ELL and four fluent English speakers and instructed by the classroom teacher. *FOSS* I-Check pre and posttest scores, recorded videos, artifacts, field notes, and classroom teacher's observations were collected from both phases to evaluate participants' science understanding and language development. The findings from the combination of the data collection methods sought to answer the following research questions:

Research Questions

1. How will an integrated literacy/science intervention impact third grade English language learners' (ELLs') conceptual understanding of scientific concepts as compared to ELLs and fluent English-speaking peers not receiving the intervention?
2. What effect will the addition of listening, speaking, reading, and writing strategies to an integrated literacy/science intervention have on third grade ELLs' receptive and productive language abilities?

Method

Research Design

The research design is mixed methods with the collection of both quantitative and qualitative data to address the two research questions. The quantitative data addressed the first question when comparing the treatment group's understanding of scientific concepts when compared to their ELL and English-speaking peers. Qualitative data was collected to address how the integrated literacy/science intervention effected participants' receptive and productive language abilities. An in-depth case study of the treatment group participants' language progression throughout the two phases of the study.

Procedures

Integrated Literacy/Science Intervention. To ensure fidelity to implementation, the intervention was instructed and recorded by the researcher using a *SWIVL* robot and recorded sessions were uploaded to *SWIVL.com* for review. Because the study site utilized a block schedule that provides a 40-minute block of time, the intervention was implemented in a separate setting. The researcher used the science curriculum currently mandated by the district, the *Full Option Science System (FOSS)*, a research-based science curriculum for grades K-8 developed at the Lawrence Hall Science, University of California, Berkeley (Full Option Science System, 2017). The curriculum is aligned with the Next Generation Science Standards (NGSS) and created to provide students and teachers with meaningful experiences through active participation in scientific inquiries and the reading of expository text.

The integrated literacy/science intervention focused on simultaneously developing literacy-based skills, science content knowledge, and productive and receptive language utilizing the *FOSS* modules, *Water and Climate, Matter and Motion,* and *Structures of Life.* The basic components of the intervention were scientific inquiry, authentic communication, receptive and productive language components and systematic and repeated practice of these strategies (see Figure 3.1). All resources generated during the sessions, e.g. vocabulary sheets, charts, and science journals were available to participants during the administration of their I-Check assessments.

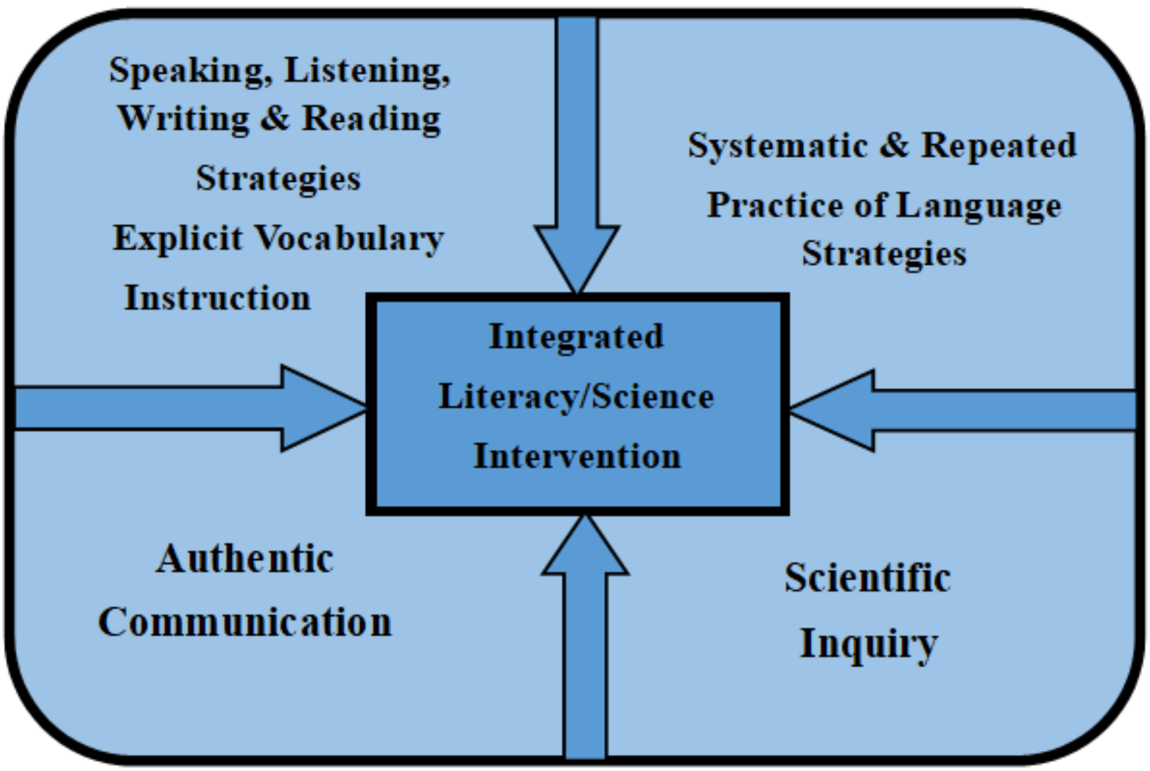


Figure 3.1 The components of the integrated literacy/science intervention.

Speaking, Listening, Writing, and Reading Strategies. Throughout the discussions, each student was given equal opportunity to respond and elaborate on their understanding of scientific concepts with the reduction of teacher talking time and an increase in participant talking time. To promote active listening and engagement, participants rephrased their peer's responses and dictation was used in partner work, participants interviewed their partner and wrote their responses in their journals. To engage participants in the science text and promote listening comprehension, the researcher read sections of the text and then they were given minute to quick sketch and label their six-grid graphic organizers. The participants created a six-grid organizer by folding an 8"x11" piece of paper into thirds then in half to create six boxes. I read portions of the text to them and they would follow along in their student books. After listening to the text, they would have one minute to quick sketch and label the main idea in one of the six boxes (see Figure 3.2). The purpose of using this metacognitive strategy was to develop their receptive language skills and learn how to conceptualize and determine the most relevant parts of the text to transfer and label on their six-grid organizers. The graphic organizer was then used as a conversation tool where the four participants took turns explaining their understanding of each connection to the text. At the end of each session, participants were encouraged to reflect on session content and communication while others listened and recorded the number of times they heard their peers use domain-specific vocabulary. Throughout the investigations, participants recorded their observations and predictions in their science journals utilizing both general and domain-specific academic vocabulary. The previously generated vocabulary sheets and sentence frames were provided. Participants were given focus questions obtained from the *FOSS* curriculum and they responded in their science journals; sentence frames were provided. Each session concluded with participants writing a reflection utilizing the sentence frame: *Today I* _____________ *and I learned* _______________. Participants were expected to use the daily vocabulary in their reflection. The reading comprehension strategy consisted participants listening and following along to sections of the science text, determining the most relevant ideas from the text to add to their six-grid organizers.

Figure 3.2 Student example of completed six-grid organizer.

Vocabulary Instruction. Participants were encouraged to participate in communicating in a variety of contexts. Vocabulary review and introduction took place at the beginning of each session. Academic and domain-specific vocabulary was selected using the researcher's discretion as to the words that would enhance participants' understanding of scientific concepts. No more than five words were introduced during one session and each word was written on a separate piece of paper. Participants defined the word in either words and/or pictures with their previous knowledge (see Figure 3.3). After each participant added their understanding, the researcher added the correct definition and discussed and questioned each participant. Following the introduction of vocabulary, participants updated their science journals with definitions and accompanying visuals. Before each session, vocabulary was reviewed from the previous sessions.

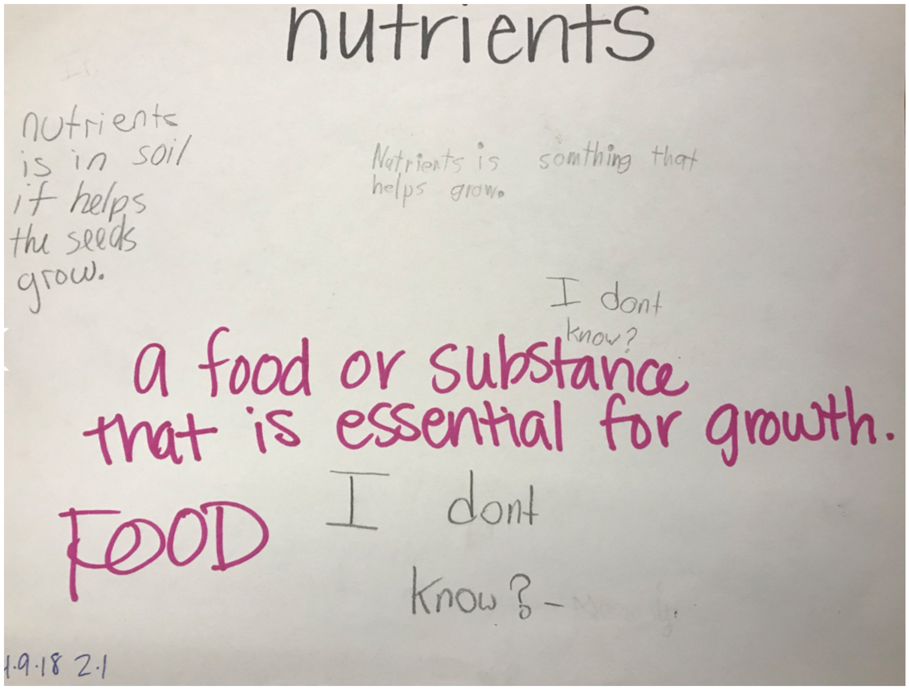


Figure 3.3 Vocabulary introduction and review procedure for *Structures of Life.*

Instructional Sequence

Each session was delivered in a consistent manner and followed a timed instructional sequence as highlighted in Table 3.1 for a total of 40 minutes. Each session began with the vocabulary routine of reviewing previously introduced words and the introduction of no more than five new words. The sessions were based and instructed in either scientific inquiry or the reading of expository science text with the incorporation of the speaking, listening, writing, and reading strategies. The sessions concluded with participants reflecting on either the science experiment conducted during that particular day or the expository science reading. These reflections were recorded in their science journals and shared with the group.

Table 3.1

Integrated Literacy/Science Intervention Instructional Routine

Time	**Activity**		
10 minutes	Vocabulary review of previously introduced words from previous sessions. Introduction of no more than five new words using separate page method. Access students' prior knowledge then discuss actual meaning of words and students record the meaning in their science journals.		
Vocabulary			
20 minutes	**Scientific Inquiry**	**OR**	**Expository Science Reading**
Lesson Content	During scientific inquiry, pose focus questions and give equal opportunity for each student to respond and ask others to listen to their peers. Use science journals for students to write their predictions, observations, and conclusions from experiments and encourage listening and speaking strategies. Provide sentence starters for responses to focus questions.		Divide text into six sections and ask students to create a six-grid organizer by folding their papers into six sections. Read each portion of the text to student then ask them to quick sketch and label their drawings with domain-specific vocabulary. At the completion of the text, ask students to explain their organizers with a partner.
10 minutes	Students take time to reflect on what they did during the session and record what they've learned. Provide sentence frames such as: *Today I…*and *I learned….* After completing their reflection, ask students to share their reflections with their peers.		
Reflection			
40 minutes			

Participants

The four third grade students in the treatment group were recommended by the classroom teacher that would benefit from a small group intervention. I chose to work with third grade students because students are transitioning from *learning how to read* to *reading for understanding.* The remaining eight participants in the control group were selected because of their identified/nonidentified ELL status, four were identified as an ELL and four as fluent English speakers. Parental consent forms were translated into Spanish because it was the number one language spoken in the district. The forms were given to all 21 students of which 12 were returned. All participants' names were changed to protect their identity and respect their privacy. In the treatment group, there were two boys (John and Cameron) and two girls (Helena and Christina) at a *beginning* level (2) and an *intermediate* level (3) on their *Kansas English Language Proficiency Assessment* (*KELPA*) 2017 composite test scores. Three of the four students received additional time of classroom sheltered, push-in and pull-out support from a state licensed and endorsed ESL teacher. The control – ELL group consisted of four students, identified as ELLs (Nancy, Chris, Ella, and Karen) by their *KELPA* 2017 composite test scores. The control – fluent English speakers participants (Allison, Thomas, Jacob, and Jordan) were chosen by their willingness to return the signed parental consent form.

Cameron was born in the United States and entered school in 2014 and the district ESL program in 2016; he was 8.11 years old at the time of the study. His family was from Micronesia and they spoke Mokil and English at home; he understood when spoken to in Mokil and responded in both languages. His ILP indicated he was to receive 135 daily minutes and his *KELPA* composite score was a three which placed him at the *intermediate* level in his second language acquisition.

Helena was female, 8.6 years old, she spoke and understood Spanish. Her father was fluent in English; however, her mother only speaks Spanish. When Dad was deployed, Helena's only opportunity to speak English was at school. She was born in the United States and entered school in 2014 and the district ESL program in 2016. Helena's ILP indicated she was to receive 230 minutes daily and her composite *KELPA* score was a two which placed her as a *high beginner* in her English language acquisition.

Christina was female, 8.1 years old and bilingual in both Tagalog and English. At the beginning of third grade, the classroom and ESL teachers were concerned about her listening comprehension because she struggled with following oral directions and subject/verb agreement in her writing. The ESL teacher tested her English proficiency and Christina tested proficient in all areas except listening where she scored at an *intermediate* level. It was decided by both teachers that she would be instructed and monitored by the classroom teacher; it would not be necessary for the ESL teacher to pull her for small group instruction.

John was 8.3 years old, born in Samoa and spoke both English and some Samoan. His parents both speak Samoan and John understood and often responded back in English. He entered school in the United States in 2014 and the district ESL program in 2016. According to his ELL Individual Learning Plan (ILP), he received a total of 230 minutes daily of language support. John's *KELPA* 2017 test score placed him at a *high beginner* in his English language acquisition. The participant descriptions are synthesized in Table 3.2.

Table 3.2

Participant Profiles

Participant	Age in years/ Months	Language(s)	Individual Learning Plan (ILP) on file	Total weekly minutes of support by ESL teacher	Composite KELPA 2017 Score	Notes
Cameron	8.11	English/Mokil	Yes	135	3	*Family from Micronesia *Both languages at home *Responds in both
Helena	8.6	English/Spanish	Yes	230	2	*Father fluent in both languages *Mother – Spanish only *Classroom teacher noted when Dad is deployed, noticeable changes in Helena's language abilities *Dad deployed, English at school
Christina	8.1	English/Tagalog	No	Monitor status	-	*Struggled with following oral directions at start of year *Monitor status
John	8.3	English/Samoan	Yes	230	2	*Born in Samoa *Both languages at home *Samoan spoken, responds in English

Research Site

This study took place at a public elementary school located on an U.S. Army installation in the Midwest, United States. The district was comprised of 4,203 students, 698 of which are identified as English language learners and 41 different languages were represented. Spanish was the number one language spoken (75%). The study site was one of 14 elementary schools with a current enrollment of 569 students, 46 ELLs which was the highest enrollment of ELLs in the district (9%). The ethnic composition included 56% White, 15% Hispanic, 17% African American, 7% Multiracial, 2% Native Hawaiian, 2% Asian, and 1% American Indian. The school was randomly selected from 14 schools and the third-grade teacher volunteered to participate. The composition of her classroom included 21 students, eight of which were identified as ELL. She served all ELLs for grade 3 because she was the only ESL endorsed and licensed practitioner at her grade level. The research site was selected from 14 schools within the district. The classroom was selected from four third grade classrooms based on the fact the room had the highest population of English language learners (38%).

Data Collection

The intent of this study was to compare science conceptual knowledge and language acquisition after participants received an integrated literacy/science intervention. Both quantitative and qualitative data was collected to measure the effects and answer the two research questions. To evaluate and compare scientific knowledge, quantitative data in the form of pre/posttest scores was collected from all participants in the treatment and control groups. The components of the Communicative Language Approach guided the kind of data collected as illustrated in Table 3.3.

Table 3.3 *Data Collection – Connection to Theoretical Framework*

Communicative Language Approach	**Data Collected**
Authentic opportunities for ELLs to develop receptive and productive language	Focus question discussions *SWIVL* videos Participant artifacts - Science journal entries & Six-grid organizer Science journals - Daily written reflections, predictions and observations
ELLs communicate in authentic, spontaneous, and meaningful contexts	Focus question discussions *SWIVL* videos Science journal entries Daily written reflections
Sufficient practice with language which translate to the reduction of teacher talk and increase in student talk	Focus question discussions – equal opportunity to share thoughts *SWIVL* videos Science journal entries – Daily written reflections

***FOSS* I-Check Assessments.** *FOSS* I-Check assessments were administered at the beginning (pre) and the end (post) of each of the five investigations from the modules, *Climate and Weather, Motion and Matter,* and *Structures of Life*. The I-Check assessments are comprised of 83% multiple-choice questions and included open-ended questions graded with a rubric and multiple-choice items.

Observations and Field Notes. Observations enhance the quality of data and interpretation during fieldwork; a researcher can take part in the interactions and events of a group of people as means of learning the aspects of their lives (DeWalt & DeWalt, 2011). To gauge participants' speaking occurrences using academic vocabulary and document their active listening, each session was recorded using a *SWIVL* robot and the videos were uploaded to the website *SWIVL.com* for review.

Field notes are described as "the record of the study unfolding over time" (Phillippi & Lauderdale, 2018, p. 383). They are an essential component of qualitative research because they provide rich descriptions and document valuable, in-depth data of a study's context (Creswell, 2013; Phillippi & Lauderdale, 2018). For the proposed study, the researcher recorded and reflected after each session noting the progression of vocabulary language usage in participants' speaking and writing. Additionally, the efficiency and consistency of the routine on the participants' acquisition of language and productivity was noted.

Participant Artifacts. In this study, artifacts refer to work produced by the participants in the treatment group which included illustrations, pictures, and writing samples. The purpose of collecting artifacts as data is to offer a contextual and deeper understanding of the research topic (Bhattacharya**,** 2017). Schwantdt (2007) claimed artifacts are "Products of human workmanship or handcrafting, for example, a tool, text, work of art, monument, or photograph.

An artifact is an object that carries meaning of the culture of its creator and users" (p. 9). The artifacts in this study were classified as science journals, six-grid graphic organizers, and vocabulary charts will serve to provide evidence of participants' comprehension of science content and utilization of domain-specific vocabulary.

Interview. Qualitative interviews allow the researcher to delve deeply with specific ways of inquiring with reflexivity into social and personal matters (DiCicco-Bloom & Crabtree, 2006; Bhattacharya, 2017). The classroom teacher instructed the control groups, fluent English speakers and students identified as ELL not receiving the intervention. There was only one in-depth, formal, semi-structured interview with the teacher using a set of pre-determined open-ended questions to compare classroom instructional components to the intervention practices:

(a) Can you describe your instructional routine during scientific inquiry?

(b) How do you incorporate opportunities for your students to utilize language with their peers during scientific inquiry?

(c) What specific strategies do you use to incorporate reading, writing, listening, and speaking into your science lessons?

(d) If you use partners, what factors do you take into consideration when you partner your ELL students with fluent English speakers?

(e) During scientific inquiry and science reading, what kinds of scaffolds do you provide for your ELL students?

(f) How closely did you follow the *FOSS* curriculum (e.g. videos, online activities?

(g) Did you incorporate any additional materials outside the *FOSS* curriculum?

Data Analysis

Data analysis involves creating processes that allows the researcher to reflect on deeper insights related to theoretical and analytical frameworks thus leading to identification of findings (Bhattacharya, 2017). According to Neale (2015), "The researcher needs a basic understanding of the nature and range of topics and themes within the data before they can interpret them, to look for patterns, categories, and explanations and relate them to a broader body of knowledge" (p. 1098). According to Denzin (1978) and Patton (1999), methods triangulation is defined as using multiple sources of an investigation to produce understanding. For this study, the researcher achieved triangulation by using multiple sources of quantitative and qualitative data to search and identify common themes and provide answers and understanding for the two research questions.

Quantitative Data Analysis

Student science achievement was assessed using *FOSS* I-Check assessments at the beginning (pre) and the end (post) of each of the five investigations from modules, *Climate and Weather, Motion and Matter,* and *Structures of Life*. The administration of the I-Check at the beginning of the investigation served as a measure of initial science knowledge. The I-Check assessments include open-ended items in addition to multiple-choice and matching questions, constructed writing portions were graded with the *FOSS* rubric provided in the *Assessment Coding Guide*. Scores from five *FOSS* I-Check pre and posttest assessments scores were collected and averaged; the percent change was also calculated for each of the three groups.

Qualitative Data Analysis

The researcher reviewed all data from *SWIVL* videos, field notes, artifacts, and classroom teacher interviews utilizing inductive analysis. Inductive analysis is defined as the chunking data into smaller analytical units of meaning, then clustering similar units into categories by identifying patterns and themes. This process is based on the researcher's analytical thinking skills (Bhattacharya, 2017) and their ability to review the data carefully and identify key issues, attach codes, and cluster themes into groups. The uncovered themes were written for each individual participant in the treatment group to show an increased incidence of general academic and domain-specific vocabulary in their oral language and writing.

Researcher's Role and Subjectivities

In qualitative data analysis, as researchers look for repeating themes and trends, their own assumptions, beliefs, and values will inform the way they construct meaning. As a result, it's important for researchers to identify their subjectivities as to not distort their findings (Bhattacharya, 2017).

Bhattacharya (2017) claimed, "How well a qualitative researcher can achieve depth of understanding is contingent on the relationships the researcher makes with the participants, the quality of data collection, and the researcher's analytical skills" (p. 36). I had previously conducted eight weeks of the same intervention in the Fall, 2017 so participants were familiar with the intervention process. They were aware of the reason why I conducted this study; they were compliant and engaged in the intervention. I selected a variety of data collection methods to examine participants' utilization of domain-specific vocabulary in their speaking and writing.

I have worked with both children and adult English language learners in small and whole group settings as a classroom teacher, ESL teacher, and ESL coach. I've observed classroom and ESL teachers' practices. In addition, I've consulted with administrators and the district's elementary assistant superintendent on best practices for developing receptive and productive language skills in ELLs. My ability to critically analyze data and identify themes was based on these experiences interacting, observing, and working with ELLs.

Summary

The purpose of this study was to investigate the impact of an integrated literacy/science intervention on third grade ELLs' science content knowledge and language development. This study focused on authentic communication, repeated practice, and focused instruction. The treatment group consisted of four ELL students, two girls and two boys. The control group consisted of four fluent English speakers and four students identified as ELLs. These groups were instructed by the classroom teacher while the researcher instructed the treatment group. Initially, participants received eight weeks of the intervention as preliminary data was collected from three *FOSS* I-Check assessments from modules, *Climate and Weather* and *Motion and Matter*. They received an additional six weeks covering two investigations from the *FOSS* module, *Structures of Life*. All quantitative and qualitative data was collected, analyzed, and compared to measure the effectiveness of the integrated literacy/science intervention on participants' science content knowledge and language development.

Chapter 4 - Analysis of Data

On October 10, 2017, I began the first eight-week phase of the integrated literacy/science intervention. At that time, I collected data from three *FOSS* I-Check investigations, two from *Water and Climate* and one from *Motion and Matter.* I presented my findings to my committee on January 26, 2018, it was agreed I'd return for six more weeks of research and add a qualitative research component to add a more in-depth analysis of the benefits of the literacy/science intervention. I would include an interview with the classroom teacher to describe and compare her instruction to what participants were receiving in the intervention. Additionally, I would continue recording my observations in my field journal, and participants would continue using their science journals to record their observations, predictions, and domain-specific word meanings. I returned to my research site on March 6, 2018 and worked with the same participants until April 20, 2018. During the second phase, I incorporated the suggestions from my committee, added a reflection after each session, and collected data from two more *FOSS* I-Check Investigations from the *Structures of Life* module, and *SWIVL* video observations.

Through consistent, explicit, and focused small group instruction, ELLs can acquire the necessary English language skills to successfully comprehend science knowledge. According to the Communicative Language Approach, ELLs are given opportunities to develop language in authentic and meaningful contexts. The intent of this study was to show how participation in a literacy-based intervention in science would positively affect participants' ability to understand scientific concepts and develop their receptive and oral language abilities. I chose a variety of both quantitative and qualitative data sources to provide different perspectives on how participants could benefit from small group instruction. Initially, I understood the importance of emphasizing domain-specific vocabulary in the intervention practices.

This chapter begins with the analysis of quantitative data from the five *FOSS* I-Check assessments from both phases of the study. My research thinking was to compare the groups' progress from pre to posttest scores, this would clearly illustrate how the intervention positively affected the participants' progress in their conceptual understanding of scientific concepts when compared to their ELL and fluent English-speaking peers.

The second section of the chapter provides an in-depth case study analysis of the qualitative data collected from each of the four participants, Christina, Cameron, John, and Helena. The purpose in the analysis was to illustrate the effect the intervention had on their receptive and productive language abilities. The intervention sessions were recorded and documented the occurrence of participants' utilization of domain-specific vocabulary in their speaking opportunities. These data sources are relevant because they illustrate the effectiveness of the integrated literacy/science intervention on their acquisition of language.

Because the classroom teacher instructed both control groups, the ELLs and fluent English speakers not receiving the intervention, I interviewed her on April 23, 2018 to obtain information about her instructional practices during scientific inquiry. Then I compared it to the literacy/science intervention. I was curious if the intervention's language strategies were going to have a significant effect on participants' language development. An intervention delivered with consistency and focused in a small group setting can benefit ELLs' acquisition of the necessary English language skills to successfully comprehend content knowledge.

Data Analysis

The purpose of this study was to investigate ELLs' conceptual understanding of scientific concepts and acquisition of receptive and productive language skills after receiving an integrated literacy-based intervention.

FOSS I-Check Pre/Posttest Analysis

Initially, I averaged the pretest scores for each of the three groups from five *FOSS* I-Check assessments. Then I averaged the posttest scores for each group and calculated the percent changer from pre to posttest to determine participants' conceptual understanding when compared to their ELL and fluent English-speaking peers.

In analyzing the quantitative data, my intention was to identify a statistically significant relationship between the treatment and control groups' achievement on their I-Check assessments. If the treatment group showed significant gains when compared to the control groups, it would justify the effectiveness of the integrated literacy/science intervention. The *ANCOVA* results from the first phase of the study did not produce a statistically significant relationship because of the relatively small sample size. As a result, it did not warrant running another *ANCOVA* statistical analysis for the second phase. As an alternative, I calculated and averaged the three groups' pre and posttest scores in addition to the percentage change from pre to posttest each group.

In Table 4.1, the average percentage of the *FOSS* I-Check pretest was 55.45% for the treatment group which was the lowest percentage of all three groups in previous scientific knowledge. The average pretest percentages for the control groups were 55.75% (ELLs) and 57.1% (fluent English speakers) respectively. The average score for the posttest was 84.75% for the treatment group which was higher than the control group - ELL (83.45%) and close to the control group - fluent English speakers (85%). The percent change from pretest to posttest was 52.84% for the treatment and ELL control group - ELL was 49.69% while the fluent English speaker percentage change was 48.86%.

Table 4.1.

Average FOSS I-Check Pre/Posttest Percentages by Group

Group	**Pretest Average Percentage Score**	**Posttest Average Percentage Score**	**Pre to Posttest Percent Change**
Treatment	55.45%	84.75%	52.84%
Control – ELL	55.75%	83.45%	49.69%
Control – Fluent English Speaker	57.1%	85%	48.86%

It was beneficial to understand the groups' pretest average score percentages to understand their level of previous scientific knowledge. The pre to posttest percentage change illustrates the groups' growth and what effect the intervention had on their science understanding. The analysis of the numbers alone was not a true representation of the conceptual gains the participants achieved in the intervention because the *FOSS* I-Checks were comprised of 83% multiple-choice questions. A multiple-choice question does not necessarily assess students' ability to express their knowledge. For a student to be able to synthesize their understanding and create a written response would be a more accurate gauge of science comprehension. While this data is useful in understanding participants' background knowledge, further analysis was required to determine the effectiveness of the intervention.

FOSS **I-Check Open-Response Analysis**

The quantitative data provided the treatment group's achievement on their *FOSS* I-Check assessments when compared to their ELL and English-speaking peers. To provide a more in-depth analysis of their conceptual understanding, I analyzed and compared their written responses to the *FOSS* I-Check open-response questions. If participants could effectively communicate their thoughts and ideas utilizing proper English syntax and vocabulary in context, they understood the scientific content. As I coded and compared the data from their *FOSS* I-Check answers to the open-response questions with those from the control groups, noticeable themes emerged. Because participants in the treatment group challenged themselves to express their understandings of scientific concepts in their responses, these examples are organized into sections based on the *FOSS* I-Check Investigations open-response answers from modules, *Motion and Matter* and *Structures of Life.* Each section describes the question and how the response was scored followed by an in-depth analysis of the treatment groups' responses in comparison with the control groups.

FOSS* I-Check Investigation 1, *Motion and Matter. The *FOSS* I-Check open-response question from Investigation 1, *Motion and Matter,* asked students to explain how a student could make a system that appears to make a paper butterfly float in the air inside a sealed jar. Students should have understood there are magnets hidden inside the lid of the jar and on the back of the paper butterfly. The magnets were being pulled together by the magnetic force so the butterfly appeared to be floating. According to the *FOSS Assessment Coding Guide,* students would have received a four if they noted things were hidden, e.g., a magnet inside the lid and one on the back of the butterfly to make the system work. A score of three included the same information as that of a four, but with minor errors. A score of a two contained only one piece of relevant information and a one is an attempt to write any other answer. Students received a zero if they made no attempt (Full Option Science System, 2018).

I analyzed and compared Christina's (treatment group) response to Nancy's (control – ELL) and Allison's (control – fluent English speaker) in Figure 4.1. According to the *FOSS*

Assessment Coding Guide, Christina scored a four because she noted a magnet in the butterfly and one on the top of the lid. She didn't, however, mention the magnets were attracting to make the system work. Christina did include the subjects from the question scenario, *the student* and *the second student* in her explanation adhering to the question prompt. In contrast, Nancy (control group – ELL) scored a three because she confused the *repelling* of the magnets instead of *attracting* but did mention the location of the magnets. Allison (control group – fluent English speaker) scored a three because she only mentioned the location of the magnet on the lid and not on the back of the butterfly.

Question: "Look what I made! It's a paper butterfly flying in the jar!" exclaimed one students. Another student looked in the jar and said, "Wait a minute, what's that string for? Something suspicious is going on here!" Explain how a student could make this system that appears to make a paper butterfly float in the air. **(Full Option Science System, 2018)**					
Student	**Treatment Response**	**Student**	**Control - ELL Not Receiving Intervention Response**	**Student**	**Control - Fluent English Speaker Response**
Christina	Student drew a diagram of a jar with a butterfly, string, and tape and labeled small magnets. The student that made the butterfly in the jar put a magnet in the butterfly and on the top of the jar. Then he showed the second student he or she got so amazed. That is what the first student did. **Score: 4 / 4**	Nancy	There is a paper clip on the butterfly and the magnet is on the lid and the paper clip is repeling the magnet. **Score: 3 / 4**	Allison	I think they have the string connected the paper clip and a magnet on the lid. **Score: 3 / 4**

Figure 4.1. FOSS I-Check Investigation 1 - *Motion and Matter* Open-Response Comparison between treatment and control groups' answers to the open-response question.

The data from this question is useful because it represents Christina's ability to adhere to answering the question prompt. Her descriptive response is written accurately utilizing complete sentences and correct English syntax to express her scientific understanding.

***FOSS* I-Check Investigation 1, *Structures of Life*.** The open-response question for *FOSS* I-Check for Investigation 1, *Structures of Life* asked students to describe the seeds of two different fruits including the number and properties of each, e.g. size, shape, or color. In the second part of the question, students were asked to describe at least one way the seeds were alike and different. *FOSS Assessment Coding Guide* suggested if students described the seeds of two fruits and included two properties, they received a four. A score of a three consisted of minor errors, e.g. their seed estimates were unrealistic or they only included one property. An answer that included only an estimate of seeds or only properties scored a two. If students attempted to answer or made no attempt, they scored a one or zero. In the second part of the question, if a student responded with at least one *alike* seed property and one *different* with no incorrect information, they would have scored a four. A score of a three was similar to a four, however, it contained minor errors. If students described either how the seeds were *alike* but not *different* or vice versa, they would have scored a two. And finally, an unrelated response or made no attempt, they would have scored a one or zero (Full Option Science System, 2018).

Cameron scored a four in his first answer (see Figure 4.2) because he described the color and amount of seeds in the apple and apricot. In the second part of the question, he also scored a four because he described how the two fruits were similar, apple and apricot and the texture of their seeds, *hard to break*. He also described the difference between the two seeds, the apricot seed had *holes* while the apple did not. Chris (control – ELL) also scored a four on the first part of the question because he named two fruits, apple and tomato. He described the size and location of the apple seeds and the size of the tomato seeds and their appearance including color and texture. He compared the two fruits by their color on the inside and outside and location of seeds. Thomas (control group – fluent English speaker) scored a four on the first part of the question because he mentioned two fruits, mango and apple and described the size and location of the apple seeds. In the second part, he described the differences in the size of the mango and apple seeds, however, his description of how they're alike is ambiguous, *they both grow into a fruit that they came from* which resulted in a score of three.

Question: A. Describe two different fruits and their seeds. Include the number of seeds the fruit is likely to have. Also include at least two properties that describe the seeds. B. How are the seeds from these two fruits alike and how are they different? **(Full Option Science System, 2018)**					
Student	**Treatment Response**	**Student**	**Control - ELL Response**	**Student**	**Control - Fluent English Speaker Response**
Cameron	A. Apple has 4 or less seeds, the seeds are black or brownish and hard to break because its hard shell. Apricot has at less one seed, the seeds are brown with little holes in it and like an apple, it is also hard to break. **Score: 4 / 4** B. They are both fruits, they both hold their seeds and their shell is hard to break. The apricot has holes in their seed but the apple seed doesn't. **Score: 4 / 4**	Chris	A. An apple has one or two seeds. The seeds are medium sized right in the center of the apple. They were brown and very hard. Tomatoes have a lot of seeds. Their seeds are super tiny. They were yellow they were covered with tomato juice. **Score: 4 / 4** B. There both red and these seeds are in the middle of the fruit. The apple only has two seeds. A tomato has a lot of seeds. An apple has yellow inside a tomato has red. **Score: 4 / 4**	Thomas	A. The mango seed is right in the middle and it takes up a lot of room because it is big. The apple has little seeds that have a point on the end and a curve on the other. **Score: 4 / 4** B. They both grow into a fruit that they came from. The mango seed is big and there is only one but the apple has little seeds and has a few seeds but not one. **Score: 3 / 4**

Figure 4.2. FOSS I-Check Investigation 1- *Structures of Life* Open-Response Comparison between treatment and control groups' answers to the open-response question.

In comparing Cameron's answer to his ELL and fluent English-speaking peers, his adherence to the question prompt and attention to detail are evident in his response. As with Christina's open-response to I-Check Investigation 1, *Motion and Matter,* there is a recurring theme of detail in both responses.

***FOSS* I-Check Investigation 2, *Structures of Life* Q#1.** The first question of *FOSS* I-Check Investigation 2, *Structures of Life* was a two-part question. The first part required students to put the drawings of the tomato life cycle in order and number them from one to six. The second part asked them to describe what was happening at each stage. If students wrote the correct number order, 5, 1, 4, 6, 3, 2 then they would have scored a two. Any other order or no attempt would have scored either a one or zero. For scoring the second part of the question, if students wrote logical descriptions of how the plant developed over time, they would have received a four. A score of three consisted of all parts of the life cycle: *seed, root, leaves, flowers, developing fruit, ripe fruit with seeds*, but with minor errors. If there were errors in the order or they omitted a stage, students would have received a two. Unrelated information or no attempt resulted in either a one or zero (Full Option Science System, 2018).

Figure 4.3 displays the responses of the treatment and control groups to describe the stages of the tomato's life cycle. I counted the incidence of domain-specific vocabulary usage for each group, the treatment group had a total of 22, control group - ELL, 23, and control group - fluent English speakers, 20. While the control group - ELL had one more occurrence than the treatment group, when I analyzed more closely, I realized the treatment group used a greater variety of words than both control groups. All three groups used the words: *seed, embryo, root, leaves, flowers, fruit,* and *stem* and the control groups both used *life cycle.* The treatment and ELL control group both used *seedling,* moreover, *germination* was unique to the ELL control group. The words used by only the treatment group included *dormant, seed coat, fibrous root,* and *cotyledon.* In the intervention sessions, we spent time defining, labeling visuals, and discussing these terms. In their open-response answers, their ability to use these words correctly in context illustrated their understanding and connections to the scientific concepts we had studied.

Even though two participants in the treatment group, Helena and Christina scored the same (5 out of 6) as that of Ella and Nancy (control group – ELL) and Jacob and Allison (control group – fluent English speakers). Christina used *seed, dormant, seed coat, embryo,* and was the only one to use *fibrous roots* and *cotyledon.* Similarly, Helena used *seed, root, stem, leaves,* and *flowers* while control group – ELL participant, Ella used *seed, embryo, root,* and *leaves.* Nancy (control group – ELL) also used *seed, root,* and *leaves.* In the control group – fluent English speakers, Jacob used *seed, flowers,* and *life cycle* and Allison used *embryo, stem, leaves,* and *flowers.*

Question: The pictures show the life cycle of a tomato plant. A. Number the pictures to show how a tomato plant grows, starting with the seed. B. Describe what is happening at each stage of the life cycle as you numbered it above. (Full Option Science System, 2018)					
Student	**Treatment Response**	**Student**	**ESL Not Receiving Intervention Response**	**Student**	**Fluent Speakers Response**
Cameron	1. The seed is dormant until it gets all it needs. 2. The seed has all it needs it grows an embryo to grow. 3. Now the seeds have a root, a leaves to be a young plant. 4. Now the plant is growing flowers. 5. The flowers make fruit for the plant. 6. Inside the plant a little seeds to grow. **Score: 5 / 6**	Chris	1. Seedling: Giving food to the embryo 2. Germination: starting to grow 3. Leafing: starting to grow leaf 4. Flowering: growing flowers 5. Fruit: starting to grow fruit with seeds. 6. Starting the life cycle again. **Score: 6 / 6**	Thomas	1. A seed is put in the ground to grow. 2. The seed grows an embryo out of the back of it. 3. The seed grows a root and a stem with leaves on it. 4. The plants starts to grow a tomato. 5. The tomatoes are ready to get picked. 6. There are more seeds in the tomato to start the life cycle over again. **Score: 5 / 6**
Helena	1. On one there is a seed. 2. On two it is the same thing but there is a root coming out. 3. On three there are more roots and a stem coming out and leaves. 4. On four there are flowers blooming and more leaves but there are little tomatoes. 5. On five there are leaves but no flowers blooming and some big ripe tomatoes. 6. On six there is the inside of a tomato and there are eighteen seeds. **Score: 5 / 6**	Ella	1. Tiny, small, tomato seed. 2. The seed is growing an embryo. Baby root. 3. The seeds root is growing with leaves. 4. Baby tomato. 5. Tomatoes are done. 6. Grab a tomato. **Score: 5 / 6**	Jacob	1. Seed being put in the ground. 2. Seed grows a little bit. 3. Seed sprouts. 4. Plant grows flowers, baby tomatoes start growing. 5. Big tomatoes start growing. 6. Tomato gets picked and eaten the seeds get put in the ground to start a new life cycle. **Score: 5 / 6**
Christina	1. In the first picture the seed is dormant and has its seed coat on it still. 2. The second picture show the seed with an embryo and still has its seed coat on. 3. The next one is showing it as a young plant with fibrous roots and does not have its cotyledon. 4. Next picture shows that it almost has food ready for us to eat and it does have its seed coat on it anymore. 5. The fifth picture shows more tomatoes in the tree	Nancy	1. Seed is trying to grow. 2. The root is start to come out of the seed. 3. Leafs and root are growing and also getting taller. 4. Roots are getting taller and taller and tomatoes are starting to grow. 5. Tomatoes are starting to show. 6. There is seed in the tomato. **Score: 5 / 6**	Allison	1. Seed trying to grow. 2. Embryos 3. The stem and leaves have spread. 4. The flower is growing. 5. The tomato is sprouting. 6. The tomato has grown it start all over again. **Score: 5 / 6**

	and about to fall off and almost ready to eat. 6. In the last picture it shows the good tomatoes ready to eat and go and it also shows all other seeds in the fruit **Score: 5 / 6**				
John	1. In 1, the first thing that always happens to a seed is to stay dormant. 2. In picture number 2, it is not dormant. It's a seedling. 3. In picture 3, it is a full tomato so people can eat. 4. In 4 this only has leaves pretty soon it's going to grow tomatoes. 5. In 5 it doesn't have tomatoes, it only has flowers and leaves. 6. In 6, now it grew tomatoes, flowers, and leaves. **Score:3 / 6**	Karen	1. Collection food for germination. 2. Root and embryo is starting to grow. 3. Leaf and stem start growing and it is a plant now. 4. Flowers start growing 5. The flowers start to grow into the fruit that you planted. 6. Now it is ripe enough to eat and cycle starts all over again. **Score: 6 / 6**	Jordan	1. When it's like the first time it is born. 2. The stem is coming out of it. 3. It has grown the root and leaves also the stem. 4. It now has grown flowers and starting to grow the fruit. 5. The plant is now ready to produce the fruit. 6. The fruit that has seeds inside of it and then come out then the life cycle will start again. **Score: 6 / 6**

Figure 4.3. *FOSS* I-Check Investigation 2 – *Structures of Life,* Q#1 Open-Response Comparison between treatment and control groups' answers to the open-response question.

The data from this open-response question is significant because the participants in the treatment group utilized a variety of word choice, detail to the question prompt, and wrote in complete sentences. This data is useful because it justifies the importance of a small group intervention for ELL students to develop their content knowledge.

***FOSS* I-Check Investigation 2, *Structures of Life* Q#2.** The second *FOSS* I-Check open-response question from Investigation 2, *Structures of Life* asked students to analyze diagrams of two hydroponic tanks with plants and determine which tank contained the nutrients based on the appearance of the plants. If students indicated tank two contained the nutrients and described two pieces of evidence, the increased number of leaves and their color, they received a three. If students only used one piece of evidence, they received a two and if they wrote anything else or made no attempt, they received a one or zero (Full Option Science System, 2018).

Helena's response (treatment group) as illustrated in Figure 4.4, scored a three because she compared the difference between the two tanks and gave two pieces of evidence, e.g., *it was all green and has a lot of leaves. It means it had a lot more time and food for it to grow faster than tank one*. In comparison to the control groups, Nancy's response (control – ELL) scored a one because she did not make a comparison between the two tanks and she mentioned *green* but does not refer to what is *green*. Furthermore, Allison's response (control – fluent English speaker) scored a two because she did compare the amount of leaves in each tank but failed to mention the leaf color in relation to tank two receiving more nutrients.

In comparing Christina's response to Nancy (control group – ELL) and Allison (control group – fluent English speaker), she clearly expressed her understanding of the connection between nutrients and color and amount of leaves which resulted in her receiving a three. In contrast, Nancy's response mentioned the color of the leaves; however, her response is incorrect because *green* leaf color is not associated with *less* food and sunlight. In Allison's response, she specifically stated the amount of leaves in both tanks, but she did not express the relationship between leaf color and more nutrients. Both participants, Helena and Christina, adhered to the question prompt and provided detailed responses written in complete sentences with the use of correct English syntax.

Question #2: Two students planted bean seedlings in two hydroponic tanks. One student forgot to put nutrients in his tank. After 4 weeks, they measured the bean plants. Their data are shown in the table below. Which tank had the nutrients? Why do you think that tank had the nutrients? (Full Option Science System, 2018)					
Student	**Treatment Response**	**Student**	**Control - ELL Not Receiving Intervention Response**	**Student**	**Control - Fluent English Speaker Response**
Helena	Tank 2. I think because there more leaves and Tank 1 has the least leaves. One more thing I spotted out that all the leaves on Tank 2 are all green and Tank 1 has light green and green. That is why I think Tank 2 has more nutrients. That is my answer. **Score: 3 / 3**	Ella	Tank 2. I think tank 2 had nutrients because each day it has more leafs than tank 1. **Score: 2 / 3**	Jacob	Tank 2. Tank 2 had the nutrients because it had more leaves and all the leaves were green. **Score: 3 / 3**
Christina	Tank 2. I think that tank 2 had the nutrients because it was all green and has a lot of leaves on it and if it has a lot of leaves on it. It means it had a lot more time and food for it to grow faster than tank one. That is my answer. **Score: 3 / 3**	Nancy	2. I think tank 2 because green means it has less food and sunlight to grow tall. **Score: 1 / 3**	Allison	2. Tank 2 has 40 leaves if you count and 12 is the number for tank 1. That's why I think tank 2 had nutrients. **Score: 2 / 3**

Figure 4.4. FOSS I-Check Investigation 2 – *Structures of Life,* Q#2 Open-Response Comparison between treatment and control groups' answers to the open-response question.

The purpose in analyzing the treatment groups' answers to the open-response questions to their fluent English-speaking peers and ELLs not receiving the intervention was to demonstrate their conceptual understanding of scientific concepts. The treatment groups' ability to consistently adhere to the question prompt, the length and detail of their written responses, and their use of domain-specific vocabulary demonstrated their conceptual understanding of science.

Description of Participants

An in-depth analysis of each of the four participants, Christina, Cameron, John, and Helena is provided to address the effectiveness of the intervention on participants' receptive and productive language skills.

The intervention was delivered with a degree of consistency and predictability utilizing reading, writing, listening, and speaking strategies. Through consistent, explicit, and focused instruction in a small group setting, ELLs can acquire the necessary English language skills to successfully comprehend content knowledge. I closely examined and analyzed first and final science journal entries including their daily written reflections, listening and reading connections on their six-grid organizers, and occurrence of speaking on the recorded intervention sessions for each participant. The importance in providing examples of these artifacts is to illustrate how the literacy/science intervention had a positive effect on participants' receptive and productive language.

Field Notes and Observations

In the beginning of the study, participants were unfamiliar with the specific language strategies. It took some time for them to become accustomed and comfortable with the intervention expectations. As a result, our sessions together were less efficient. As time went on, the length and quality of their daily science entries increased including their usage of domain-specific vocabulary as you will see in each individual participant's description. While the language strategies and expectations remained constant, participant interest, engagement, and their willingness to express themselves in both speaking and writing increased. These themes are noted in each participant's description. All names have been changed to protect participants' identity and privacy.

Cameron

At the time of the study, Cameron was eight years, eleven months old. While he was born in the United States, his family was from Micronesia and he was bilingual in English and his native language, Mokil. His ESL Individual Learning Plan (ILP) indicated he was to receive 135 daily minutes of push-in and small group pull-out instruction from the site's ESL teacher. The amount of time indicated on an ILP is determined by the student's KELPA composite score.

The amount of time of daily minutes of language support can be met by a certified and licensed classroom teacher to teach English language learners. Given that there are only two ESL teachers per site, one who serves the primary grades (kindergarten-2nd grade) and one for the intermediate grades (3rd-5th), they divide their time among their designated grade levels. According to the language needs of the students they serve, they can deliver either whole group (push-in) or small group (pull-out) support. Cameron's composite KELPA 2017 score of a three placed him at an *intermediate* level in his English language acquisition. When I examined more closely the subareas of his exam (speaking, reading, writing, and listening), writing was his lowest area which classified him as *high intermediate* (4). Cameron's stronger areas included speaking, reading, and listening where he scored *advanced* (5).

Science Journal Entries. Presented in Figure 4.5 are Cameron's first and last entries in his science journal addressing the lesson's focus question. For the first entry, I provided the sentence starter: *The weather forecast tells us* ___________________. *Forecasting the weather is important because* ___________________. In his first entry dated October 10, 2017, he did use the sentence starters, but only provided two simple statements without extensive elaboration or use of domain-specific vocabulary. The last entry he wrote dated April 17, 2018 followed a logical, detailed sequence of a bean plant's life cycle. Before writing his response, we had conducted the activity illustrated in Figure 4.5 where the four participants worked together to first label the drawings with domain-specific vocabulary, place them in the correct order, then write a description of each stage. Cameron incorporated words such as *nutrients, seedling, root, leaves, stem, roots,* and *flowers* and used them correctly in context. His ability to utilize domain-specific vocabulary to convey his conceptual understanding of the bean plant's life cycle clearly demonstrated his progression in his productive language skills.

First Science Journal Entry			
Date	***FOSS* Module**	**Focus Question** (Full Option Science System, 2018)	**Cameron's Written Response**
10/10/17	*Water and Climate*	What does the forecast tell us?	The weather forecast tells us what weather it is. Forecasting the weather is important because you will not get frost bite.
Last Science Journal Entry			
Date	***FOSS* Module**	**Focus Question** (Full Option Science System, 2018)	**Cameron's Written Response**
4/17/18	*Structures of Life*	What is the sequence of the bean plant's life cycle?	The Bean Seed Life Cycle Stage 1 – The seed is dormant now, it will grow until it gets the right things it needs, water, soil, and sunlight plus nutrients. Stage 2 – Now after the seed has all it needs, it will grow into a seedling, the seedling now has a root to collect the water and nutrients in the soil. Stage 3 – The seedling is a young bean plant. The young plant has leaves for its food and a long stem and roots too. Stage 4 – The young plant is now a bean plant, it has its leaves, roots, and the stem but now it also has a flower. Stage 5 – The bean plant is an adult plant, it still has everything the bean plant has but now it has a bean pod from the flower.

Figure 4.5. Cameron's first science journal entry dated October 10, 2017 and his last science journal entry dated April 17, 2018.

At the end of every session, I asked participants to reflect on the day's lesson and they wrote in their journals using the sentence starters: *Today I ________________ and I learned ___________*. I encouraged them to think deeply about the scientific inquiry we had conducted and to include the vocabulary in their written reflections. In analyzing Cameron's daily written reflections, he wrote a total of 12 times and used domain-specific vocabulary correctly in context a total of 34 times. In Cameron's first entry dated March 6, 2018, he wrote:

> *I learned that even you can't see a raspberry seed, they're still a seed there.*

Because writing was one of his weaker areas, I noticed towards the end of the study, he was writing without hesitation and his entries became more detailed. An example of his entry dated April 10, 2018 illustrates his conceptual understanding of the classification of what makes something a fruit and the purpose of a seed:

> *I learned that an avocado and olives are fruit because they hold there seed in the middle of the fruit. Today I learned that plants reproduce to grow because plants live forever. I learned that the inside of a seed is an embryo, the seed protects the embryo from getting harmed.*

Six-Grid Organizer. When I first introduced the six-grid organizer strategy to participants, it took them some time to learn how to focus and listen for the most relevant information. They would ask me to repeat sections of the text so they could listen more attentively. Towards the end of the study, they were accustomed to the strategy and knew they had to listen closely to have something to add to their organizers. On November 21, 2017, I read *Climates Regions* from the *FOSS* student science book, *Water and Climate* module while students followed along. After reading the portion of the text, I gave the group one-minute to sketch and label the main idea from the text. Cameron's sketch (see Figure 4.6) is very simple and included a picture of a cactus and connected the words *hot arid* which are ideas mentioned in the text. He understood the climate region was hot and dry and the kinds of plants that grow there.

On April 10, 2018, I read *Germination* from the *FOSS* student science book, *Structures of Life* module. Because I had participants use this strategy for the first eight weeks during the pilot study, they were familiar with the routine and I noticed sketches were becoming much more detailed with labeled domain-specific vocabulary.

Cameron's sketch related to the text (see Figure 4.7), he illustrated the first structure related to the germination process of the root emerging. While he also illustrated the embryo, he did not label it. His second sketch is more closely related to the text than his first and is labeled correctly. The purpose in providing Cameron's before and after sketches was to illustrate his progression in utilizing this listening strategy and his ability to conceptualize the text and label it correctly.

Text – *Climate Regions*	**Cameron's Sketch**
The hot arid zone in the western United States and parts of Mexico has warm, dry, winters. The summers are very hot and dry. Little rain falls during most of the year. During summer thunderstorms can bring heavy rains that sometimes cause flash floods. The hot and arid zone supports many kinds of plants that are adapted for dry conditions including cactus, mesquite, and yucca (Full Option Science Systems, 2015, p.51).	

Figure 4.6. Cameron's Six-Grid Sketch – *Climate Regions.* His first sketch after listening and interpreting the passage, *Climate Regions*, dated November 21, 2017.

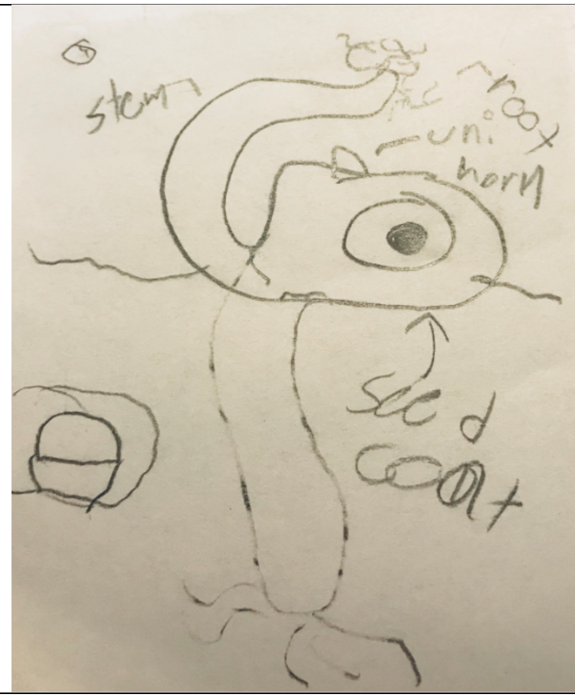
Text – *Germination*	**Cameron's Sketch**
The embryo starts to grow. The swelling cotyledons break open the seed coat so that more water can get in. This is called germination. It is the first step in seed growth. Soon the embryo starts to develop structures. The first structure to come out of the seed is the root (Full Option Science Systems, 2015, p.23).	

Figure 4.7. Cameron's Six-Grid Sketch – *Germination.* After listening to the reading passage on April 10, 2018*,* Cameron's last sketch as he interpreted the text.

I provided examples of Cameron's writing and listening artifacts illustrating his progression and growth because I wanted to show how the small group intervention was impacting his ability to write detailed responses and listen attentively. These data sources are important in showing how the intervention was impacting the quality of his work.

Helena

Helena was eight years, six months old and her native language was Spanish. While her father was bilingual in both English and Spanish, her mother only spoke Spanish. Helena's father was active-duty military so during his deployments, she was left with her mother. Being an only child, her only opportunity to speak English was at school. Her KELPA 2017 composite score was two which means she was a *high beginner* in her second language acquisition. In KELPA reading and writing subareas, she scored at an *intermediate* level (3) while her stronger areas were speaking, *advanced* (5), and listening, *high intermediate* (4). According to Helena's

ILP, she was to receive 230 daily minutes of push-in and small group pull-out from the ESL teacher.

Science Journal Entries. Early in the study, Helena struggled with incorporating detail and depth in her writing. In her first entry dated October 10, 2017, she did use the sentence starters, however, her response was only two simple statements without incorporating any domain-specific vocabulary. As she progressed, I noticed her writing became more detailed and she incorporated more vocabulary. I also noticed her attitude towards writing changed, she was more eager to express herself and I didn't have to prod or probe her to write. Her last entry dated April 17, 2018 illustrates the increase in her writing fluency (see Figure 4.8). She incorporated domain-specific vocabulary such as *dormant, seeds, seed coat, embryo, roots, cotyledon, leaves, stem,* and *flowers* to describe the life cycle of a bean plant. Her response is more descriptive and lengthier.

First Science Journal Entry			
Date	***FOSS* Module**	**Focus Question** (Full Option Science System, 2018)	**Helena's Written Response**
10/10/17	*Water and Climate*	What does the forecast tell us?	The weather forecast tells us the weather. Forecast the weather is important because we need to wear the right clothes.
Last Science Journal Entry			
Date	***FOSS* Module**	**Focus Question** (Full Option Science System, 2018)	**Helena's Written Response**
4/17/18	*Structures of Life*	What is the sequence of the bean plant's life cycle?	The Bean Seed Life Cycle Stage 1 is where a bean seed is dormant and it has a seed coat. Stage 2 is where it has an embryo, roots, a cotyledon and a seed coat but no leaves. Stage 3 is where it is a young plant and has leaves, long stem, and roots. Stage 4 no cotyledon, bean plant is not dormant, it has leaves, flowers, stem. Stage 5 it is a adult plant, it also has flowers, leaves, and bean pod. Stage 6 is now a bean pod, it has a little stem, it came from the flowers. The bean seeds is in the bean pod.

Figure 4.8. Helena's first science journal entry dated October 10, 2017, and last science journal entry dated April 17, 2018.

Helena reflected a total of 13 times and used domain-specific vocabulary a total of 32 times. In her entry dated March 6, 2018, she wrote:

> *Today we did about how we estimate the seeds in the fruit. I learned how many seeds they can be in a fruit.*

While she consistently used vocabulary in her entries, they progressed to become more complex and detailed as shown in her entry dated April 10, 2018:

> *Today we did is that we read and made our six books. And today I learned that flowers can get nutrients from the roots. A coconut and a sunflower have hard seed coats. And a seedling needs its cotyledon because without it will not survive that long. The leaves are important because it can soak up the water to make its food. The stem also is important because its straight and holds up the plant.*

As the study progressed, her ability to express her thoughts and ideas clearly and concisely while incorporating vocabulary correctly in context significantly increased. In addition, her confidence in her writing skills also increased; she was no longer hesitant to express herself in her writing.

Six-Grid Organizer. On November 21, 2017, I read the passage, *Climate Regions,* and Helena's first attempt at conceptualizing the text is displayed in Figure 4.9 is simple and lacks detail to the text's main idea. She did, however, label it *hot arid zone* and drew a picture of a cactus so she understood the climate and plants that grow in that region. As the study progressed, her final sketch (see Figure 4.10) on April 10, 2018 was more detailed a*s* she captured the seed coat opening and the root emerging; she understood and labeled both the *seed coat* and *root*. This data is important to illustrate Helena's progression and her ability to utilize the listening strategy and label it correctly with domain-specific vocabulary.

Text – *Climate Regions*	**Helena's Sketch**
The hot arid zone in the western United States and parts of Mexico has warm, dry, winters. The summers are very hot and dry. Little rain falls during most of the year. During summer thunderstorms can bring heavy rains that sometimes cause flash floods. The hot and arid zone supports many kinds of plants that are adapted for dry conditions including cactus, mesquite, and yucca (Full Option Science Systems, 2015, p.51).	

Figure 4.9. Helena's Six-Grid Sketch – *Climate Regions.* Her first sketch after listening and interpreting the passage, *Climate Regions* on November 21, 2017.

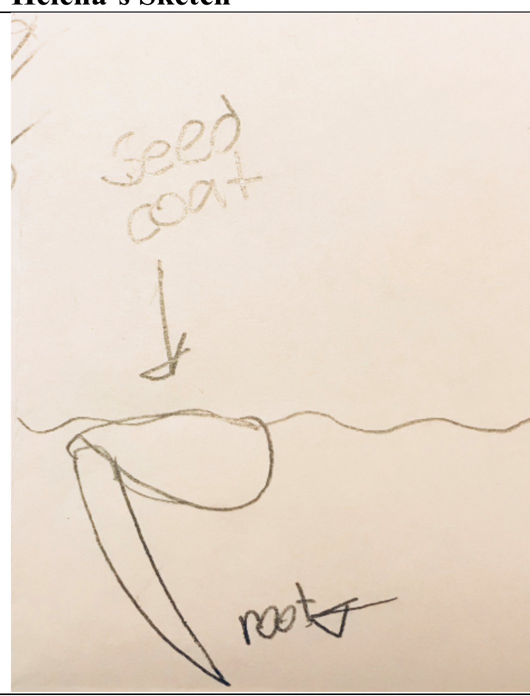
Text – *Germination*	**Helena's Sketch**
The embryo starts to grow. The swelling cotyledons break open the seed coat so that more water can get in. This is called germination. It is the first step in seed growth. Soon the embryo starts to develop structures. The first structure to come out of the seed is the root (Full Option Science Systems, 2015, p.23).	

Figure 4.10. Helena's Six-Grid Sketch – *Germination.* After listening to the reading passage on April 10, 2018*,* Helena's last sketch as she interpreted the text.

During the intervention, the reading, writing, listening, and speaking strategies were consistently delivered to the group. The data from Helena's science journal entries and six-grid organizer reflect this emphasis. As a result, her writing became more concise and she was able to use vocabulary correctly in context.

Christina

Christina was eight years, one month old at the time of the study. Her family was from the Philippines and she spoke and understood Tagalog. At the beginning of her third-grade year, the classroom teacher expressed concerns about Christina's receptive language skills; she was having difficulty understanding and following oral directions. At that time, the teacher expressed her concerns to the ESL teacher and it was decided the ESL teacher would work with Christina. She would closely monitor her receptive language before testing her English language proficiency. When I worked with Christina, she was very focused, listened attentively, and was willing to complete all tasks.

Science Journal Entries. As shown in previous science journal entries from Cameron and Helena, Christina also lacked the ability to fluently express her thoughts and ideas in her writing. In her first entry dated October 10, 2017 (see Figure 4.11), she used the first part of the sentence starter then attempted to answer why forecasting the weather was important. While she understood the relationship between the weather and dressing appropriately, she clearly experienced problems with syntax and word choice, e.g. *it is important because to be safely* and *You get somebody sick and get frost bites.* In her final entry dated April 17, 2018, I was beginning to see her expression and fluency improve, e.g. *Stage 3 is a young plant and it has leaves and a very long stem and roots.* While not completely fluent yet, Christina was making good gains in improving her expression in writing.

First Science Journal Entry			
Date	***FOSS* Module**	**Focus Question** (Full Option Science System, 2018)	**Christina's Written Response**
10/10/17	*Water and Climate*	What does the forecast tell us?	The weather forecast tells us what it is going to be outside and it is important because to be safely. You get somebody sick and get frost bites and it will not be safe if you dress badly.
Last Science Journal Entry			
Date	***FOSS* Module**	**Focus Question** (Full Option Science System, 2018)	**Christina's Written Response**
4/17/18	*Structures of Life*	What is the sequence of the bean plant's life cycle?	The Germination Process Stage 1 is the dormant and it has a seed coat and it is a bean seed inside is a new part of a plant that needs water. Stage 2 still has a seed coat but no leaves yet and it has some roots and an embryo and a cotyledon. Stage 3 is a young plant and it has leaves and a very long stem and roots. Stage 4 has no cotyledon and is not dormant it has flowers, leaves, and a long stem. Stage 5 has no cotyledon because it is an adult plant. It has flowers, leaves and a bead pod now and it can pop off. Stage 6 is a bean pod and it usually has three bean seeds inside the bean pod and it came from the flowers.

Figure 4.11. Christina's first science journal entry dated October 10, 2017, and her final science journal entry dated April 17, 2018.

Christina reflected in her journal a total of 15 times and utilized domain-specific vocabulary a total of 37 times in her entries. The repeated practice and expectation of the daily reflections effected the fluency of her entries. In an early entry dated March 6, 2018, she wrote:

> *I learned that all seeds don't have the same amount of seeds and that sometimes you have to estimate.*

I noticed her entries were becoming lengthier, more detailed, and domain-specific vocabulary occurrences were increasing. For example, in her entry dated March 27, 2018, she wrote:

> *Today I learned that rice seeds grow on terrestrial land or aquatic land to grow but some animals and bugs live there too. A part that keeps the rice safe is called*

a hull and they also grow rice everywhere. When the rice grows they are called an organism and grow in wet or dry land.

Christina understood the difference between *terrestrial* (dry) and *aquatic* (wet), she mentioned *hull* which was introduced in the text we read and made a connection between *grows* and *organism.*

Six-Grid Organizer. In Christina's first attempt on November 21, 2017 (see Figure 4.12), she added *hot arid zone* and *very dry air,* she made the connection between the words *arid* and *dry*, and understood the types of plants that grow in the region. In analyzing her second sketch on April 10, 2018 (see Figure 4.13), she clearly attempted to illustrate the first step in the germination process. She drew and labeled the *seed coat, embryo*, and *root*. The purpose in providing this data was to show how Christina's ability to listen to the text and conceptualize an image then label it correctly.

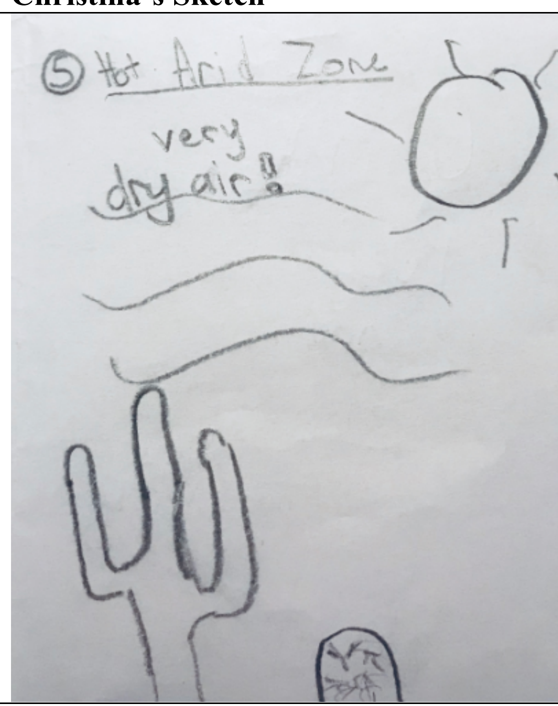
<table>
<tr><th>Text – Climate Regions</th><th>Christina's Sketch</th></tr>
<tr><td>The hot arid zone in the western United States and parts of Mexico has warm, dry, winters. The summers are very hot and dry. Little rain falls during most of the year. During summer thunderstorms can bring heavy rains that sometimes cause flash floods. The hot and arid zone supports many kinds of plants that are adapted for dry conditions including cactus, mesquite, and yucca (Full Option Science Systems, 2015, p.51).</td><td>
</td></tr>
</table>

Figure 4.12. Christina's Six-Grid Sketch – *Climate Regions.* Her first sketch after listening and interpreting the passage, *Climate Regions* on November 21, 2017.

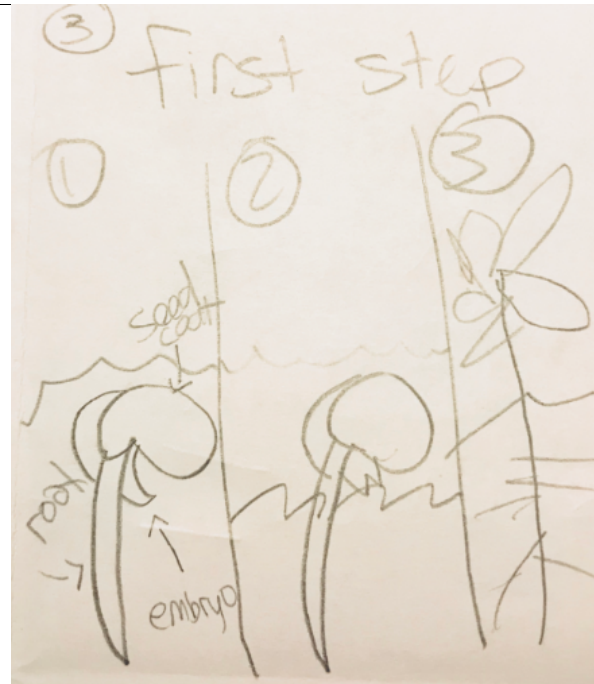
Text – *Germination*	Christina's Sketch
The embryo starts to grow. The swelling cotyledons break open the seed coat so that more water can get in. This is called germination. It is the first step in seed growth. Soon the embryo starts to develop structures. The first structure to come out of the seed is the root (Full Option Science Systems, 2015, p.23).	

Figure 4.13. Christina's Six-Grid Sketch – *Germination.* After listening to the reading passage on April 10, 2018*,* Christina's last sketch as she interpreted the text.

The analysis of Christina's artifacts is important because they illustrate the progression of her writing and listening skills. The repetition and familiarity of the routine affected her ability to express herself. It's useful to note these changes as the intervention having a positive effect on her productive language.

John

At the time the study took place, John was eight years, three months old. He was born in Samoa and both parents spoke Samoan. While he understood when spoken to in his native language, he often responded in English. His KELPA 2017 composite score was two which identified him as a *high beginner.* John scored as *high intermediate* (4) in speaking, reading, and listening and *advanced* (5) in writing. He did have a current ILP on file at the study site and received 230 daily minutes of bilingual instruction from the ESL teacher which included push-in and pull-out support.

Science Journal Entries. In John's first entry, dated October 10th, 2017, he did utilize the sentence starters I provided, however, he did not elaborate in his response. He mentioned a *tornado*, but I'm not sure how he came up with *earthquake* as a weather phenomenon. When compared to his final entry on April 17, 2018, he did elaborate and synthesized the information from the labeled drawings (see Figure 4.14) and included domain-specific vocabulary in his description of a bean plant's life cycle. His responses to stages 2 and 3 show a level of complex thinking:

> *Stage 2 – It is a little seed that has a cotyledon for food and it's protected by the seed coat and in the soil, it spreads its roots.*
>
> *Stage 3 – It has leaves also to make its own food and a long stem to make it free standing.*

John understood the purpose of the cotyledon, seed coat, leaves, and stem and demonstrated this knowledge by using the domain-specific vocabulary correctly in context. Interestingly, he used the words *free standing* which we had not discussed.

First Science Journal Entry			
Date	***FOSS* Module**	**Focus Question** (Full Option Science System, 2018)	**John's Written Response**
10/10/17	*Water and Climate*	What does the forecast tell us?	The weather forecast tells us the weather or it is gonna be a tornado or an earthquake. Forecasting the weather is important because we know the weather is.
Last Science Journal Entry			
Date	***FOSS* Module**	**Focus Question** (Full Option Science System, 2018)	**John's Written Response**
4/17/18	*Structures of Life*	What is the sequence of the bean plant's life cycle?	The Bean Seed Life Cycle Stage 1 – Seed is dormant and has a seed coat and it's a bean seed. Stage 2 – It is a little seed that has a cotyledon for food and its protected by the seed coat and in the soil, it spreads its roots. Stage 3 – It has leaves to make its own food and a long stem to make it free standing. It has roots. Stage 4 – It has leaves also to make food. And its flowers for pollen sometimes for bees. Stage 5 – It has leaves, flowers and the bean pod came from the flowers. Stage 6 – It only has bean seeds in a bean pod.

Figure 4.14. John's first science journal entry on October 10, 2017, and his last science journal entry on April 17, 2018.

When I analyzed John's reflections, he wrote a total of 13 times and used domain-specific vocabulary a total of 27 times. More specifically, one of his first entries dated March 6, 2018, he wrote:

> *Today I learned a plant is an organism and when plants are seeds they are at stage dormant. A plant is a living thing.*

John needed additional practice with English syntax and while he mentioned the word *dormant,* he did not describe why or how seeds are in a *dormant* stage. He understood plants were living things but did not make the connection and join this sentence to define the word *organism.* In a later entry dated March 27, 2018, John wrote:

> *I learned aquatic means of the water. If it's talking about water, there are many things in the water like muskrats. An organism is an individual plant or animal*

like muskrats. Some must create work individually. I learned terrestrial is of the land like my territory, American Samoa. Samoa is a place where I lived, Samoa we speak different languages in Samoa. There is not much to do there.

In the first entry, John struggled with making the connection with the word *organism* and phrasing his sentence correctly to reflect its meaning. In the second entry, he understood that an *organism* was *an individual plant or animal* which is what we had discussed; he even gave an example, *muskrats.* When we discussed the word *terrestrial,* I mentioned its similarity to the word *territory*. John's ability to relate the meaning of these two words to *land* and share his personal connections to *American Samoa* clearly demonstrated his level of complex thinking.

Six-Grid Organizer. John's first sketch from the text read to him on November 21, 2017, *Climate Regions,* illustrated a picture of a cactus and the labels *hot arid zone* (see Figure 4.15) which shows his general understanding of the first section of the text. He understood the plants grown in that region. In comparing his first sketch with his second from the text, *Germination,* on April 10, 2018 (see Figure 4.16), he drew the seed underground. He labeled the first structure, *root* and understood the seed coat opens so the root can emerge. In providing examples of John's written artifacts demonstrates how the literacy/science intervention was impacting his ability to express himself in his writing to explain scientific concepts. Because an emphasis was placed on utilizing vocabulary, the evidence is clearly demonstrated in these examples.

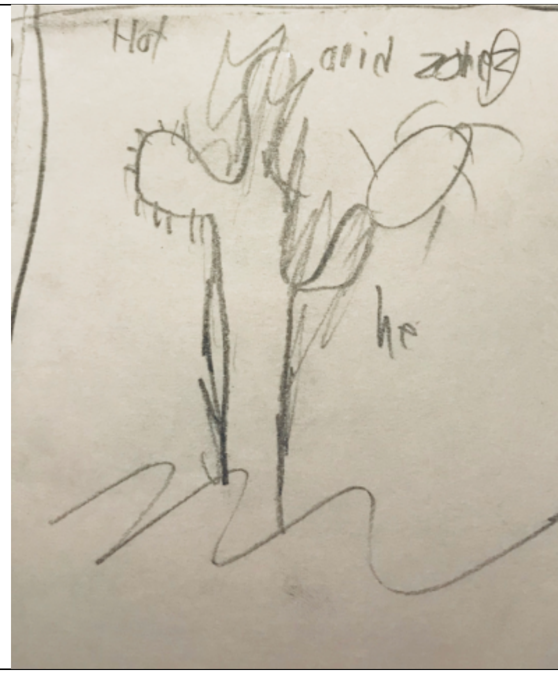
Text – *Climate Regions*	**John's Sketch**
The hot arid zone in the western United States and parts of Mexico has warm, dry, winters. The summers are very hot and dry. Little rain falls during most of the year. During summer thunderstorms can bring heavy rains that sometimes cause flash floods. The hot and arid zone supports many kinds of plants that are adapted for dry conditions including cactus, mesquite, and yucca (Full Option Science Systems, 2015, p.51).	

Figure 4.15. John's Six-Grid Sketch – *Climate Regions.* His first sketch after listening and interpreting the passage, *Climate Regions* on November 21, 2017.

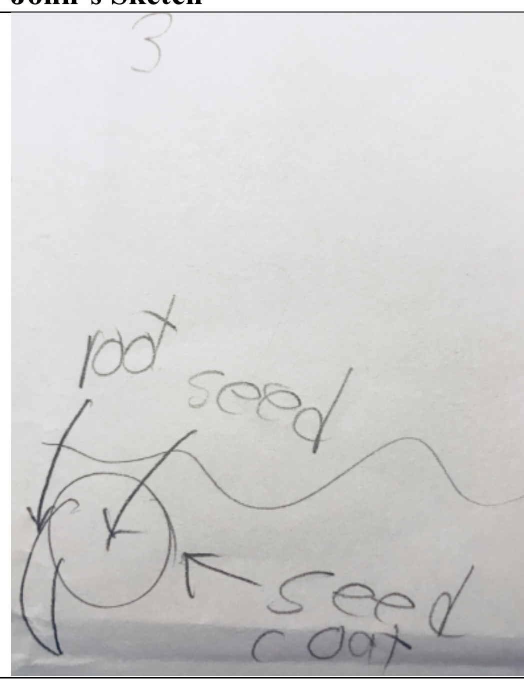
Text – *Germination*	**John's Sketch**
The embryo starts to grow. The swelling cotyledons break open the seed coat so that more water can get in. This is called germination. It is the first step in seed growth. Soon the embryo starts to develop structures. The first structure to come out of the seed is the root (Full Option Science Systems, 2015, p.23).	

Figure 4.16. John's Six-Grid Sketch – *Germination.* After listening to the reading passage on April 10, 2018*,* John's last sketch as she interpreted the text.

The purpose in analyzing participants' artifacts was to measure the effectiveness the integrated literacy/science intervention had on their receptive and productive language. The data collected through their first and last science journal entries and written reflections is important because it demonstrates a progression in their writing abilities. Analysis of their first and last six-grid organizer sketches illustrates their ability to listen attentively when read to and negotiate the most relevant information to sketch and label. Themes noted included an increase in writing fluency, use of domain-specific vocabulary, the length and detail of their responses, text-to-self connections, and their engagement and willingness to write. The consistency of the intervention's delivery resulted in higher quality products from participants thus supporting the benefits of the literacy/science small group intervention for English language learners.

***SWIVL* Observations**

During the study, I recorded the intervention sessions using a *SWIVL* robot and iPad because through consistent, explicit, and focused instruction in a small group setting, ELLs can acquire the necessary English language skills to successfully comprehend content knowledge. The purpose in recording these sessions was to illustrate the effectiveness of the intervention on participants' speech. The intervention's instruction, the vocabulary strategy of reviewing previously taught vocabulary and asking participants to discuss word meanings before each session is demonstrated in Figure 4.17. The purpose in presenting this data is to illustrate how participants responded with domain-specific vocabulary.

Date	Question	Participant Response
3/26/18	What does the word *characteristic* mean? What does the word *dormant* mean?	Christina – *A quality belonging to a person, place or thing.* Helena – *Suspended, it's alive but it's sleeping.*
4/3/18	What does *exist* mean? What is a *fruit?* What is a *seed?*	Christina – *You continue to live and leave a mark that you existed there.* Cameron – *A fruit is something that holds a pit or seed.* Helena – *Something that you eat, seeds make a new plant so they can reproduce again.* Christina – *It's something that has a seed inside and it's edible. The seed helps it grow another plant, it reproduces.* Helena – *It's something that's inside a fruit that helps it sprout and reproduce. When it hits the ground, it starts growing, when it's in a fruit it's dormant.* Christina – *A seed is something inside a fruit and it has an embryo, the seed is dormant because it's not growing.* John – *It's what comes out of a fruit and when it hits the ground, it begins to grow.*
4/4/18	What is an *organism?* What does *aquatic* mean? What does *terrestrial* mean? What does *reproduce* mean? What's an *embryo?*	Cameron – *A living thing.* Helena – *It means in the water, it's wet.* John – *It means territory, the Earth and it's dry.* Christina – *It means to create again.* Cameron – *It's the small, growing part of the plant.*
4/9/18	What's a *cotyledon?*	Cameron – *The cotyledon holds the food for the plant until it grows up. When it doesn't need it, it just falls off.*
4/10/18	What are the purpose of a bean plant's structures?	Helena – *The purpose of the stem is to make it stand up straight. The purpose for the leaves is for it to soak up the water and make its nutrients.* Christina – *The purpose of the root is to soak up water and it takes up nutrients.* John – *The purpose of the seed coat is to protect the seed until it's fully grown. It is small but when it's big, it does not need it and it falls off.* Cameron – *The cotyledon is for it to collect food while it's little then when it grows up, it doesn't need it anymore.*
4/13/18	What's a *structure?*	John – *A pattern or an organization*
4/16/18	What's the meaning of *inherit?*	John – *To get a quality or characteristic from your parents*
4/17/18	What is a *root?* What does it mean to *survive?* What is a *stem?* What is a *cotyledon?* What is a *seedling?*	John – *A part of the plant that sucks the water up.* Helena – *It means to continue to live or exist.* Christina – *A stem is the main body of the plant, it holds it up. Water and nutrients come through the stem.* Helena – *A part of a germinating seed to get food.* Cameron – *A young plant raised from a seed.*

Figure 4.17. Vocabulary Questions & Answers – *SWIVL* Videos from participants speaking opportunities to answer and define domain-specific vocabulary.

A systematic vocabulary review occurred at the beginning of each session as described in Chapter 3, participants were asked to define word meanings from previous sessions. During whole group classroom instruction, the classroom teacher did not deliver a systematic vocabulary routine as described in the next section. The data is useful to note that participants were able to continually provide the correct meaning for domain-specific vocabulary. The research thinking behind this practice was if I consistently asked them to define vocabulary, the participants would eventually incorporate the vocabulary into their own productive language. Participants utilized domain-specific vocabulary in their oral responses a total of 33 times. On April 3rd, I asked them to define a *fruit* and *seed,* Helena and Christina used *reproduce, embryo,* and *dormant* in their descriptions. On April 17th, I asked them to define *stem,* Christina described how *nutrients* came up through the stem. Helena also responded with *a germinating seed* to describe a *cotyledon.* Most interestingly, they also used general academic vocabulary such as *suspended, exist, existed, edible, sprout, territory, pattern, organization,* and *quality* in their oral responses.

Classroom Teacher Interview

I interviewed the classroom teacher because I was interested in how her practices contributed to participants' receptive and productive language and content knowledge when compared to the intervention. Through consistent, explicit, and focused instruction in a small group setting, ELLs can acquire the necessary English language skills to successfully comprehend content knowledge. In a small group setting, participants' science content knowledge and language acquisition can be closely monitored. It was useful to analyze the classroom instructional practices to see if the intervention was having a positive effect on participants.

On April 23, 2018, I conducted an in-depth, semi-structured interview with the classroom teacher**.** I asked her a set of pre-determined, open-ended questions:

(a) Can you describe your instructional routine during scientific inquiry?

(b) How do you incorporate opportunities for your students to utilize language with their peers during scientific inquiry?

(c) What specific strategies do you use to incorporate reading, writing, listening, and speaking into your science lessons?

(d) If you use partners, what factors do you take into consideration when you partner your ELL students with fluent English speakers?

(e) During scientific inquiry and science reading, what kinds of scaffolds do you provide for your ELL students?

(f) How closely did you follow the *FOSS* curriculum (e.g. videos, online activities?

(g) Did you incorporate any additional materials outside the *FOSS* curriculum?

The responses from the interview were transcribed and themes were detected in both similarities and differences between classroom instruction and intervention practices as noted in Figure 4.18 on page 78. The classroom teacher began her science instruction by introducing the focus question which was presented in the *FOSS Investigations Guide* followed by either scientific inquiry or reading, discussion, and writing. The goal of her instructional cycle was for students to be able to answer the focus question. During scientific inquiry, students worked independently in groups of four and she paired strong bilingual speakers, mainly Spanish, with those whose bilingual receptive skills were more prominent. While students were working, she probed and questioned them focusing on the usage of domain-specific vocabulary. If students were reading science text, they were paired with a partner with similar reading abilities and they used a sequential graphic organizer, scaffolded notes, to understand the main ideas from the text. The lessons concluded with students answering the focus question in their science journals. She provided sentence starters and entry parameters such as length and the use of specific vocabulary.

The classroom teacher incorporated a variety of language scaffolds and vocabulary development such as word mapping and a modified DOTS chart, visuals, the use of cognates and students' native language for simple words like *seeds, green,* and *leaves.* In addition, through repeated practice and modeling, the teacher rephrased students' responses and encouraged them to speak in complete sentences. For example, she said if a student responded with "Oh look, it has more leaves," she would ask "What has more leaves? The plant has more leaves, is it a young plant? What is it?" She encouraged them to be more specific with their oral responses. While she occasionally asked students to rephrase what their partner said, active listening strategies weren't always used consistently.

The classroom teacher mentioned this was the first year of the *FOSS* curriculum implementation in the district, they were required to focus on scientific inquiry and science notebooks. While she adhered to the curriculum approximately 85% of the time, she did incorporate materials from outside sources.

The literacy/science intervention possessed many of the same instructional practices as that of the classroom. Because we both used the *FOSS Investigations Guide,* our lessons utilized the focus question before, during, and after lessons. Students independently conducted scientific inquiry, the classroom in groups of four, and the intervention in partnerships. We both utilized science journals and provided sentence starters and parameters for written journal entries. A noticeable difference between the classroom and intervention was the participants' daily reflections. While we both provided vocabulary scaffolds, the intervention had vocabulary-based activities like the one pictured in Figure 4.19. Participants were expected to label the drawings with domain-specific vocabulary, put the pictures in order, then describe each stage in writing.

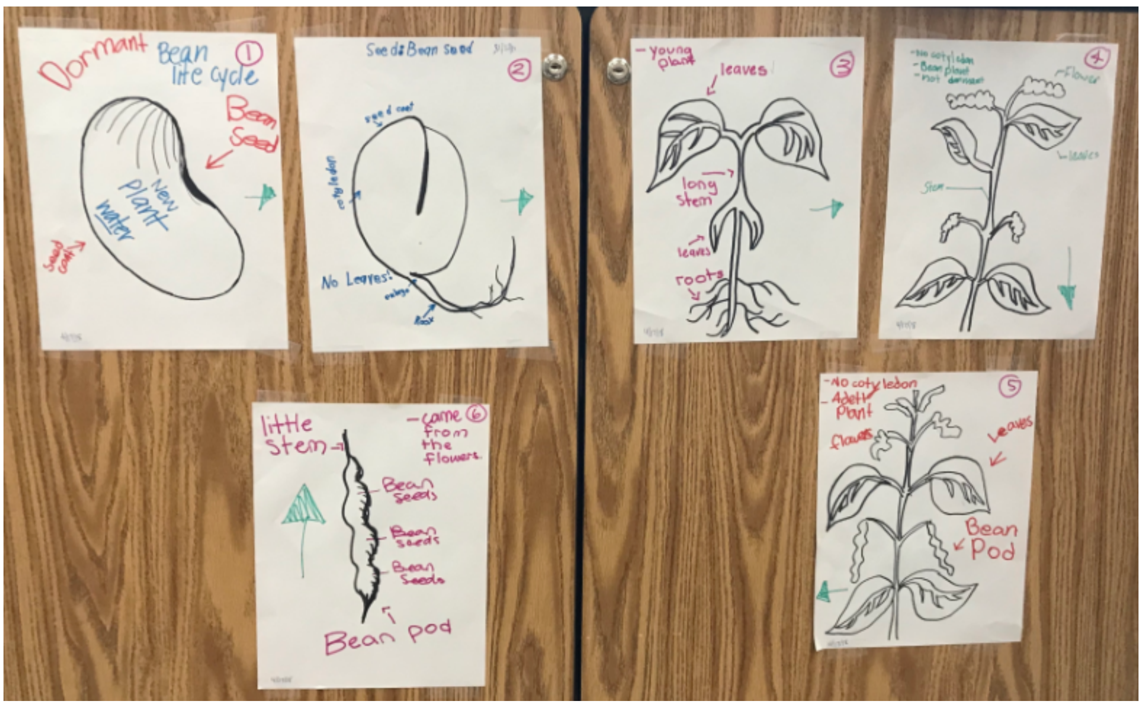


Figure 4.19. Bean Plant Life Cycle Vocabulary Activity. Participants labeled the drawing with domain-specific vocabulary then wrote a description of each stage in their science journals.

The classroom and intervention both used graphic organizers to help students process expository text. The classroom teacher allowed her students to read independently in partnerships and complete scaffolded notes while I read sections of the text to the participants then asked them to quick sketch and label the most relevant information. This activity was purposefully planned to develop their receptive English language skills. Additionally, I planned opportunities for participants to actively, dictate, and recite what their partners said whereas the classroom teacher only incorporated occasional active listening strategies.

We both modeled proper English syntax and probed students to expand on their responses in both their speaking and writing. Because I only worked with four students, this allowed me to consistently monitor their understanding of scientific concepts and use of domain-specific vocabulary. I provided them with repeated exposures and multiple opportunities to read, write, speak, and listen to vocabulary.

I analyzed the similarities and differences between the classroom teacher's instruction and the intervention practices I delivered in the small group setting. While I found many similarities between the two, the intervention had a greater focus on vocabulary knowledge, vocabulary-based activities, active listening, writing, and self-reflection. Consistent and focused implementation of reading, writing, listening, and speaking strategies can affect ELL students' English language skills to comprehend content area knowledge.

Classroom Instruction	Intervention Practices
• Began lesson with focus question • Students independently conducted scientific inquiry to answer focus question • Whole group discussion • Wrote their answer to focus question in science journals • Provided sentence starter • Used native language & cognates – simple words like seed/leaves/green • Partner read with scaffolded notes – partnered with same reading level • Probed students to rephrase or expand on their answers • Occasionally reads to them; use of audio books • Reads test questions if they request • 4-member teams for scientific inquiry. Tried to include a strong speaking bilingual with a listening bilingual • Modeled speaking structure with vocabulary accompanied with a synonym • 85% fidelity to curriculum; first year of implementation focused on inquiries and science notebooks • Incorporation of outside materials • Vocabulary scaffolds – word mapping, DOTS chart	• Direct vocabulary instruction and review at the beginning of each session • Participants recorded domain-specific vocabulary definitions in journal • During scientific inquiry, participants recorded observations and predictions in journals • Vocabulary based activities • Active listening – rephrase partner's response, dictation, and listening to text read to them • Six-grid organizer to process and determine most relevant information to sketch and label • Daily reflection encouraged students to use daily vocabulary • Writing – provided sentence starters/frames • Use of focus question before, during & after scientific inquiry • Conducted scientific inquiry in partnerships • Group discussions • 95% fidelity to curriculum • No incorporation of outside materials
Similarities	**Differences**
• Students independently conducted scientific inquiry in groups • Used focus question before, during, and after • Provided sentence starters for writing • Used of familiar graphic organizer, scaffolded notes • Used science journals for writing • Modeled and probed speaking strategies and correct English syntax • Read test questions • Vocabulary scaffolds	• Direct, explicit and review of vocabulary at the start of each session • Definitions recorded in science journals • Vocabulary based activities • Active listening strategies used consistently • Daily lesson reflection • Guided scientific inquiry in partnerships • Participants negotiate the most relevant information after the text is read to them to sketch and label on their organizer • Higher percentage of fidelity to curriculum • No incorporation of outside materials

Figure 4.18. Comparison of Classroom Instruction and Intervention Practices noting similarities and differences between the two.

Summary

This chapter outlined the most relevant quantitative and qualitative data to represent how the integrated literacy/science intervention impacted participants' science knowledge and language acquisition. The participants' ability to successfully express their scientific knowledge in English is represented in their open-response answers in their *FOSS* I-Check assessments.

Their individual receptive and productive language progress is highlighted in their science journal entries and six-grid organizer samples. The comparison between the classroom teacher's instruction and intervention practices emphasized the importance of direct and explicit vocabulary instruction and activities, participants' active listening, and daily writing practice which included time for participants to self-reflect on the lessons. In referring back to the theoretical framework for this study, the Communicative Language Approach, the findings related to the components are illustrated in Table 4.2.

Table 4.2 *Data Analysis – Connection to Theoretical Framework*

Communicative Language Approach	**Findings**
Authentic opportunities for ELLs to develop receptive and productive language	Incidence of domain-specific vocabulary, length, and detail of *FOSS* I-Check open-response questions and daily written reflections
ELLs communicate in authentic, spontaneous, and meaningful contexts	Incidence of domain-specific vocabulary in speaking and writing.
Sufficient practice with language which translate to the reduction of teacher talk and increase in student talk	Incidence of speaking opportunities and incidence of domain-specific vocabulary as witnessed in *SWIVL* videos

Chapter 5 - Findings, Discussion, and Implications

ELL students could benefit from explicit and focused small group instruction to acquire English language skills to meet these rigorous standards. The intent of this study was to show how participation in an integrated literacy/science intervention that fostered authentic communication among participants to positively impact participants' conceptual understanding of science and acquisition of English language skills.

This chapter begins with a summary of the study and its findings as they are presented in Chapter 4. The discussion section answers the two research questions with critical analysis of the present study to recent integrated literacy/science interventions. The chapter concludes with practical suggestions for ESL practitioners based on the issues raised in this study, and a detailed plan for future research.

Summary of the Study

There is an important link between science and literacy, students use their literacy skills to gather information as well as communicate their understanding of scientific concepts (Zwiep, Straits, Stone, Beltran, & Furtado, 2011). The adoption of the Next Generation Science Standards (NGSS) in 2013 ensured science education would be accessible and equitable for all students including English language learners (ELLs). The NGSS standards are interrelated and language intensive which required a shift in the way teachers instruct ELL students in science. This shift can be characterized as more specialized instruction in domain-specific science vocabulary. English as a second language teachers (ESL) must make scientific content comprehensible while simultaneously developing students' English language proficiency.

The intent of this study was to evaluate the impact of an integrated literacy/science intervention on third grade ELLs' science achievement when compared to their ELL and fluent

English-speaking peers and the acquisition of participants' receptive and productive English language skills. The study was conducted at a public elementary school on an Army installation in the Midwest, United States. The 12 participants were selected from a third-grade classroom, eight identified as English language learners, four received the small group intervention and four received classroom instruction, and four fluent English speakers. The four participants that received the intervention were chosen based on their *KELPA* 2017 composite scores. The intervention was delivered in two phases, phase one was eight weeks and phase two for an additional six weeks. The intervention was based on scientific inquiry and authentic communication in the systematic and repeated practice of listening, speaking, writing, and reading strategies and explicit vocabulary instruction. Participants were given opportunities to participate, develop, and reflect on their language in meaningful contexts. The active listening strategies included: (a) listening to partner's response, (b) interviewing their partner and dictating their responses, (c) listening and determining most relevant information from science text to add to their six-grid organizers, and (d) listening for domain-specific vocabulary in participants' written reflections. Speaking strategies included (a) equal opportunity to respond to questions during discussions, e.g. vocabulary definitions, (b) Rephrasing partner's responses, (c) Interviewing and asking their partner questions and responding to partner's questions, (d) Discussing their six-grid organizers, and (e) sharing of their daily written reflections. Writing strategies consisted of (a) daily use of science journals, (b) Written responses to focus questions, (c) recording predictions and observations from scientific inquiry, and (d) daily written reflections. The reading comprehension strategy consisted participants listening and following along to sections of the science text, determining the most relevant ideas from the text to add to their six-grid organizers. The vocabulary routine took place at the beginning of each session and consisted of (a) reviewing previously introduced vocabulary, (b) introduction of five new vocabulary words by accessing prior knowledge, (c) defining vocabulary, and (d) addition of new vocabulary to science journals.

In this mixed methods study, triangulation was achieved by simultaneously collecting quantitative and qualitative data from multiple sources during the two phases of the study. The first phase consisted of eight-weeks in which quantitative data was collected from three *FOSS* I-Check assessments from modules, *Climate and Weather* and *Motion and Matter*. During that time, an *ANCOVA* statistical test was run, however, no statistically significance was noted between groups. The second phase of the study consisted of an additional six weeks and both quantitative and qualitative data were collected. Scores from two additional *FOSS* I-Checks assessments from the module, *Structures of Life,* were added to the existing three from the first phase of the study and pre/posttest scores were averaged for all three groups. Qualitative data in the form of *FOSS* I-Check responses to the open-response questions were compared from all groups to address participants' scientific knowledge and language acquisition. To address participants' receptive and productive English language skill progression, participants' first and last science journal entries, written daily reflections, and samples from their first and last six-grid organizers were collected. *SWIVL* observations from recorded intervention sessions were analyzed to assess participants' speaking incidence of domain-specific vocabulary. Finally, an interview with the classroom teacher was conducted to compare instructional practices to the intervention components.

Findings

In this section, all findings from this study will be factually presented as they appear in Chapter 4. All quantitative and qualitative data was collected to illustrate how participation in a literacy-based intervention in science would impact participants' science content knowledge when compared to their ELL and fluent English-speaking peers. In addition, what effect would the implementation of reading, writing, listening, and speaking strategies have on participants' receptive and productive English language skills.

Science Content Knowledge

In response to participants' acquisition of scientific knowledge when compared to their ELL and fluent English-speaking peers, there were two significant findings supporting the integrated literacy/science intervention had an impact both as a group and individual participant's progress. As a group, the treatment groups' average pretest score (55.45%), the control – ELL (55.75%) and control – fluent English speakers (57.1%) illustrating their level of previous knowledge of tested scientific concepts. The posttest score for the treatment group was 84.75%, 83.45% for control – ELL, and 85% for control – fluent English speakers. The treatment group's percentage change from pre to posttest scores at 52.84%, control – ELL at 49.69% and control – fluent English speakers at 48.86%.

The individual participant's progress on their *FOSS* I-Check open-response written answers when compared to their ELL and fluent English-speaking peers, three of the treatment group participants, Christina, Cameron, and Helena received the maximum points possible on their written responses to three out of the four *FOSS* I-Check open-response questions. John, treatment group, did score the lowest of all participants on *FOSS* I-Check Investigation 2 – *Structures of Life,* question 1 (3 out of 6 possible points). The control group – ELL participants, Chris and Karen received the maximum points possible on their responses to two out of the four questions. And finally, the control – fluent English speaker participants, Jordan and Jacob received the maximum points on two out of the four questions analyzed.

Receptive and Productive Language

In this study, only the four participants in the treatment group were analyzed individually to measure their language acquisition and progression. Their written responses on the *FOSS* I-Check open-response questions were compared to the control groups' responses.

Writing. When I analyzed each participant's first journal entry, all four participants consistently struggled with fluently expressing their thoughts and ideas in their writing. The participants' final journal entries all increased in length and detail from writing two simple statements with virtually no incidence of domain-specific vocabulary to more detailed, lengthier written response incorporating the lesson's vocabulary. In their bean plant life cycle descriptions, Cameron used seven words, Helena nine, Christina ten, and John nine. Throughout the second phase of the study, participants wrote written reflections of the day's lesson. Participants wrote an average of 13 times with an average of 32 incidence of domain-specific vocabulary in their reflections. All participants showed a gain in length, detail, and utilization of domain-specific vocabulary from their first to final reflections. The number of sentences written increased for all participants with three out of the four participants showing an increase in the incidence of domain-specific vocabulary. Even though John's final entry contained more sentences than his first, his final entry contained the same number of domain-specific vocabulary. Helena showed the greatest gain in both length and use of vocabulary, she went from two sentences to six and two domain-specific vocabulary to eight. These findings are important to note because they demonstrate the progression of the participants' productive language.

Listening and Reading. The strategy of listening and following along as I read the expository science text in sections then allowed them to sketch and label their understanding yielded some interesting results. At the beginning of using this metacognitive strategy, participants began with simple drawings labeled with one domain-specific vocabulary word, *arid.* As they became more familiar with the process, their sketches and labels became more detailed. In their final sketches, they all drew a picture of a seed with a root emerging and labeled it with *root* and *seed coat* which was closely related to the text they heard: *The first structure to come out of the seed is the root.* In Christina's sketch, she tried to illustrate the germination process in three stages and was the only one to include the label *embryo.* In the beginning of using this strategy, I had to often time repeat the text and towards the end of the study, the repetitions became less frequent. These findings are important to note as participants became more efficient at actively listening and producing their conceptual understanding of the text and domain-specific vocabulary.

Speaking. All sessions were recorded using a *SWIVL* robot and the videos were uploaded to *SWIVL.com* for review. In carefully analyzing participants' oral responses, their responses consistently contained domain-specific vocabulary. In the eight recorded sessions, there were 33 incidences of domain-specific vocabulary noted. Furthermore, participants utilized general academic vocabulary a total of nine times. These findings are significant because participants were consistently using both general academic and domain-specific vocabulary in their speaking.

Classroom Teacher Interview

In interviewing the classroom teacher, there were similarities between the classroom teacher's instruction and the intervention. While similarities were noted such as the focus on modeling and encouraging students to speak with proper English syntax, there were some differences. The intervention had a greater focus on vocabulary knowledge and usage including vocabulary-based activities, active listening, and daily written reflections.

Discussion

Answering the First Research Question

In interpreting the results from this study, participants benefitted from the literacy/science integrated intervention in both the acquisition of scientific knowledge and language. In addressing the first research question:

1. How will the literacy/science integrated intervention impact ELLs' scientific knowledge when compared to their ELL and fluent English-speaking peers not receiving the intervention?

The treatment pretest scores were not significantly lower than the control groups. The treatment group did have the highest percentage change from pre to posttest scores for all three groups; however, it may not be statistically significant. Three out of the four participants in the treatment group received the maximum points possible on their open-response answers which was the highest of the groups. They were able to clearly and fluently express their understanding of scientific concepts in their written responses to receive the highest points possible. These findings demonstrated the impact of the literacy/science integrated intervention on the participants' conceptual understanding of scientific concepts and their ability to fluently express their understanding in their written responses.

The findings from this section of the study add to the existing body of research that English language learners do benefit from a separate block of designated for language and content area development. Saunders et al., (2006) examined the effects of a separate block of time designated for English-language and literacy development for ELLs. Their findings concluded ELLs who received this time performed moderately better than students who received an integrated English-language development (Saunders et al., 2006). In comparison with other literacy and science integrated interventions conducted within the past six years, the findings from this study align with other integrated literacy/science intervention studies. Bravo et al. (2014) conducted an integrated literacy/science intervention based on scientific inquiry, their findings showed the intervention group showed higher gains on posttest science understanding. Lara-Alecio et al. (2012) daily 85-minute inquiry-based intervention, Project Middle School Science for English language learners (MSSELL) found a significant intervention effect in favor of the treatment group on district-wide benchmark tests of science. And finally, Llosa et al. (2016) P-SELL intervention, ELLs in the treatment group outperformed ELLs in the control group.

Answering the Second Research Question

To address the second research question:

2. What effect will the addition of listening, speaking, reading, and writing strategies to an integrated literacy/science intervention have on third grade ELLs' receptive and productive language acquisition?

At the conclusion of the second six-week phase of this study, the emphasis on vocabulary development is evidenced in their ability to use domain-specific vocabulary in their speaking and writing. Their increased writing length and attention to detail could be attributed to the consistency and systematic delivery of the vocabulary routine, language strategies, and daily writing practice. This is also evident in the comparison between the classroom teacher's instruction and the intervention practices. In the intervention, there was more emphasis placed on vocabulary knowledge and usage, active listening, and daily written reflections. While listening and reading are receptive language skills and difficult to measure, all participants were able to clearly express and label their understanding from listening to the expository science text read to them.

An integrated literacy/science intervention should contain specific components which may prove to be effective means for students to acquire receptive and productive language, however, further research is needed to validate this statement. These components include vocabulary instruction, authentic communication, active listening, and opportunities for students to express their understanding in writing. In analyzing the classroom teacher's instruction, the intervention had a greater focus on vocabulary knowledge and usage including vocabulary-based activities, active listening, and daily written reflections.

Vocabulary Instruction. Vocabulary instruction should be intensive, systematic, and explicit while also providing students frequent opportunities for expression through reading, writing, listening, and speaking (Moje et al., 2001; Beck et al., 2002; Fang & Schleppegrell, 2008; Francis et al., 2006; Snow et al., 2009; Green, 2004; Lee & Buxton, 2013). Effective vocabulary instruction provides multiples exposures through rich, varied, relevant, and meaningful activities (Marzano, 2004). Vocabulary instruction should be intensive, systematic, and explicit because the participants in this study received repeated exposures to vocabulary meanings and were encouraged to speak and write using vocabulary. In the selection of domain-specific vocabulary to include in the intervention is dependent on the concepts under investigation. Baker et al. (2014) suggests that teachers gauge the words' usefulness for comprehension and the frequency they occur within the text and other content areas. This research supports Baker et al. (2014) that careful consideration should be given to the selection of vocabulary words. In two studies reviewed for this study, Zwiep and Straits (2013) believed "narrowing vocabulary and language forms and functions within a lesson resulted in more powerful language support" (p. 1318). In Lara-Alecio et al. (2012) study, researchers frontloaded general academic and domain-specific vocabulary before participants began reading. According to Zweip and Straits (2013) and Lara-Alecio et al. (2012), the selection of vocabulary needs to be very specific and should not exceed more than five words at one introduction as to not confuse students. Additionally, systematic review of previously introduced vocabulary is very important and should take place at the beginning of every session which reinforces meaning and context.

Authentic Communication. This study was based on the Communicative Language Approach where participants were given opportunities to develop, practice, and reflect on their language usage in authentic and meaningful contexts. Participants practiced language with the reduction in teacher talking time and the increase in participant talking time. Because the academic register of science is highly technical and complex, students need opportunities to explore, discuss, and develop their own understandings (Zwiep & Straits, 2013). In Zwiep and Straits (2013) study, the intention was to blend inquiry science with English language development; student thinking was the priority and was supported with authentic language. Though I agree with student thinking needing to be the priority and supported with authentic language development, it is the teacher's responsibility to guide and create opportunities for students to communicate their understanding. Coleman and Goldenberg (2009) also agreed it was the teacher's responsibility to structure interactions and model communication strategies for ELLs. Throughout the entire study, I created opportunities for participants to authentically communicate with me and their peers. I modeled correct usage of vocabulary in context and encouraged participants to not only speak with vocabulary, but also write.

Listening. Listening is a receptive language skill that requires students to learn how to listen attentively and interpret language. It can be difficult to assess ELLs' listening skills unless you ask them to express their understanding through either their speaking or writing. In this study, focused listening strategies were incorporated so that participants learned how to listen attentively to teachers and their peers. This was an important aspect of language acquisition, participants needed to learn how to listen and interpret information. The studies reviewed study did not include an active listening component in their integrated literacy/science interventions. They did, however, mention the idea of *wait time*, allowing students time to process the information before giving a response. Brave et al. (2014) highlighted the importance of *wait time* when questioning ELLs which allows them to process the language and formulate a response. Furthermore, Lara-Alecio et al. (2012) integrated study focused on providing adequate wait time for students to process content through timed thinking.

Writing. In this study, participants wrote daily recording their observations, predictions, and lesson reflections in their science journals. In the studies reviewed, all incorporated writing as an assessment and reflective piece of their integrated intervention. Llosa et al. (2016) and Tong et al. (2014) used science notebooks for predictions, observations, labeled illustrations and diagrams, and reflections. Klentschy (2005) claimed, "The act of writing by its very nature may enhance thinking and demands a student to organize their thinking" (p. 25). Klentschy's idea of the demands of writing are surely correct because as I witnessed participants struggling at the beginning of this study to fluently express themselves in their writing. As the study progressed and writing became a part of the daily routine, their writing fluency, length, and detail increased. In fact, their attitude towards writing changed from hesitation to a willingness to express their thoughts in writing. Furthermore, Huerta and Spies (2016) claimed, "When writing is incorporated with science inquiry, ELLs can make gains in their conceptual understanding and academic language in science" (p. 25). When writing is incorporated with science inquiry, ELLs can make gains in their conceptual understanding and academic language science as witnessed by incorporating writing in this study. Writing is a process that requires a degree of fluent thought processes and knowledge of English syntactical semantic, and grammatical rules to be able to express those thoughts effectively and correctly in English. Working with students in a small group setting can help students master this transfer through repeated practice and monitoring.

Implications for ESL Practitioners

The overall findings from this study indicate that ELLs do benefit from an integrated literacy/science intervention in the acquisition of science content knowledge and language skills. Researchers have concluded that teacher's pedagogical practices including the amount of scaffolding they provide, routines, activities, and strategies effect student achievement (Garza et al., 2017; Klentschy, 2003). The practices in this study were systematic, routine, and explicit in promoting both content and language usage. There are several practical suggestions for ESL practitioners to address the issues that have been raised in this research:

- Work in small groups, 4-5 students max, in a separate setting from the classroom so each student has an opportunity to speak, actively listen to you and peers, and you can monitor their language production.
- Use the same grade-level curriculum as that of the classroom teacher. Make sure to keep in close communication with the classroom teacher to shares student progress.
- Instructional routine should be systematic, intensive, and predictable so students understand expectations. This is important for efficiency and quality of student work.

Incorporate your reading, writing, listening, and speaking strategies and consistently use the same strategies throughout each session.

- Focus on a specific vocabulary routine to review and introduce domain-specific vocabulary. Introduce no more than five domain-specific vocabulary words at one time and make sure the vocabulary routine occurs during every session.
- When speaking, make model domain-specific vocabulary correctly in context for the students.
- Writing should take place during every session. Incorporate a written reflection at the end of every session and encourage students to use vocabulary in their reflections. Through reading their reflections, the teacher can gauge their level of understanding and assist with English language structures.
- Active listening strategies are important so make sure students learn how to listen to the teacher and peers. Students can interview each other and record their responses in their journals. Additionally, read sections of the science text and ask students to express what they felt was the most relevant information in some form of productive way, e.g. writing, quick sketches, or discussions.
- Most importantly, create the structure for language to occur during the instructional routine then allow students to experiment with their newly acquired language skills.

The purpose in providing small group instruction to ELLs is to monitor very closely their interpretation of science content and receptive and productive language skills. This routine can be applied during scientific inquiry or expository reading of scientific concepts. Most importantly, ESL teachers should be consistent and systematic with their instructional approach.

Future Research

In the review of the literature for integrated literacy/science interventions, there was no mention of active listening strategies as an essential component of the studies. Listening is a receptive language skill and difficult to measure because the process of interpreting language happens internally. Until the student produces language in the form of either speaking or writing does a teacher get an opportunity to gauge a student's level of understanding. ELLs are acquiring a second language and sometimes their only opportunity to speak English might be at school. At home, they listen to their parents speak their native language then return to school to listen to their teacher and peers speak English. Working with the four participants in this study, I noticed it took intentional listening activities to get them to focus their attention. As a result, their interest, engagement, and quality of work increased. A potential area of future research is the question of the incorporation of active listening strategies impact ELLs' engagement and quality of work?

Summary

Language acquisition requires time. Caravita and Hallden (1994) are credited with pointing out that language development is a slow and gradual process as ELLs acquire the necessary language skills to process content, the achievement gap continues to widen. If time is what it takes, shouldn't we, as teachers, do everything possible to maximize our instruction and make it as efficient as possible during the time ELL students are acquiring a second language? Teacher's pedagogical practices such as proceeding in small steps while checking for student understanding will achieve active and successful engagement from all students (Rosenshine, 1987). This to be particularly true in working with the participants for this study. I was curious if a small group integrated literacy/science intervention would result in content knowledge and language growth for students. As a teacher, it was my responsibility to foster language development in the strategies and activities I selected and how I interacted with my students.

The purpose of this study was to show how the participation in an integrated literacy/science intervention would impact participants' conceptual understanding of science and the acquisition of both receptive and productive language skills. The intervention was based on the systematic and repeated practice of speaking, listening, writing, and reading strategies coupled with explicit vocabulary instruction. Authentic materials and communication were used during scientific inquiry and reading of expository science text. The purpose in comparing their results from the *FOSS* I-Check assessments to their ELLs and English-speaking peers was to show a small group intervention can positively impact participants' content and language achievement.

The overall findings concluded the treatment group did attain scientific knowledge when compared to their ELL and fluent English-speaking peers not receiving the intervention. Out of the three groups, the treatment group did have the lowest pretest score and the highest percentage change from pre to posttest. Even though their posttest scores were slightly lower than their English-speaking peers, they were higher than their ELL peers not receiving the intervention. Three out of the four treatment group participants received the maximum number of points possible on their *FOSS* I-Check open-response answers. The individual participants' oral and written responses showed growth incorporating domain-specific vocabulary and increasing in both length and detail.

Ultimately, the responsibility falls on the ESL teacher to plan an intervention routine that will encompass language strategies then allow students to navigate their newly acquired language skills independently while facilitating their growth. As I found in this study, it's equally important to deliver the routine in a systematic, explicit, and predictable way for ELL students. The incorporation of a vocabulary routine and daily written reflections could prove to assist ELL students in acquiring both content knowledge and language skills which could possibly result in reducing the achievement gap between ELLs and their fluent English-speaking peers.

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Appendix A – IRB Approval

KANSAS STATE UNIVERSITY | University Research Compliance Office

TO: Dr. F. Todd Goodson
Curriculum and Instruction
261A Bluemont Hall

Proposal Number: 8896

FROM: Rick Scheidt, Chair
Committee on Research Involving Human Subjects

DATE: 08/21/2017

RE: Approval of Proposal Entitled, "ELL Knowledge-Based Competencies and language development routine in grade 3."

The Committee on Research Involving Human Subjects has reviewed your proposal and has granted full approval. This proposal is **approved for <u>one year</u> from the date of this correspondence, pending "continuing review."**

APPROVAL DATE: 08/21/2017

EXPIRATION DATE: 08/21/2018

Several months prior to the expiration date listed, the IRB will solicit information from you for federally mandated "**continuing review" of the research**. Based on the review, the IRB may approve the activity for another year. **If continuing IRB approval is <u>not</u> granted, or the IRB fails to perform the continuing review before the expiration date noted above, the project will expire and the activity involving human subjects must be terminated on that date. Consequently, it is critical that you are responsive to the IRB request for information for continuing review if you want your project to continue.**

In giving its approval, the Committee has determined that:

- ☒ There is no more than minimal risk to the subjects.
- ☐ There is greater than minimal risk to the subjects.

This approval applies only to the proposal currently on file as written. Any change or modification affecting human subjects must be approved by the IRB prior to implementation. All approved proposals are subject to continuing review at least annually, which may include the examination of records connected with the project. Announced post-approval monitoring may be performed during the course of this approval period by URCO staff. Injuries, unanticipated problems or adverse events involving risk to subjects or to others must be reported immediately to the Chair of the IRB and / or the URCO.

203 Fairchild Hall, Lower Mezzanine, 1601 Vattier St., Manhattan, KS 66506-1103 | 785-532-3224 | fax: 785-532-3278
comply@k-state.edu | k-state.edu/research/comply

Appendix B – IRB Modification Approval

KANSAS STATE UNIVERSITY | University Research Compliance Office

TO: Dr. F. Todd Goodson
Curriculum and Instruction
261A Bluemont Hall

FROM: Rick Scheidt, Chair
Committee on Research Involving Human Subjects

DATE: 03/08/2018

RE: Proposal #8896.1, entitled "ELL Knowledge-Based Competencies and language development routine in grade 3."

MODIFICATION OF IRB PROTOCOL #8896, ENTITLED, "ELL Knowledge-Based Competencies and language development routine in grade 3"

EXPIRATION DATE: 08/21/2018

The Committee on Research Involving Human Subjects (IRB) has reviewed and approved the request identified above as a modification of a previously approved protocol. **Please note that the original expiration remains the same.**

All approved IRB protocols are subject to continuing review at least annually, which may include the examination of records connected with the project. Announced in-progress reviews may also be performed during the course of this approval period by a member of the University Research Compliance Office staff. Unanticipated adverse events involving risk to subjects or to others must be reported immediately to the Chair of the IRB, and / or the URCO

It is important that your human subjects activity is consistent with submissions to funding / contract entities. It is your responsibility to initiate notification procedures to any funding / contract entity of any changes in your activity that affects the use of human subjects.

203 Fairchild Hall, Lower Mezzanine, 1601 Vattier St., Manhattan, KS 66506-1103 | 785-532-3224 | fax: 785-532-3278
comply@k-state.edu | k-state.edu/research/comply

Appendix C – Parental Consent Form

March 13, 2018

Dear Parents/Guardians:

My name is Amy Davis and I am a student at Kansas State University in my third year of my Ph.D. program. I currently hold a *M.S.Ed* degree in Curriculum & Instruction with an emphasis in English as a Second Language from Newman University in Wichita, Kansas. I began my career 12 years ago teaching 4th and 5th grades then moved into an English as a Second Language teacher and coach positions with Wichita's USD 259. I left my job with the district to accept a Graduate Teaching position and complete my degree in Curriculum & Instruction at KSU. My research interest includes creating and researching an instructional routine for English language learners that promotes language usage through students' reading, writing, listening, and speaking.

I am asking for volunteer participation in a 6-week long study in which I will be implementing a 45-minute instructional routine to five students identified as English language learners. From those who return consent forms, four English language learners will receive the routine. Four ELLs not receiving the routine and five fluent English speakers will be instructed using the district's mandated intervention program. All third-grade students will receive a consent form, fifteen students will be randomly selected to participate.

The purpose of the study, *ELL Knowledge-Based Competencies and Language Development Routine in Grade 3*, will be to evaluate the efficacy of the instructional routine to increase ELLs receiving the routine will show growth comparable to their fluent English-speaking peers. To do this, I will compare data from FOSS I-Checks scores from two investigations of three groups of students: ELLs receiving instructional routine, ELLs not receiving routine, and fluent English Speakers students performing at grade level. The routine will be as follows:

- 10 minutes – Building Background & Vocabulary Development – During this time, the use of visuals to assess vocabulary and background knowledge generating an anchor chart with predictive questions generated by students (oral language). Attachment of visual to five key vocabulary words derived from the text; generate word bank anchor chart. Use of morphemes, context clues frames, cognates, multiple meaning words, antonyms and synonyms.
- 10 minutes – Comprehension – Read passage to students chunking text, 2-3 sentences at a time focusing on English syntax and structure, ask varying leveled questions based on text. Use of six-grid 'quick sketch' graphic organizer (oral & written language).
- 10 minutes – Writing & Closing – Use of both Vocabulary and Building Background anchor charts and six-grid graphic organizer to write a five-sentence paragraph reflecting on text's meaning. Use of sentence starters to aide in completion of task. (written language). Each student will share writing with group emphasizing active listening from other participants who will be required to record at least one vocabulary word they heard in peer's narration (listening, oral, and written language).

The benefit of participating in this study will be English language learners will have an increased opportunity to develop their language skills (listening, reading, writing, and speaking) and vocabulary and comprehension development.

The study will involve no minimal risk and all participation is voluntary. Refusal to participate will involve no penalty or loss of benefits to which the participant is otherwise entitled. The participant may discontinue participation at any time without penalty or loss of benefits. Participants will be assigned a pseudonym developed by the researcher and all stored data will be identified only through pseudonyms. All data will be stored in a locked cabinet and available to the researcher, Amy Davis and the Principal Investigator, Dr. F. Todd Goodson.

An informational meeting will be held for parents/legal guardians prior to the beginning of the study and at the conclusion in which the researcher, Amy Davis will summarize findings and answer questions.

I believe in the language advancement and development of English language learners through meaningful, clear, and purposeful instruction. I want to thank you in advance for allowing me to complete my research and hope the instructional routine will yield positive results for those participating. I look forward to meeting with you and sharing my findings.

Best regards,

Amy Davis

<u>Contact information</u>

Principal Investigator: Dr. F. Todd, Goodson, Ph.D.
Co-Investigator: Amy Davis, *M.S. Ed.*
Contact Details for Problems/Questions: Dr. Goodson – (785) 532-5904
Amy Davis – (316) 680-5629

Principal Investigator Contact: Kansas State University
261 Bluemont Hall
1114 Mid-Campus Drive
Manhattan, KS 66506

IRB Committee Chair: Rick Scheidt, Committee Chair
rscheidt@ksu.edu
(785) 532- 1483
University Research Compliance Office
203 Fairchild Hall
1601 Vattier Street
Manhattan, KS 66502

I understand this project is research, and that my child's participation is voluntary. I also understand that if my child decides to participate in this study, I may withdraw he/she consent at any time, and stop participating at any time without explanation, penalty, or loss of benefits, or academic standing to which my child may otherwise be entitled.

I verify that my signature below indicates that I have read and understand this consent form, and willingly agree to have my child participate in this study under the terms described, and that my signature acknowledges that I have received a signed and dated copy of this consent form.

Participant Name: ____

Parent/Guardian Signature: ____Date: ___________

Parent/Guardian Printed Name: ____

Appendix D – Educator Consent Form

February 25, 2018

Dear Participating Educator:
My name is Amy Davis and I am a student at Kansas State University in my third year of my Ph.D. program. I currently hold a *M.S.Ed* degree in Curriculum & Instruction with an emphasis in English as a Second Language from Newman University in Wichita, Kansas. I began my career 12 years ago teaching 4th and 5th grades then moved into an English as a Second Language teacher and coach positions with Wichita's USD 259. I left my job with the district to accept a Graduate Teaching position and complete my degree in Curriculum & Instruction at KSU. My research interest includes creating and researching an instructional routine for English language learners that integrated literacy and language practices into science.
I am asking for your participation in a 6-week long study in which I will be implementing a 45-minute instructional routine to four students identified as English language learners. I will be conducting no more than three taped interviews with you which will be transcribed and included in chapter 4, the Findings section, of my dissertation.

The benefit of participating in this study will be the sharing of your insights and observations of participants' development of their language skills (listening, reading, writing, and speaking) and vocabulary and comprehension development in science.

The study will involve no minimal risk and all participation is voluntary. Refusal to participate will involve no penalty or loss of benefits to which the participant is otherwise entitled. The participant may discontinue participation at any time without penalty or loss of benefits. Participants will be assigned a pseudonym developed by the researcher and all stored data will be identified only through pseudonyms. All data will be stored in a locked cabinet and available to the researcher, Amy Davis and the Principal Investigator, Dr. F. Todd Goodson.

I believe in the language advancement and development of English language learners through meaningful, clear, and purposeful instruction. I want to thank you in advance for allowing me to complete my research and hope the instructional routine will yield positive results for those participating. I look forward to working with you.

Best regards,

Amy Davis

<u>Contact information</u>

Principal Investigator: Dr. F. Todd, Goodson, Ph.D.
Co-Investigator: Amy Davis, *M.S. Ed.*
Contact Details for Problems/Questions: Dr. Goodson – (785) 532-5904
Amy Davis – (316) 680-5629

Principal Investigator Contact: Kansas State University
261 Bluemont Hall
1114 Mid-Campus Drive
Manhattan, KS 66506

IRB Committee Chair: Rick Scheidt, Committee Chair
rscheidt@ksu.edu
(785) 532- 1483
University Research Compliance Office
203 Fairchild Hall
1601 Vattier Street
Manhattan, KS 66502

I understand this project is research, and that my participation is voluntary. I also understand that if I choose to participate in this study, I may withdraw my consent at any time, and stop participating at any time without explanation or penalty.

I verify that my signature below indicates that I have read and understand this consent form, and willingly agree to participate in this study under the terms described, and that my signature acknowledges that I have received a signed and dated copy of this consent form.

Participant Name: ____

Participant Signature:

____ Date:_________________________

Participant Printed Name: ____

Appendix E – Research Timetable – Phase 2

Date	Time	Investigation	Lesson	Vocabulary	Materials	Lesson Description/Focus Questions for Discussion & Writing
3/5/18 #1	40 m	Structures of Life 1 – Origin of Seeds	1.1 Seed Search	Introduce - Characteristic, structure, dormant, estimate, predict	Apple, edamame pods, science journals	Vocabulary development, Strategies – writing, listening & speaking Characteristics of an apple & edamame Line plot – observations & predictions. Reflection.
3/6/18 #2	40 m	Structures of Life 1 – Origin of Seeds	1.1 Seed Search	Review – characteristic, structure, dormant, estimate, predict	Apple, lemon, orange, raspberries, strawberries, orange, science journals	Review vocabulary, look for seeds in fruit, record findings in journal, compare & contrast seeds, daily reflection.
3/7/18 #3	40 m	Structures of Life 1 – Origin of Seeds	1.1 Seed Search	Introduce - Reproduce, function	Science journals, student science book	Introduce new vocabulary, interview a partner, dictation, listen to "The Reason for Fruit" add quick draws to 6-grid organizer. Discuss questions – return to chart and record responses. Daily reflection.
3/8/18 #4	40 m	Structures of Life 1 – Origin of Seeds	1.1 The Reason for Fruit	Review – reproduce, function	Science journals, student science book	Read reflection from previous day, finish reading "The Reason for Fruit" and complete 6-grid organizer. Discuss with a partner, return to chart in journal, answer four questions, share responses w/LS. Reflection – share out.
3/12/18 #5	40 m	Structures of Life	1.3 Seek Soak	Review - Estimate, predict	FOSS balances, 15 1-gram weights,	Discuss focus question: How much water does a

		1 – Origin of Seeds			2 cups, dry lima beans, science journals	seek soak up? Weigh dry seeds, add water & predict what will happen to the beans. Reflection.
3/13/18 #6	40 m	Structures of Life 1 – Origin of Seeds	1.3 Seed soak cont.	Review - Function, structure Introduce - cotyledon, embryo, organism, germinate	FOSS balances, 15 1-gram weights, 2 cups, soaked lima beans, science journals	Vocabulary intro Drain seeds, return to prediction in journals. Predict how they can find out how much water the seeds soaked up in their journals. Weigh soaked seeds, write results in journal. Open seeds, discuss strategies, diagram and label in journals. Answer how much does a seed soak up? What happens to the seed after it soaks up the water? Daily Reflection.
3/26/18 #7	40 m	Structures of Life 1 – Origin of Seeds	1.2 The Sprouting Seed	Review - Characteristic, organism Introduce - Terrestrial, aquatic	Containers with lids, sprouter, bean, corn, sunflower, pea seeds, science journals	Review & introduce vocabulary. Predict focus question: What affect does water have on seeds? Prepare sprouter container. Reflection
3/27/18 #8	40 m	Structures of Life 1 – Origin of Seeds	1.2 The Most Important Seed	Review terrestrial, aquatic, & organism	Student science books, journals	Read "The Most Important Seed," 6-grid organizer. Reflection
3/28/18 #9	40 m	Structures of Life 1 – Origin of Seeds	1.2 The Most Important Seed	Review terrestrial, aquatic, & organism	Student science book, journals	Maddox & Mareh were absent 3/27/18 so we will review the reading
4/03/18 #10	60 m	Structures of Life 1 – Origin of Seeds	1.4 Seed Dispersal 1.4 How seeds travel	Review – terrestrial, aquatic, organism Introduce - Compete, survive, disperse	Science Journals	How do seeds disperse from the parent plant? How do seeds spread if humans don't touch them? How do seeds disperse away from the parent plant? Students will view video. Reflection.
4/04/18 #11	60 m	Structures of Life	1.4 Seed Dispersal	Review – terrestrial,	Science Journals	Review from yesterday

		1 – Origin of Seeds	1.4 How seeds travel	aquatic, organism Introduce - Compete, survive, disperse	Science Book	Read “Nature Journal – How Seeds Travel” 6-grid organizer. Reflection.
4/5/18	40 m	FOSS I-Check Investigation 1 FOSS I-Check Pretest Investigation 2				
4/9/18 #12	60 m	Structures of Life 2 – Growing Further	2.1 Germination & Growth	Review - cotyledon, strategies, survive Introduce – germination, root, stem, leaves, nutrients, seedling	Dry seeds, seeds in sprouter, journals	What strategies does a seedling have to help it grow & survive? Observe & record observations of bean seedlings & dry seeds. The germination process. Reflection.
4/10/18 #13	60 m	Structures of Life 2 – Growing Further	2.1 Reading Germination	Review – germination, seedling, nutrients, root, stem, leaves	Student science books, journals	Read “Germination” 6-grid organizer. Reflection.
4/12/18 #14	40 m	Structures of Life 2 – Growing Further	2.2 Life Cycle of a Bean	Review – Organism, nutrients, strategies, function Introduce – inherit, life cycle	Plants in containers, journals, string, ruler	Measure bean plant growth, record in journal. What does the environment provide for plant growth? What if things changed – How would these changes affect the growth of a plant? Does a plant get everything it needs from its roots? Video – “How Plants Get Food” Observe and record growth, draw & label plants in journals. Reflection.
4/16/18 #15	40 m	Structures of Life 2 – Growing Further	2.2 Life Cycle of a Bean	Review – inherit, life cycles	Student science books, journals, string, ruler	Measure bean plant growth, add to chart in journal. Read “Life Cycles” 6-grid organizer. What is a life cycle? Describe the life cycle of one kind of animal. How does your bean-plant life-

						cycle drawing help you predict what stages other plants might go through in their life cycle? Reflection.
4/17/18 #16	40 m	Structures of Life 2 – Growing Further	2.2 Life Cycle of a Bean	Review- nutrients, strategies, cotyledon, stem, roots, leaves, organism, germination, seedling Introduce – flowers, bean pods	Journals, bean life cycle illustrations, string, ruler, bean plants	Measure bean plant growth and add to chart in journal, students put illustrations of the bean cycle in order and label with domain-specific vocabulary. In journals, they illustrate and write about each stage. Reflection.
4/18/18 #17	40 m	Structures of Life 2 – Growing Further	2.3 Roots and Shoots	Introduce - fibrous roots, shoots, taproot	Science journals, fibrous and taproot plant examples, bean plants, string, ruler, shovel	Measure bean plant growth, record in journal. Differentiate between fibrous and taproots, compare to bean plant roots. Dig up plants and identify the type of root. Reflection.
4/19/18 #18	40 m	Structures of Life 2 – Growing Further	2.1 Germination and Growth 2.2 Life Cycle of a Bean 2.3 Roots and Shoots	Review – roots, stems, leaves, cotyledon, strategies, nutrients, germinate, germination, fibrous root, taproot	Questions and answer cards for matching game	To review for Investigation 2 I-Check, students will work with a partner to match questions with their answers. Reflection.
4/20/18	40 m	FOSS I-Check Investigation 2				

Appendix F – Lesson Plans – Phase 2

<table>
<tr><td>Teacher's Name: A. Davis</td><td>Child's Name: Research Group</td><td>Child's Age/Grade Level: 8/3rd</td></tr>
<tr><td>Date: 3/5/18</td><td>Tutor Session #: 1 – 1.1 Seed Search</td><td>Length of Session: 40 minutes</td></tr>
<tr><td colspan="3">Literacy, Language, & Science standards:
LS1.B – Growth & development of organisms
LS3.A – Inheritance of traits
LS3.B – Variation of traits
L 4 – Determine the meaning of unknown words
L6 – Acquire and use domain-specific words
SL 1 – Engage in collaborative discussions
SL 4 – Recount an experience with appropriate facts and relevant descriptive details
R 1 – Describe the relationship between scientific ideas using language that pertains to cause and effect
W.3.2 – Write exploratory texts to examine a topic and convey ideas and information clearly
MP.2 – Reason abstractly and quantitatively
MP.4 – Model with mathematics
ELP.2-3.2 – Participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments, and questions
ELP.2-3.3 – Speak and write about grade-appropriate literacy and informational texts and topics
ELP.2-3.4-Construct grade-appropriate oral and written claims & support them with reasoning and evidence
ELP.2-3.5 – Conduct research and evaluate and communicate findings to answer questions or solve problems
ELP.2-3.7 – Adapt language choices to purpose, task and audience when speaking & writing
ELP. 2-3.9 – Create clear and coherent grade-appropriate speech and text
ELP. 2-3.10 – Make accurate use of standard English to communicate in grade-appropriate speech and writing</td></tr>
<tr><td colspan="3">Literacy-based objectives for the session – may use "I can…" statements: "I can define five vocabulary words in my science journal" "I can listen to my peer's response and restate" "I can describe an apple and edamame" "I can count the number of seeds inside my edamame and plot the number on a number line" "I can predict how many seeds an edamame might have and record my prediction in my journal"</td></tr>
<tr><td colspan="3">Vocabulary: Introduce - characteristics, structure, dormant, estimate, predict</td></tr>
<tr><td colspan="3">Texts use by teacher/student during session: No text used during scientific inquiry</td></tr>
<tr><td colspan="3">Materials needed: Apple, edamame pods, science journals, chart paper</td></tr>
<tr><td colspan="3">Lesson Outline - brief narrative or bulleted list. (Include estimated time for each major activity)
Introduction to vocabulary (10 minutes): Display the vocabulary chart with the words: characteristic, structure, dormant, estimate, and predict, WS-ask students to write and/or illustrate what they think these words mean. SS-Ask each student to describe the meanings while the others listen, LS-Student responding must rephrase what peer said before adding their understandings. Add meanings and illustration to chart and go back to science journals and add to definitions.
Lesson Body (20 minutes): Using an apple, WS-ask students to write their observations using descriptive words (e.g. small, big, round, flat, rough, smooth, hard, soft) in their science journals. SS-Ask each student to describe the characteristics of the apple while others listen, LS-Student responding must rephrase what peer said before adding their response. Display Apple Characteristic Chart, add responses to chart in words and/or pictures.

Repeat same structure using edamame pods. Ask student to draw a line plot in their science notebooks. Plot the number of edamame seeds found in each pod. Display line plot chart, WS-Ask students to write their observations and predictions using the sentence frames: 1. I notice _____________, this is because _____________. 2. If we were to open an edamame pod, I estimate there will be ___________because_________. SS-Discuss their observations and predictions using the word "estimate", LS-Student responding must rephrase what peer said before responding with their observations and predictions.

Lesson Closing (10 minutes): Inquiry reflection – Students will write two sentences summing up inquiry using the sentence frame: Today, I _________________. I learned ________________. Share reflections with group – LS/SS.</td></tr>
</table>

Assessments/ progress monitoring used in lesson: Students' ability to write using vocabulary correctly in the context of their writing in their science journals and describe the characteristics of the apple then plot the number of edamame seeds found in each pod. Students' ability to use domain-specific vocabulary in their daily reflections.					
Lesson Checklist: Are the following intentionally or explicitly addressed in the lesson?					
XSkills-based activity included/ w/practice	❑ Fluency	XVocabulary	❑ Reading/Writing connection	❑ Comprehension	XChild's Interest/ Motivation
XHigher-order thinking	XStudent-focused activity	❑ Connections to previous work	XApplication to future work	XAssessment	XClosure
Provide the rationale for your choices in the lesson plan: I wanted to incorporate specific writing, speaking, and listening strategies to develop receptive and productive language skills and students' ability to utilize domain-specific vocabulary. I wanted them to understand and describe characteristics of an apple and edamame and count the seeds in each edamame pod.					
What areas do you anticipate the student to need scaffolding/support? Why? What might be your alternative approaches? Rephrasing questions for added depth and understanding. Provide a wordlist of descriptive words and a completed line plot and explain how it was constructed.					

Teacher's Name: A. Davis	Child's Name: Research Group	Child's Age/Grade Level: 8/3rd
Date: 3/6/18	Tutor Session #: 2 – 1.1 Seed Search	Length of Session: 40 minutes
Literacy, Language, & Science standards: LS1.B – Growth & development of organisms LS3.A – Inheritance of traits LS3.B – Variation of traits L 4 – Determine the meaning of unknown words L 6 – Acquire and use domain-specific words R 1 – Describe the relationship between scientific ideas using language that pertains to cause & effect SL 1 – Engage in collaborative discussions SL 4 – Recount an experience with appropriate facts and relevant descriptive details W.3.2 – Write exploratory texts to examine a topic and convey ideas and information clearly MP.2 – Reason abstractly and quantitatively ELP.2-3.2 – Participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments, and questions ELP.2-3.3 – Speak and write about grade-appropriate literacy and informational texts and topics ELP.2-3.4-Construct grade-appropriate oral and written claims & support them with reasoning and evidence ELP.2-3.5 – Conduct research and evaluate and communicate findings to answer questions or solve problems ELP.2-3.7 – Adapt language choices to purpose, task and audience when speaking & writing ELP. 2-3.9 – Create clear and coherent grade-appropriate speech and text ELP. 2-3.10 – Make accurate use of standard English to communicate in grade-appropriate speech and writing		
Literacy-based objectives for the session – may use "I can…" statements: "I can compare, contrast, and describe seeds from four different fruit" "I can write my observations in my science journal and share with the group" "I can actively listen to my peers describe the seeds"		
Vocabulary: Review - characteristics, structure, dormant, estimate, predict		
Texts use by teacher/student during session: No text used during scientific inquiry		
Materials needed: Apple, lemon, raspberries, strawberries, science journals,		
Lesson Outline - brief narrative or bulleted list. (Include estimated time for each major activity) **Introduction to vocabulary (10 minutes)**: Review vocabulary by asking one student to define the word and the next must rephrase the definition and then define the next word **LS/SS**. **Lesson Body (20 minutes)**: Ask the questions: What do you think is the same about them? What do you think might be different? Why do you think they are different? **LS/SS** Using fruit, students will work with a partner to count the number of seeds. They will record their answers in their journals using the following format:		

Fruit	Number of Seeds	Color, shape, size

In journals, they will answer the questions:
1. How are the seeds alike? The _____________ seeds are alike because _____________.
2. How are the seeds different? The ____________seeds are different because _________________.

Students will share out their findings using the **LS/SS.**

Lesson Closing (10 minutes): Inquiry reflection – Students will write two sentences summing up inquiry using the sentence frame: Today, we _________________. I learned ________________. Share reflections with group – **LS/SS**.

Assessments/ progress monitoring used in lesson: Students' ability to record observations in journal and compare and contrast seeds. Their ability to use domain-specific vocabulary in their daily reflections.

Lesson Checklist: Are the following intentionally or explicitly addressed in the lesson?					
XSkills-based activity included/ w/practice	❑ Fluency	XVocabulary	❑ Reading/Writing connection	XComprehension	XChild's Interest/ Motivation
XHigher-order thinking	XStudent-focused activity	XConnections to previous work	XApplication to future work	XAssessment	XClosure

Provide the rationale for your choices in the lesson plan: I wanted to incorporate specific writing, speaking, and listening strategies to develop receptive and productive language skills and conceptual understanding of seed structure. I wanted students to realize fruit produces seeds for reproduction and during scientific inquiry, I wanted them to compare and contrast characteristics of the fruit.

What areas do you anticipate the student to need scaffolding/support? Why? What might be your alternative approaches? Rephrasing questions for added depth and understanding and proper English syntax. Give examples of descriptive words to describe color, shape, and size so they can compare and contrast the fruit.

Teacher's Name: A. Davis	Child's Name: Research Group	Child's Age/Grade Level: 8/3rd
Date: 3/7/18	Tutor Session #: 3 – 1.1 Seed Search READING	Length of Session: 40 minutes

Literacy, Language, & Science standards:
LS1.B – Growth & development of organisms
LS3.A – Inheritance of traits
LS3.B – Variation of traits
L 4 – Determine the meaning of unknown words
L 6 – Acquire and use domain-specific words
SL 1 – Engage in collaborative discussions
SL 2 – Determine the main idea from information presented orally
SL 4 – Recount an experience with appropriate facts and relevant descriptive details
RI 1 – Ask and answer questions to demonstrate understanding of a text
RI 5 – Use text features to locate information
RI 7 – Use information gained from illustrations and words to demonstrate understanding of the text
W.3.2 – Write exploratory texts to examine a topic and convey ideas and information clearly
ELP.2-3.1 – Construct meaning from oral presentations and literacy and informational text through grade-appropriate listening, reading, and writing
ELP.2-3.2 – Participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments, and questions
ELP.2-3.3 – Speak and write about grade-appropriate literacy and informational texts and topics
ELP.2-3.4-Construct grade-appropriate oral and written claims & support them with reasoning and evidence
ELP.2-3.5 – Conduct research and evaluate and communicate findings to answer questions or solve problems
ELP.2-3.7 – Adapt language choices to purpose, task and audience when speaking & writing

ELP.2-3.8 – Determine the meaning of words and phrases in oral presentations and literacy and informational text ELP. 2-3.9 – Create clear and coherent grade-appropriate speech and text ELP. 2-3.10 – Make accurate use of standard English to communicate in grade-appropriate speech and writing
Literacy-based objectives for the session – may use "I can…" statements: "I can interview a partner and record their answers in my journal" "I can listen to Ms. Davis read 'The Reason for Fruit' and add my understandings and label my 6-grid organizer" "I can share my organizer with a partner" "I can answer questions in my journal" "I can write my reflections from the lesson"
Vocabulary: Review - characteristics, structure, dormant, estimate, predict Introduce - reproduce, function
Texts use by teacher/student during session: FOSS Student science book
Materials needed: Student science book, science journals, 6-grid organizer

Lesson Outline - brief narrative or bulleted list. (Include estimated time for each major activity)

Introduction to vocabulary (10 minutes): Ask students to write definitions in words/pictures of reproduce and function in their science journals. Discuss meanings, point out prefix "re" in reproduce and ask what does produce mean? Give examples of something is functioning. **LS/SS**. Return to journals and add more information.

Lesson Body (20 minutes): Have students create the chart below in their journals and interview a partner. They will write their responses in the space provided: **LS/SS/WS-Dictation**

Questions	**Partner's Responses**	**My Response**
What is a fruit?		
How does a plant's fruit help it survive and reproduce?		
What is a seed?		
What function does a plant's seed have?		

Read "The Reason for Fruit" p. 3 in the student science book to students. Stop periodically for students to add a quick draw to their 6-grid graphic organizer. After reading, ask partners to share their organizers with a partner **LS/SS**

Have students return to their charts in their journals and answer four questions. Students will share their responses with the group using **LS/WS/SS**

Lesson Closing (10 minutes): Inquiry reflection – Students will write two sentences summing up inquiry using the sentence frame: Today, I _________________. I learned ________________.

Students will share out their reflections using the **LS/SS.**

Assessments/ progress monitoring used in lesson: Students' ability to answer questions in journal and share their understanding of scientific concepts by labeling and explaining their 6-grid organizer. Observe and listen to their explanation with their partners. Their ability to use domain-specific vocabulary in their daily reflections.

Lesson Checklist: Are the following intentionally or explicitly addressed in the lesson?					
XSkills-based activity included/ w/practice	❑ Fluency	XVocabulary	XReading/Writing connection	XComprehension	XChild's Interest/ Motivation
XHigher-order thinking	XStudent-focused activity	XConnections to previous work	XApplication to future work	XAssessment	XClosure

Provide the rationale for your choices in the lesson plan: I wanted to incorporate specific writing, speaking, and listening strategies to develop receptive and productive language skills and conceptual understanding of scientific concepts. I wanted them to actively listen to me read the sections of the text so they could conceptualize the meaning and then transfer the images to their 6-grid organizers and label with domain-specific vocabulary. I wanted active listening.

What areas do you anticipate the student to need scaffolding/support? Why? What might be your alternative approaches? Reread parts of the text if students do not understand, rephrase questions and help them label their sketches with vocabulary.		
Teacher's Name: A. Davis	Child's Name: Research Group	Child's Age/Grade Level: 8/3rd
Date: 3/8/18	Tutor Session #: 4 – 1.1 Seed Search READING	Length of Session: 40 minutes

Literacy, Language, & Science standards:
LS1.B – Growth & development of organisms
LS3.A – Inheritance of traits
LS3.B – Variation of traits
L 4 – Determine the meaning of unknown words
L 6 – Acquire and use domain-specific words
R 1 – Describe the relationship between scientific ideas using language that pertains to cause & effect
SL 1 – Engage in collaborative discussions
SL 2 – Determine the main idea from information presented orally
SL 4 – Recount an experience with appropriate facts and relevant descriptive details
RI 1 – Ask and answer questions to demonstrate understanding of a text
RI 5 – Use text features to locate information
RI 7 – Use information gained from illustrations and words to demonstrate understanding of the text
W.3.2 – Write exploratory texts to examine a topic and convey ideas and information clearly
ELP.2-3.1 – Construct meaning from oral presentations and literacy and informational text through grade-appropriate listening, reading, and writing
ELP.2-3.2 – Participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments, and questions
ELP.2-3.3 – Speak and write about grade-appropriate literacy and informational texts and topics
ELP.2-3.4-Construct grade-appropriate oral and written claims & support them with reasoning and evidence
ELP.2-3.5 – Conduct research and evaluate and communicate findings to answer questions or solve problems
ELP.2-3.7 – Adapt language choices to purpose, task and audience when speaking & writing
ELP.2-3.8 – Determine the meaning of words and phrases in oral presentations and literacy and informational text
ELP. 2-3.9 – Create clear and coherent grade-appropriate speech and text
ELP. 2-3.10 – Make accurate use of standard English to communicate in grade-appropriate speech and writing

Literacy-based objectives for the session – may use "I can…" statements: "I can interview a partner and record their answers in my journal" "I can listen to Ms. Davis read 'The Reason for Fruit' and add my understandings to my 6-grid organizer and label with vocabulary" "I can share my organizer with a partner" "I can answer questions in my journal" "I can write my reflections from the lesson"

Vocabulary: Review - characteristics, structure, dormant, estimate, predict Introduce - reproduce, function

Texts use by teacher/student during session: FOSS Student science book

Materials needed: Student science book, science journals, 6-grid organizer

Lesson Outline - brief narrative or bulleted list. (Include estimated time for each major activity)
Introduction to vocabulary (30 minutes): Share reflection from previous session. Review vocabulary with students, ask them to refer back to their journals for definitions. **LS/SS**. Read "The Reason for Fruit" p. 3 in the student science book to students. Stop periodically for students to add a quick draw and label their 6-grid graphic organizer. After reading, ask partners to share their organizers with a partner **LS/SS**

Have students return to their charts in their journals and answer four questions. Students will share their responses with the group using **LS/WS/SS**

Lesson Closing (10 minutes): Inquiry reflection – Students will write two sentences summing up inquiry using the sentence frame: Today, I __________________. I learned _________________.

Students will share out their reflections using the **LS/SS.**

Assessments/ progress monitoring used in lesson: Students' ability to answer questions in journal and share their 6-grid organizer with their partner. Observe and listen to their discussions with their partner and their ability to use domain-specific vocabulary in their daily reflections.					
Lesson Checklist: Are the following intentionally or explicitly addressed in the lesson?					
❑ Skills-based activity included/ w/practice	❑ Fluency	XVocabulary	XReading/Writing connection	XComprehension	XChild's Interest/ Motivation
XHigher-order thinking	XStudent-focused activity	XConnections to previous work	XApplication to future work	XAssessment	XClosure
Provide the rationale for your choices in the lesson plan: I wanted to incorporate specific writing, speaking, and listening strategies to develop receptive and productive language skills. I wanted them to actively listen to me read the text so they could conceptualize the meaning of the text and transfer the images in their mind to their 6-grid organizer then label their drawings with domain-specific vocabulary. I wanted them to actively listen to their partner and record their responses.					
What areas do you anticipate the student to need scaffolding/support? Why? What might be your alternative approaches? Reread parts of the text if students don't understand or didn't hear it clearly, rephrase questions and responses with proper English syntax. Help them label their drawings with domain-specific vocabulary					

Teacher's Name: A. Davis	Child's Name: Research Group	Child's Age/Grade Level: 8/3rd
Date: 3/12/18	Tutor Session #: 5 – 1.3 Seed Soak	Length of Session: 40 minutes
Literacy, Language, & Science standards: LS1.B – Growth & development of organisms LS3.A – Inheritance of traits LS3.B – Variation of traits L 4 – Determine the meaning of unknown words L 6 – Acquire and use domain-specific words R 1 – Describe the relationship between scientific ideas using language that pertains to cause & effect SL 1 – Engage in collaborative discussions SL 4 – Recount an experience with appropriate facts and relevant descriptive details W.3.2 – Write exploratory texts to examine a topic and convey ideas and information clearly ELP.2-3.1 – Construct meaning from oral presentations and literacy and informational text through grade-appropriate listening, reading, and writing ELP.2-3.2 – Participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments, and questions ELP.2-3.3 – Speak and write about grade-appropriate literacy and informational texts and topics ELP.2-3.4-Construct grade-appropriate oral and written claims & support them with reasoning and evidence ELP.2-3.5 – Conduct research and evaluate and communicate findings to answer questions or solve problems ELP.2-3.7 – Adapt language choices to purpose, task and audience when speaking & writing ELP. 2-3.9 – Create clear and coherent grade-appropriate speech and text ELP. 2-3.10 – Make accurate use of standard English to communicate in grade-appropriate speech and writing		
Literacy-based objectives for the session – may use "I can…" statements: "I can predict how much water a seek soaks up" "I can weigh dry lima beans using a balance and weights" "I can estimate the size of the lima beans after they've soaked overnight"		
Vocabulary: Review - estimate, predict		
Texts use by teacher/student during session: No text used during scientific inquiry		
FOSS balance, 15 1-gram pieces, 2 cups, 5 lima beans, science journals		
Lesson Outline - brief narrative or bulleted list. (Include estimated time for each major activity) **Introduction to vocabulary (10 minutes)**: Review the definitions of estimate & predict. Discuss and ask students to record their prediction in their science journals. Students will share their responses with the group **LS/SS** **Lesson Body (20 minutes):** Introduce focus question: How much water does a seek soak up?		

Introduce balance, weights, and lima beans. Students will figure out how much the dry beans weigh by placing the beans in one cup on the balance and adding weights to another cup. Students will draw a diagram of the investigation in their journals. Add the water to the beans.
Students will answer the question in their journals using the sentence starter and one of the three options and why:
After soaking overnight, do you estimate the lima beans to be the same size, twice as big, or more than twice as big as the dry lima beans?
I predict the lima beans will be ________________________ because ________________________. Students will share their predictions with the group **LS/SS**

Lesson Closing (10 minutes): Inquiry reflection – Students will write two sentences summing up inquiry using the sentence frame: Today, I _________________. I learned ________________. **LS/SS**

Students will share out their reflections using the **LS/SS.**

Assessments/ progress monitoring used in lesson: Students' ability to answer questions in journal and share their predictions with the group. Their ability to use vocabulary in their daily reflections.

Lesson Checklist: Are the following intentionally or explicitly addressed in the lesson?

XSkills-based activity included/ w/practice	❑ Fluency	XVocabulary	❑ Reading/Writing connection	XComprehension	XChild's Interest/ Motivation
XHigher-order thinking	XStudent-focused activity	XConnections to previous work	XApplication to future work	XAssessment	XClosure

Provide the rationale for your choices in the lesson plan: I wanted to incorporate specific writing, speaking, and listening strategies to develop receptive and productive language skills while understanding scientific concepts. I wanted students to estimate and predict the effect water will have on their seeds.

What areas do you anticipate the student to need scaffolding/support? Why? What might be your alternative approaches? Rephrasing questions during inquiry.

Teacher's Name: A. Davis	Child's Name: Research Group	Child's Age/Grade Level: 8/3rd
Date: 3/13/18	Tutor Session #: 6 – 1.3 Seed Soak	Length of Session: 40 minutes

Literacy, Language, & Science standards:
LS1.B – Growth & development of organisms
LS3.A – Inheritance of traits
LS3.B – Variation of traits
L 4 – Determine the meaning of unknown words
L 6 – Acquire and use domain-specific words
R 1 – Describe the relationship between scientific ideas using language that pertains to cause & effect
SL 1 – Engage in collaborative discussions
SL 4 – Recount an experience with appropriate facts and relevant descriptive details
W.3.2 – Write exploratory texts to examine a topic and convey ideas and information clearly
ELP.2-3.1 – Construct meaning from oral presentations and literacy and informational text through grade-appropriate listening, reading, and writing
ELP.2-3.2 – Participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments, and questions
ELP.2-3.3 – Speak and write about grade-appropriate literacy and informational texts and topics
ELP.2-3.4-Construct grade-appropriate oral and written claims & support them with reasoning and evidence
ELP.2-3.5 – Conduct research and evaluate and communicate findings to answer questions or solve problems
ELP.2-3.7 – Adapt language choices to purpose, task and audience when speaking & writing
ELP. 2-3.9 – Create clear and coherent grade-appropriate speech and text
ELP. 2-3.10 – Make accurate use of standard English to communicate in grade-appropriate speech and writing

Literacy-based objectives for the session – may use "I can…" statements: "I can measure how much water the seeds soaked up after 24 hours" "I can explain the functions of the seed's strategies" "I can explain what happens to the seed after it soaked up the water"

Vocabulary: Review - function, structure Introduce - cotyledon, embryo, organism, germinate

Texts use by teacher/student during session: No text used during scientific inquiry

FOSS balance, 15 1-gram pieces, 2 cups, soaked lima beans, science journals

Lesson Outline - brief narrative or bulleted list. (Include estimated time for each major activity)

Introduction to vocabulary (10 minutes): Review the definitions of function & structure. Ask students to record what they think cotyledon, embryo, and organism means

Discuss and ask students to go back to their definitions and add more information. Students will share their responses with the group **LS/SS**

Check soaked seeds, return to their predictions from yesterday and add the appearance of the seeds to their journals. **WS**

Lesson Body (20 minutes): Introduce focus question: How can we find out how much water the beans soaked up? Ask them to record their predictions in their journals, share with the group. **WS/SS/LS**

Using the balance, weights, and soaked lima beans. Students will figure out how much the soaked beans weigh by placing the beans in one cup on the balance and adding weights to another cup. They will write the weight next to the dry measure.

Students will open the beans and using the chart, we will discuss each structure. Students will diagram and label the beans in their journals. **WS/SS/LS**

Students will answer the questions:

1. How much water does a seed soak up? The seed soaked up _________________ of water.
2. What happens to the seed after it soaks up this water? The seed ________________________.

Students will share their predictions with the group **LS/SS**

Lesson Closing (10 minutes): Inquiry reflection – Students will write two sentences summing up inquiry using the sentence frame: Today, I _________________. I learned ________________. **LS/SS**

Students will share out their reflections using the **LS/SS.**

Assessments/ progress monitoring used in lesson: Students' ability to answer the focus question in journal. Weight the seeds to determine the amount of water the seeds soaked up overnight. Use domain-specific vocabulary in their daily reflection.

Lesson Checklist: Are the following intentionally or explicitly addressed in the lesson?

XSkills-based activity included/ w/practice	❑ Fluency	XVocabulary	❑ Reading/Writing connection	XComprehension	XChild's Interest/ Motivation
XHigher-order thinking	XStudent-focused activity	XConnections to previous work	XApplication to future work	XAssessment	XClosure

Provide the rationale for your choices in the lesson plan: I wanted to incorporate specific writing, speaking, and listening strategies to develop receptive and productive language skills. I wanted students to understand the effect water has on seeds and be able to determine how much the seed soaked up overnight.

What areas do you anticipate the student to need scaffolding/support? Why? What might be your alternative approaches? Rephrasing of questions during inquiry, sentence frames and starters.

Teacher's Name: A. Davis	Child's Name: Research Group	Child's Age/Grade Level: 8/3rd
Date: 3/26/18	Tutor Session #: 7 -1.2 The Sprouting Seed	Length of Session: 40 minutes

Literacy, Language, & Science standards:

LS1.B – Growth & development of organisms

LS3.A – Inheritance of traits

LS3.B – Variation of traits

L 4 – Determine the meaning of unknown words

L 6 – Acquire and use domain-specific words

R 1 – Describe the relationship between scientific ideas using language that pertains to cause & effect SL 1 – Engage in collaborative discussions SL 4 – Recount an experience with appropriate facts and relevant descriptive details W.3.2 – Write exploratory texts to examine a topic and convey ideas and information clearly ELP.2-3.1 – Construct meaning from oral presentations and literacy and informational text through grade-appropriate listening, reading, and writing ELP.2-3.2 – Participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments, and questions ELP.2-3.3 – Speak and write about grade-appropriate literacy and informational texts and topics ELP.2-3.4-Construct grade-appropriate oral and written claims & support them with reasoning and evidence ELP.2-3.5 – Conduct research and evaluate and communicate findings to answer questions or solve problems ELP.2-3.7 – Adapt language choices to purpose, task and audience when speaking & writing ELP. 2-3.9 – Create clear and coherent grade-appropriate speech and text ELP. 2-3.10 – Make accurate use of standard English to communicate in grade-appropriate speech and writing
Literacy-based objectives for the session – may use "I can…" statements: "I can sort seeds by kind" "I can describe the differences (size, shape, color & texture)" "I can set up a minisprouter to grow seeds"
Vocabulary: Review - characteristic, organism, dormant-review Introduce - terrestrial, aquatic
Texts use by teacher/student during session: No text used during scientific inquiry
Bean, corn, sunflower, pea seeds, minisprouter, science journals
Lesson Outline - brief narrative or bulleted list. (Include estimated time for each major activity) **Introduction to vocabulary (10 minutes)**: Review the definitions of characteristic & organism. Ask students to record what they think terrestrial and aquatic means in their journals. Discuss and ask students to go back to their definitions and add more information. Students will share their responses with the group **LS/SS** **Lesson Body (20 minutes):** Sort seeds by kinds, lead a discussion asking the following questions with equal participation to answer: • What are the differences between the seeds? Size, shape, color, and texture • Are the seeds dormant? • Are seeds living plants? How could we find out if they're alive? They should come up with the idea of planting the seeds – • What do you think would happen if we just watered the seeds instead of planting them in soil? • Do you think they would grow? **SS/LS** In their science journal, they will write a prediction to the prompt & sentence starter: What effect does water have on seeds? Students will choose one seed and record and draw a picture in their journals Set up minisprouter with all seeds – label **WS/LS/SS** **Lesson Closing (10 minutes):** Inquiry reflection – Students will write two sentences summing up inquiry using the sentence frame: Today, I _________________. I learned ________________. **LS/SS** Students will share out their reflections using the **LS/SS.**
Assessments/ progress monitoring used in lesson: Students' ability to answer questions in journal and participate in discussion during scientific inquiry. Their ability to use domain-specific vocabulary in their daily reflections.
Lesson Checklist: Are the following intentionally or explicitly addressed in the lesson?

XSkills-based activity included/ w/practice	❑ Fluency	XVocabulary	XReading/Writing connection	XComprehension	XChild's Interest/ Motivation
XHigher-order thinking	XStudent-focused activity	XConnections to previous work	XApplication to future work	XAssessment	XClosure

Provide the rationale for your choices in the lesson plan: I wanted to incorporate specific writing, speaking, and listening strategies to develop receptive and productive language skills. I also wanted students to understand the differences between the seeds and understand the seeds were in their dormant stage.

What areas do you anticipate the student to need scaffolding/support? Why? What might be your alternative approaches? Rephrase questions, sentence frames and starters. Rephrase their responses with proper English syntax.		
Teacher's Name: A. Davis	Child's Name: Research Group	Child's Age/Grade Level: 8/3rd
Date: 3/27/18	Tutor Session #: 8 – 1.2 The Sprouting Seed READING	Length of Session: 40 minutes
Literacy, Language, & Science standards: LS1.B – Growth & development of organisms LS3.A – Inheritance of traits LS3.B – Variation of traits L 4 – Determine the meaning of unknown words L 6 – Acquire and use domain-specific words R1 – Describe the relationship between scientific ideas using language that pertains to cause & effect SL 1 – Engage in collaborative discussions SL 2 – Determine the main idea from information presented orally SL 4 – Recount an experience with appropriate facts and relevant descriptive details RI 1 – Ask and answer questions to demonstrate understanding of a text RI 3 – Describe the relationship between scientific ideas using language that pertains to cause and effect RI 5 – Use text features to locate information RI 7 – Use information gained from illustrations to demonstrate understanding of reading W.3.2 – Write exploratory texts to examine a topic and convey ideas and information clearly ELP.2-3.1 – Construct meaning from oral presentations and literacy and informational text through grade-appropriate listening, reading, and writing ELP.2-3.2 – Participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments, and questions ELP.2-3.3 – Speak and write about grade-appropriate literacy and informational texts and topics ELP.2-3.4-Construct grade-appropriate oral and written claims & support them with reasoning and evidence ELP.2-3.5 – Conduct research and evaluate and communicate findings to answer questions or solve problems ELP.2-3.7 – Adapt language choices to purpose, task and audience when speaking & writing ELP.2-3.8 – Determine the meaning of words and phrases in oral presentations and literacy and informational text ELP. 2-3.9 – Create clear and coherent grade-appropriate speech and text ELP. 2-3.10 – Make accurate use of standard English to communicate in grade-appropriate speech and writing		
Literacy-based objectives for the session – may use "I can…" statements: "I can listen to 'The Most Important Seed' read to me" "I can select the most important part to add to my 6-grid organizer and label with correct vocabulary" "I can discuss my understanding of the reading with my partner"		
Vocabulary: Review - terrestrial & aquatic		
Texts use by teacher/student during session: FOSS student science book		
Student science book, science journals, paper for 6-grid organizer		
Lesson Outline - brief narrative or bulleted list. (Include estimated time for each major activity) **Introduction to vocabulary (10 minutes)**: Review the definitions of terrestrial & aquatic – add to science journal. Check and water minisprouters. **Lesson Body (20 minutes):** Students will listen to "The Most Important Seed" read to them. After each section, students will draw and label their understanding for one-minute. Completion of the organizer, they will be paired with a student and share their drawings. **Lesson Closing (10 minutes):** Inquiry reflection – Students will write two sentences summing up inquiry using the sentence frame: Today, I _________________. I learned ________________. **LS/SS** Students will share out their reflections using the **LS/SS.**		
Assessments/ progress monitoring used in lesson: Students' ability to listen and quick sketch and label their 6-grid organizer. Observe and listen their explanations of their organizers with their partner. Their use of domain-specific vocabulary in their daily reflections.		
Lesson Checklist: Are the following intentionally or explicitly addressed in the lesson?		

XSkills-based activity included/ w/practice	❑ Fluency	XVocabulary	XReading/Writing connection	XComprehension	XChild's Interest/ Motivation
XHigher-order thinking	XStudent-focused activity	XConnections to previous work	XApplication to future work	XAssessment	XClosure
Provide the rationale for your choices in the lesson plan: I wanted to incorporate specific writing, speaking, and listening strategies to develop receptive and productive language skills. I wanted them to actively listen to me read the text so they could conceptualize the meaning and transfer their images to their organizers.					
What areas do you anticipate the student to need scaffolding/support? Why? What might be your alternative approaches? Rereading sections of the text and allowing more time for quick sketch and labeling. Assist them with labeling.					

Teacher's Name: A. Davis	Child's Name: Research Group	Child's Age/Grade Level: 8/3rd
Date: 3/28/18	Tutor Session #: 9 – The Sprouting Seed READING	Length of Session: 40 minutes
Literacy, Language, & Science standards: LS1.B – Growth & development of organisms LS3.A – Inheritance of traits LS3.B – Variation of traits L 4 – Determine the meaning of unknown words L 6 – Acquire and use domain-specific words SL 1 – Engage in collaborative discussions SL 2 – Determine the main idea from information presented orally SL 4 – Recount an experience with appropriate facts and relevant descriptive details RI 1 – Ask and answer questions to demonstrate understanding of a text RI 3 – Describe the relationship between scientific ideas using language that pertains to cause and effect RI 5 – Use text features to locate information and words to demonstrate understanding of text RI 7 – Use information gained from illustrations and words to demonstrate W.3.2 – Write exploratory texts to examine a topic and convey ideas and information clearly ELP.2-3.1 – Construct meaning from oral presentations and literacy and informational text through grade-appropriate listening, reading, and writing ELP.2-3.2 – Participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments, and questions ELP.2-3.3 – Speak and write about grade-appropriate literacy and informational texts and topics ELP.2-3.4-Construct grade-appropriate oral and written claims & support them with reasoning and evidence ELP.2-3.5 – Conduct research and evaluate and communicate findings to answer questions or solve problems ELP.2-3.7 – Adapt language choices to purpose, task and audience when speaking & writing ELP.2-3.8 – Determine the meaning of words and phrases in oral presentations and literacy and informational text ELP. 2-3.9 – Create clear and coherent grade-appropriate speech and text ELP. 2-3.10 – Make accurate use of standard English to communicate in grade-appropriate speech and writing		
Literacy-based objectives for the session – may use "I can…" statements: "I can listen to 'The Most Important Seed' read to me" "I can select the most important part to add to my 6-grid organizer" "I can discuss my understanding of the reading with my partner"		
Vocabulary: Review - terrestrial & aquatic		
Texts use by teacher/student during session: FOSS student science book		
Student science book, science journals, paper for 6-grid organizer		
Lesson Outline - brief narrative or bulleted list. (Include estimated time for each major activity) **Introduction to vocabulary (10 minutes)**: Review the definitions of terrestrial & aquatic – add to science journal. Check and water minisprouters. **Lesson Body (20 minutes):** Students will listen to "The Most Important Seed" read to them. After each section, students will draw their understanding for one-minute. Completion of the organizer, they will be paired with a student and share their drawings.		

Lesson Closing (10 minutes): Inquiry reflection – Students will write two sentences summing up inquiry using the sentence frame: Today, I _________________. I learned ________________. **LS/SS** Students will share out their reflections using the **LS/SS.**
Assessments/ progress monitoring used in lesson: Students' ability to listen and sketch, label, and share their quick sketches from their 6-grid organizer. Listen and observe their explanations with their partner. Their ability to use domain-specific vocabulary in their daily reflections.
Lesson Checklist: Are the following intentionally or explicitly addressed in the lesson?

XSkills-based activity included/ w/practice	❑ Fluency	XVocabulary	XReading/Writing connection	XComprehension	XChild's Interest/ Motivation
XHigher-order thinking	XStudent-focused activity	XConnections to previous work	XApplication to future work	XAssessment	XClosure

Provide the rationale for your choices in the lesson plan: I wanted to incorporate specific writing, speaking, and listening strategies to develop receptive and productive language skills. I wanted them to actively listen to sections of the text and conceptualize the meaning to transfer to their organizers.
What areas do you anticipate the student to need scaffolding/support? Why? What might be your alternative approaches? Rereading sections of the text and allowing more time for sketches, labeling, and sharing of organizer. Assist in labeling their sketches with vocabulary.

Teacher's Name: A. Davis	Child's Name: Research Group	Child's Age/Grade Level: 8/3rd
Date: 4/3/18	Tutor Session #: 10 – 1.4 Seed Dispersal/How Seeds Travel	Length of Session: 60 minutes
Literacy, Language, & Science standards: LS1.B – Growth & development of organisms LS3.A – Inheritance of traits LS3.B – Variation of traits L 4 – Determine the meaning of unknown words L 6 – Acquire and use domain-specific words SL 1 – Engage in collaborative discussions SL 4 – Recount an experience with appropriate facts and relevant descriptive details RI 3 – Describe the relationship between scientific ideas using language that pertains to cause and effect W.3.2 – Write exploratory texts to examine a topic and convey ideas and information clearly ELP.2-3.1 – Construct meaning from oral presentations and literacy and informational text through grade-appropriate listening, reading, and writing ELP.2-3.2 – Participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments, and questions ELP.2-3.3 – Speak and write about grade-appropriate literacy and informational texts and topics ELP.2-3.4-Construct grade-appropriate oral and written claims & support them with reasoning and evidence ELP.2-3.5 – Conduct research and evaluate and communicate findings to answer questions or solve problems ELP.2-3.7 – Adapt language choices to purpose, task and audience when speaking & writing ELP.2-3.8 – Determine the meaning of words and phrases in oral presentations and literacy and informational text ELP. 2-3.9 – Create clear and coherent grade-appropriate speech and text ELP. 2-3.10 – Make accurate use of standard English to communicate in grade-appropriate speech and writing		
Literacy-based objectives for the session – may use "I can…" statements: "I can review vocabulary and define new words" "I can answer questions we've previously discussed" "I can watch a video and take notes" "I can discuss my findings from the video" "I can reflect on what I learned during the group session"		
Vocabulary: Review - terrestrial, organism & aquatic Introduce – compete, survive, disperse		
Texts use by teacher/student during session: No text needed during scientific inquiry		
science journals, laptop for video viewing, minisprouters		
Lesson Outline - brief narrative or bulleted list. (Include estimated time for each major activity)		

Introduction to vocabulary (10 minutes): Review the definitions of terrestrial, organism & aquatic – add to science journal. Introduce compete, survive, disperse. Check and water minisprouters and record observations of seeds in science journal. **Lesson Body (40 minutes):** Discussion: • What is a fruit? • What is a seed? • Do you think all the seeds from one plant would grow up the same way? What might affect their growth? • After a seed starts to grow, what does it need? What might affect its growth? • How do seeds spread if humans don't touch them? **LS/SS** Focus Question: • How do seeds disperse away from the parent plant? Students record their predictions in their science journals **WS/LS/SS** Watch video – "How Seeds Get Here…and there" return to journals and add findings from video **(16 minutes)** **Lesson Closing (10 minutes):** Inquiry reflection – Students will write two sentences summing up inquiry using the sentence frame: Today, I _________________. I learned ________________. **LS/SS** Students will share out their reflections using the **LS/SS.**
Assessments/ progress monitoring used in lesson: Students' ability to discuss the focus question and share notes from the video. Students ability to use domain-specific vocabulary in their daily reflections.

Lesson Checklist: Are the following intentionally or explicitly addressed in the lesson?					
XSkills-based activity included/ w/practice	❑ Fluency	XVocabulary	❑ Reading/Writing connection	XComprehension	XChild's Interest/ Motivation
XHigher-order thinking	XStudent-focused activity	XConnections to previous work	XApplication to future work	XAssessment	XClosure

Provide the rationale for your choices in the lesson plan: I wanted to incorporate specific writing, speaking, and listening strategies to develop receptive and productive language skills. I also wanted the to think about the focus question and set a purpose for listening to the video.
What areas do you anticipate the student to need scaffolding/support? Why? What might be your alternative approaches? Rephrase questions and responses with a correct English syntax. The use of sentence frames and starters.

Teacher's Name: A. Davis	Child's Name: Research Group	Child's Age/Grade Level: 8/3rd
Date: 4/4/18	Tutor Session #: 11 – 1.4 Seed Dispersal/How Seeds Travel READING	Length of Session: 60 minutes
Literacy, Language, & Science standards: LS1.B – Growth & development of organisms LS3.A – Inheritance of traits LS3.B – Variation of traits L 4 – Determine the meaning of unknown words L 6 – Acquire and use domain-specific words SL 1 – Engage in collaborative discussions SL 2 – Determine the main idea from information presented orally SL 4 – Recount an experience with appropriate facts and relevant descriptive details RI 1 – Ask and answer questions to demonstrate understanding of a text RI 3 – Describe the relationship between scientific ideas using language that pertains to cause and effect RI 5 – Use text features to locate information RI 7 – Use information gained from illustrations and words to demonstrate understanding of the text W.3.2 – Write exploratory texts to examine a topic and convey ideas and information clearly		

ELP.2-3.1 – Construct meaning from oral presentations and literacy and informational text through grade-appropriate listening, reading, and writing
ELP.2-3.2 – Participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments, and questions
ELP.2-3.3 – Speak and write about grade-appropriate literacy and informational texts and topics
ELP.2-3.4-Construct grade-appropriate oral and written claims & support them with reasoning and evidence
ELP.2-3.5 – Conduct research and evaluate and communicate findings to answer questions or solve problems
ELP.2-3.7 – Adapt language choices to purpose, task and audience when speaking & writing
ELP.2-3.8 – Determine the meaning of words and phrases in oral presentations and literacy and informational text
ELP. 2-3.9 – Create clear and coherent grade-appropriate speech and text
ELP. 2-3.10 – Make accurate use of standard English to communicate in grade-appropriate speech and writing

Literacy-based objectives for the session – may use "I can…" statements: "I can listen to Ms. Davis read 'How Seeds Travel' read to me" "I can select the most important concepts and sketch and label on 6-grid organizer" "I can discuss my understanding of the reading with my partner"

Vocabulary: Review - terrestrial, organism, aquatic, compete, survive, disperse

Texts use by teacher/student during session: FOSS student science book

Students science books, science journals, laptop for video, minisprouters

Lesson Outline - brief narrative or bulleted list. (Include estimated time for each major activity)
Introduction to vocabulary (10 minutes): Review vocabulary. Check and water minisprouters and record observations of seeds in science journal.
Lesson Body (40 minutes): Review discussion questions:

- What is a fruit?
- What is a seed?
- Do you think all the seeds from one plant would grow up the same way? What might affect their growth?
- After a seed starts to grow, what does it need? What might affect its growth?
- How do seeds spread if humans don't touch them? **LS/SS**

Focus Question:

- How do seeds disperse away from the parent plant?

Students record their predictions in their science journals **WS/LS/SS**

Review video content – "How Seeds Get Here…and there" return to journals and add findings from video

Students will listen to "Nature Journal – How seeds Travel" read to them. After each section, students will draw their understanding for one-minute. Completion of the organizer, they will be paired with a student and share their drawings.
Lesson Closing (10 minutes): Inquiry reflection – Students will write two sentences summing up inquiry using the sentence frame: Today, I _________________. I learned ________________. **LS/SS**

Students will share out their reflections using the **LS/SS.**

Assessments/ progress monitoring used in lesson: Students' ability to sketch, label, and discuss their organizer with a partner. Observe and listen to their conversations. The use of domain-specific vocabulary in their daily reflections.

Lesson Checklist: Are the following intentionally or explicitly addressed in the lesson?

XSkills-based activity included/ w/practice	❑ Fluency	XVocabulary	XReading/Writing connection	XComprehension	XChild's Interest/ Motivation
XHigher-order thinking	XStudent-focused activity	XConnections to previous work	XApplication to future work	XAssessment	XClosure

Provide the rationale for your choices in the lesson plan: I wanted to incorporate specific writing, speaking, and listening strategies to develop receptive and productive language skills. I wanted them to actively listen to me read the text and determine the most important parts to add to their organizer.

What areas do you anticipate the student to need scaffolding/support? Why? What might be your alternative approaches? Rereading the selection and allowing more time for sketching and labeling organizer. Rephrase questions and responses with correct English syntax.

Teacher's Name: A. Davis	Child's Name: Research Group	Child's Age/Grade Level: 8/3rd
Date: 4/9/18	Tutor Session #: 12 – 2.1 Germination & Growth	Length of Session: 60 minutes
Literacy, Language, & Science standards: LS1.A – Structure & Function LS1.B – Growth & development of organisms LS3.A – Inheritance of traits LS3.B – Variation of traits L 4 – Determine the meaning of unknown words L 6 – Acquire and use domain-specific words SL 1 – Engage in collaborative discussions SL 4 – Recount an experience with appropriate facts and relevant descriptive details RI 3 – Describe the relationship between scientific ideas using language that pertains to cause and effect W.3.2 – Write exploratory texts to examine a topic and convey ideas and information clearly ELP.2-3.1 – Construct meaning from oral presentations and literacy and informational text through grade-appropriate listening, reading, and writing ELP.2-3.2 – Participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments, and questions ELP.2-3.3 – Speak and write about grade-appropriate literacy and informational texts and topics ELP.2-3.4-Construct grade-appropriate oral and written claims & support them with reasoning and evidence ELP.2-3.5 – Conduct research and evaluate and communicate findings to answer questions or solve problems ELP.2-3.7 – Adapt language choices to purpose, task and audience when speaking & writing ELP.2-3.8 – Determine the meaning of words and phrases in oral presentations and literacy and informational text ELP. 2-3.9 – Create clear and coherent grade-appropriate speech and text ELP. 2-3.10 – Make accurate use of standard English to communicate in grade-appropriate speech and writing		
Literacy-based objectives for the session – may use "I can…" statements: "I can compare dry seeds to seedlings and describe the differences in size, texture, and strategies" "I can illustrate and describe the germination process" "I can describe the strategies a seedling has to help it grow and survive"		
Vocabulary: Review - cotyledon, strategies, survive Introduce – germination, root, stem, leaves, seedling, nutrients		
Texts use by teacher/student during session: No text used during scientific inquiry		
Dry seeds, seedlings in sprouter, science journals		
Lesson Outline - brief narrative or bulleted list. (Include estimated time for each major activity) **Introduction to vocabulary (10 minutes)**: Review and introduce vocabulary by students reviewing definitions in journals and introducing the new vocabulary by writing what they think the words mean. Give definitions and ask students to write new word definitions in their journals. **LS/SS/WS** **Lesson Body (40 minutes):** Review discussion questions: Draw chart in journal – compare dry seed to seedling by describing size, texture, and strategies Questions to respond to in journal: • Compare the size of the seed and seedling. Why do you think they are different? • Compare how the seed and seedling feel? Why do you think they are different? • What are the differences between the parts (strategies) you can observe in the seeds and seedlings? Focus Question: What strategies does a seedling have to help it grow and survive? • The germination process Draw diagram in journal and label strategies Answer focus question in journal & discuss responses Discuss the germination process and brainstorm ideas of their observations, add to chart		

- The seed coat came off and is no longer needed to protect the seed
- The root of the seedling grows down and gets water
- The stem grows up and supports the rest of the plant
- The leaves are the flat, green part of the plant. This where the plant makes food for continued growth.
- The cotyledon of the plant provides food for the seedling. Once the cotyledon is gone, the plants makes its own food. **LS/SS/WS**

Lesson Closing (10 minutes): Inquiry reflection – Students will write two sentences summing up inquiry using the sentence frame: Today, I _________________. I learned ________________. **LS/SS**

Students will share out their reflections using the **LS/SS.**

Assessments/ progress monitoring used in lesson: Students' ability to describe and verbalize the germination process and compare and contrast the seeds. Their ability to use domain-specific vocabulary in their daily reflections.

Lesson Checklist: Are the following intentionally or explicitly addressed in the lesson?					
XSkills-based activity included/ w/practice	❑ Fluency	XVocabulary	XReading/Writing connection	XComprehension	XChild's Interest/ Motivation
XHigher-order thinking	XStudent-focused activity	XConnections to previous work	XApplication to future work	XAssessment	XClosure

Provide the rationale for your choices in the lesson plan: I wanted to incorporate specific writing, speaking, and listening strategies to develop receptive and productive language skills. I wanted students to understand the changes in seeds when they begin to germinate and grow into plants.

What areas do you anticipate the student to need scaffolding/support? Why? What might be your alternative approaches? Rephrasing questions and answers with proper English syntax. Use of sentence frames and starters.

Teacher's Name: A. Davis	Child's Name: Research Group	Child's Age/Grade Level: 8/3rd
Date: 4/10/18	Tutor Session #: 13 – 2.1 Germination & Growth READING	Length of Session: 60 minutes

Literacy, Language, & Science standards:
LS1.B – Growth & development of organisms
LS3.A – Inheritance of traits
LS3.B – Variation of traits
L 4 – Determine the meaning of unknown words
L 6 – Acquire and use domain-specific words
SL 1 – Engage in collaborative discussions
SL 2 – Determine the main idea from information presented orally
SL 4 – Recount an experience with appropriate facts and relevant descriptive details
RI 1 – Ask and answer questions to demonstrate understanding of a text
RI 3 – Describe the relationship between scientific ideas using language that pertains to cause and effect
RI 5 – Use text features to locate information
RI 7 – Use information gained from illustrations and words to demonstrate understanding of text
W.3.2 – Write exploratory texts to examine a topic and convey ideas and information clearly
ELP.2-3.1 – Construct meaning from oral presentations and literacy and informational text through grade-appropriate listening, reading, and writing
ELP.2-3.2 – Participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments, and questions
ELP.2-3.3 – Speak and write about grade-appropriate literacy and informational texts and topics
ELP.2-3.4-Construct grade-appropriate oral and written claims & support them with reasoning and evidence
ELP.2-3.5 – Conduct research and evaluate and communicate findings to answer questions or solve problems
ELP.2-3.7 – Adapt language choices to purpose, task and audience when speaking & writing
ELP.2-3.8 – Determine the meaning of words and phrases in oral presentations and literacy and informational text
ELP. 2-3.9 – Create clear and coherent grade-appropriate speech and text
ELP. 2-3.10 – Make accurate use of standard English to communicate in grade-appropriate speech and writing

Literacy-based objectives for the session – may use "I can…" statements: "I can listen to Ms. Davis read 'Germination' to me and complete a one-minute quick sketch and label my 6-grid organizer" "I can review my organizer and discuss my sketches with my partner"
Vocabulary: Review - germination, root, stem, leaves, seedling, nutrients
Texts use by teacher/student during session: FOSS student science book
Student science books, science journals
Lesson Outline - brief narrative or bulleted list. (Include estimated time for each major activity) **Introduction to vocabulary (10 minutes)**: Review vocabulary from yesterday and share reflections from journals. **LS/SS** **Lesson Body (40 minutes):** Review the strategies of a seedling. Read "Germination" while students listen and add a one-minute quick sketch to their 6-grid organizer. Finish passage, students will share their drawing with a partner. **LS/SS/WS** **Lesson Closing (10 minutes):** Inquiry reflection – Students will write two sentences summing up inquiry using the sentence frame: Today, I ________________. I learned _______________. **LS/SS** Students will share out their reflections using the **LS/SS.**
Assessments/ progress monitoring used in lesson: Students' labeled 6-grid organizers. Listen and observe partner sharing and completion of organizers. The use of domain-specific vocabulary in their daily reflections.

Lesson Checklist: Are the following intentionally or explicitly addressed in the lesson?					
XSkills-based activity included/ w/practice	❑ Fluency	XVocabulary	XReading/Writing connection	XComprehension	XChild's Interest/ Motivation
XHigher-order thinking	XStudent-focused activity	XConnections to previous work	XApplication to future work	XAssessment	XClosure

Provide the rationale for your choices in the lesson plan: I wanted to incorporate specific writing, speaking, and listening strategies to develop receptive and productive language skills. I wanted students to actively listen to me read portions of the text to determine the most important concepts to add to their organizers.
What areas do you anticipate the student to need scaffolding/support? Why? What might be your alternative approaches? Reread sections of the text if it's confusing. Rephrase their responses with proper English syntax.

Teacher's Name: A. Davis	Child's Name: Research Group	Child's Age/Grade Level: 8/3rd
Date: 4/12/18	Tutor Session #: 14 – 2.1 Germination & Growth	Length of Session: 40 minutes

Literacy, Language, & Science standards: LS1.A – Structure & Function LS1.B – Growth & development of organisms LS3.A – Inheritance of traits LS3.B – Variation of traits L 4 – Determine the meaning of unknown words L 6 – Acquire and use domain-specific words SL 1 – Engage in collaborative discussions SL 4 – Recount an experience with appropriate facts and relevant descriptive details RI 3 – Describe the relationship between scientific ideas using language that pertains to cause and effect W.3.2 – Write exploratory texts to examine a topic and convey ideas and information clearly ELP.2-3.1 – Construct meaning from oral presentations and literacy and informational text through grade-appropriate listening, reading, and writing ELP.2-3.2 – Participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments, and questions ELP.2-3.3 – Speak and write about grade-appropriate literacy and informational texts and topics ELP.2-3.4-Construct grade-appropriate oral and written claims & support them with reasoning and evidence ELP.2-3.5 – Conduct research and evaluate and communicate findings to answer questions or solve problems ELP.2-3.7 – Adapt language choices to purpose, task and audience when speaking & writing

ELP.2-3.8 – Determine the meaning of words and phrases in oral presentations and literacy and informational text ELP. 2-3.9 – Create clear and coherent grade-appropriate speech and text ELP. 2-3.10 – Make accurate use of standard English to communicate in grade-appropriate speech and writing
Literacy-based objectives for the session – may use "I can…" statements: "I can interview my partner about how the environment affects plant growth" "I can measure the growth of the bean seed from the sprouter using string and a ruler" "I can answer whether a plants gets everything it needs from its roots"
Vocabulary: Review – strategies, function Introduce – inherit, life cycle
Texts use by teacher/student during session: No text needed during inquiry.
Bean seedlings from sprouter, string, ruler, science journals, laptop for video
Lesson Outline - brief narrative or bulleted list. (Include estimated time for each major activity) **Introduction to vocabulary (10 minutes)**: Review strategies & function. Introduce inherit & life cycle. **Lesson Body (20 minutes):** Students will interview a partner and record their responses in the journals: • What does the environment provide for plant growth? • What if things changed – How would the changes affect the growth of a plant Discuss responses **LS/SS** Draw growth chart in journal and measure growth of roots with string & a ruler, record findings in their journal Watch video "How Plants Get Food" Think about the question – Does a plant get everything I needs from its roots? After video, answer question in their journals **Lesson Closing (10 minutes):** Inquiry reflection – Students will write two sentences summing up inquiry using the sentence frame: Today, I _________________. I learned ________________. **LS/SS** Students will share out their reflections using the **LS/SS.**
Assessments/ progress monitoring used in lesson: Students' ability to record their partner's responses to the questions in their journals. Their use of domain-specific vocabulary in their daily reflections.

Lesson Checklist: Are the following intentionally or explicitly addressed in the lesson?					
XSkills-based activity included/ w/practice	❑ Fluency	XVocabulary	XReading/Writing connection	XComprehension	XChild's Interest/ Motivation
XHigher-order thinking	XStudent-focused activity	XConnections to previous work	XApplication to future work	XAssessment	XClosure

Provide the rationale for your choices in the lesson plan: I wanted to incorporate specific writing, speaking, and listening strategies to develop receptive and productive language skills. I also wanted students to actively listen to the video and take notes with the focus question in mind.
What areas do you anticipate the student to need scaffolding/support? Why? What might be your alternative approaches? Rephrasing questions and responses using proper English syntax. The use of sentence starters and frames.

Teacher's Name: A. Davis	Child's Name: Research Group	Child's Age/Grade Level: 8/3rd
Date: 4/16/18	Tutor Session #: 15 – 2.2 Bean Seed Life Cycle READING	Length of Session: 40 minutes
Literacy, Language, & Science standards: LS1.B – Growth & development of organisms LS3.A – Inheritance of traits LS3.B – Variation of traits L 4 – Determine the meaning of unknown words L 6 – Acquire and use domain-specific words SL 1 – Engage in collaborative discussions SL 2 – Determine the main idea from information presented orally SL 4 – Recount an experience with appropriate facts and relevant descriptive details RI 1 – Ask and answer questions to demonstrate understanding of a text RI 3 – Describe the relationship between scientific ideas using language that pertains to cause and effect RI 5 – Use text features to locate information RI 7 – Use information gained from illustrations and words to demonstrate understanding of text		

W.3.2 – Write exploratory texts to examine a topic and convey ideas and information clearly ELP.2-3.1 – Construct meaning from oral presentations and literacy and informational text through grade-appropriate listening, reading, and writing ELP.2-3.2 – Participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments, and questions ELP.2-3.3 – Speak and write about grade-appropriate literacy and informational texts and topics ELP.2-3.4-Construct grade-appropriate oral and written claims & support them with reasoning and evidence ELP.2-3.5 – Conduct research and evaluate and communicate findings to answer questions or solve problems ELP.2-3.7 – Adapt language choices to purpose, task and audience when speaking & writing ELP.2-3.8 – Determine the meaning of words and phrases in oral presentations and literacy and informational text ELP. 2-3.9 – Create clear and coherent grade-appropriate speech and text ELP. 2-3.10 – Make accurate use of standard English to communicate in grade-appropriate speech and writing
Literacy-based objectives for the session – may use "I can…" statements: "I can review vocabulary" "I can measure the growth of the bean seed from the sprouter using string and a ruler" "I can answer whether a plants gets everything it needs from its roots" "I can agree or disagree with statements and explain my thinking" "I can listen to Ms. Davis read 'Life Cycles' and sketch and label the most important ideas on my 6-grid organizer"
Vocabulary: Review – inherit, life cycle
Texts use by teacher/student during session: FOSS student science book
Bean seedlings from sprouter, string, ruler, science journals, FOSS student science journal
Lesson Outline - brief narrative or bulleted list. (Include estimated time for each major activity) **Introduction to vocabulary (10 minutes)**: Review inherit & life cycle. **Lesson Body (20 minutes):** Agree/Disagree Chart – Students will write 'agree' or 'disagree' next to the statements: • Yes, plants get food and water through their roots • No, plants also need light and air to make their own food • No, plants take in water through their leaves • Yes, plants get everything they need from the soil Discuss why they agreed or disagreed **LS/SS** Read "Life Cycles" from science book, students will quick sketch and label their drawings from each section of text read to them. After completion, they will discuss their organizers with their partner. **LS/WS** **Lesson Closing (10 minutes):** Inquiry reflection – Students will write two sentences summing up inquiry using the sentence frame: Today, I __________________. I learned ________________. **LS/SS** Students will share out their reflections using the **LS/SS.**
Assessments/ progress monitoring used in lesson: Students' ability to sketch, label, and discuss their organizers from the reading. Their ability to use domain-specific vocabulary in their daily reflections.
Lesson Checklist: Are the following intentionally or explicitly addressed in the lesson?

XSkills-based activity included/ w/practice	❑ Fluency	XVocabulary	XReading/Writing connection	XComprehension	XChild's Interest/ Motivation
XHigher-order thinking	XXStudent-focused activity	XConnections to previous work	XApplication to future work	XAssessment	XClosure

Provide the rationale for your choices in the lesson plan: I wanted to incorporate specific writing, speaking, and listening strategies to develop receptive and productive language skills. The purpose of the reading is for participants to understand the concept of life cycles in relation to their bean seedlings.
What areas do you anticipate the student to need scaffolding/support? Why? What might be your alternative approaches? Reread portions of the text if needed and allow extra time for sketching, labeling, and discussing their organizers with a partner.

Teacher's Name: A. Davis	Child's Name: Research Group	Child's Age/Grade Level: 8/3rd
Date: 4/17/18	Tutor Session #: 16 – 2.2 Bean Seed Life Cycle	Length of Session: 40 minutes

Literacy, Language, & Science standards: LS1.A – Structure & Function LS1.B – Growth & development of organisms LS3.A – Inheritance of traits LS3.B – Variation of traits L 4 – Determine the meaning of unknown words L 6 – Acquire and use domain-specific words SL 1 – Engage in collaborative discussions SL 4 – Recount an experience with appropriate facts and relevant descriptive details RI 3 – Describe the relationship between scientific ideas using language that pertains to cause and effect W.3.2 – Write exploratory texts to examine a topic and convey ideas and information clearly ELP.2-3.1 – Construct meaning from oral presentations and literacy and informational text through grade-appropriate listening, reading, and writing ELP.2-3.2 – Participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments, and questions ELP.2-3.3 – Speak and write about grade-appropriate literacy and informational texts and topics ELP.2-3.4-Construct grade-appropriate oral and written claims & support them with reasoning and evidence ELP.2-3.5 – Conduct research and evaluate and communicate findings to answer questions or solve problems ELP.2-3.7 – Adapt language choices to purpose, task and audience when speaking & writing ELP.2-3.8 – Determine the meaning of words and phrases in oral presentations and literacy and informational text ELP. 2-3.9 – Create clear and coherent grade-appropriate speech and text ELP. 2-3.10 – Make accurate use of standard English to communicate in grade-appropriate speech and writing
Literacy-based objectives for the session – may use "I can…" statements: "I can review vocabulary" "I can measure the growth of the bean seed from the sprouter using string and a ruler" "I can put the stages of a bean plant in order" "I can label each illustration with the correct vocabulary" "I can draw, label, and describe each stage in my journal"
Vocabulary: Review – cotyledon, stem, roots, leaves, organism, strategies, germination, seedling, nutrients Introduce – flowers, bean pod
Texts use by teacher/student during session: No text used during inquiry
Bean seedlings from sprouter, string, ruler, science journals
Lesson Outline - brief narrative or bulleted list. (Include estimated time for each major activity) **Introduction to vocabulary (10 minutes)**: Review vocabulary and introduce new words. **LS/SS/WS** **Lesson Body (20 minutes):** Show each stage of the bean plant life cycle, ask students to add the correct vocabulary then have them sketch, label, and write a description utilizing the domain-specific vocabulary in their descriptions. Repeat for each stage of the life cycle. **Lesson Closing (10 minutes):** Inquiry reflection – Students will write two sentences summing up inquiry using the sentence frame: Today, I ___________________. I learned _________________. **LS/SS** Students will share out their reflections using the **LS/SS.**
Assessments/ progress monitoring used in lesson: Students' ability to sketch, label, and describe each stage of the bean plant life cycle. Listen and observe their responses.

Lesson Checklist: Are the following intentionally or explicitly addressed in the lesson?					
XSkills-based activity included/ w/practice	❑ Fluency	XVocabulary	XReading/Writing connection	XComprehension	XChild's Interest/ Motivation
XHigher-order thinking	XXStudent-focused activity	XConnections to previous work	XApplication to future work	XAssessment	XClosure

Provide the rationale for your choices in the lesson plan: I wanted to incorporate specific writing, speaking, and listening strategies to develop receptive and productive language skills. Participants need to understand each stage of the bean plant life cycle and the corresponding vocabulary and be able to utilize it in their written descriptions.

What areas do you anticipate the student to need scaffolding/support? Why? What might be your alternative approaches? Rephrase definitions and provide sentence starters/frames for their written descriptions.

Teacher's Name: A. Davis	Child's Name: Research Group	Child's Age/Grade Level: 8/3rd
Date: 4/18/18	Tutor Session #: 17 – 2.3 Roots & Shoots	Length of Session: 40 minutes

Literacy, Language, & Science standards:
LS1.A – Structure & Function
LS1.B – Growth & development of organisms
LS3.A – Inheritance of traits
LS3.B – Variation of traits
L 4 – Determine the meaning of unknown words
L 6 – Acquire and use domain-specific words
SL 1 – Engage in collaborative discussions
SL 4 – Recount an experience with appropriate facts and relevant descriptive details
RI 3 – Describe the relationship between scientific ideas using language that pertains to cause and effect
W.3.2 – Write exploratory texts to examine a topic and convey ideas and information clearly
ELP.2-3.1 – Construct meaning from oral presentations and literacy and informational text through grade-appropriate listening, reading, and writing
ELP.2-3.2 – Participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments, and questions
ELP.2-3.3 – Speak and write about grade-appropriate literacy and informational texts and topics
ELP.2-3.4-Construct grade-appropriate oral and written claims & support them with reasoning and evidence
ELP.2-3.5 – Conduct research and evaluate and communicate findings to answer questions or solve problems
ELP.2-3.7 – Adapt language choices to purpose, task and audience when speaking & writing
ELP.2-3.8 – Determine the meaning of words and phrases in oral presentations and literacy and informational text
ELP. 2-3.9 – Create clear and coherent grade-appropriate speech and text
ELP. 2-3.10 – Make accurate use of standard English to communicate in grade-appropriate speech and writing

Literacy-based objectives for the session – may use "I can…" statements: "I can measure the growth of the bean seed from the sprouter using string and a ruler" "I can identify the characteristics of fibrous and taproots" "I can dig up plants in the schoolyard and identify the type of roots"

Vocabulary: Introduce – fibrous and taproot

Texts use by teacher/student during session: No text used during inquiry

Bean seedlings from sprouter, string, ruler, science journals, shovel, fibrous and taproot examples

Lesson Outline - brief narrative or bulleted list. (Include estimated time for each major activity)
Introduction to vocabulary (10 minutes): Introduce fibrous and taproot, add definitions and drawings in journals. **LS/SS/WS**
Lesson Body (20 minutes): Show fibrous and taproot examples. Students write characteristics of each in their journals and compare to bean plant roots.
Go outside with a shovel, each student will dig up a plant and bring inside. Discussion questions:

- Are some roots harder to get out of the ground than others?
- Do you think you were able to get all of the roots out?
- Why do you think it is hard to get the roots out?
- Was anything attached to the roots when you pulled them out?
- What do roots do?

Draw and label plant they dug up in their journals. **LS/SS/WS**
Lesson Closing (10 minutes): Inquiry reflection – Students will write two sentences summing up inquiry using the sentence frame: Today, I _________________. I learned ________________. **LS/SS**

Students will share out their reflections using the **LS/SS.**

Assessments/ progress monitoring used in lesson: Students' ability to sketch, label, and describe each stage of the bean plant life cycle. Their ability to use domain-specific vocabulary in their daily reflections.

Lesson Checklist: Are the following intentionally or explicitly addressed in the lesson?

XSkills-based activity included/ w/practice	❑ Fluency	XVocabulary	XReading/Writing connection	XComprehension	XChild's Interest/ Motivation
XHigher-order thinking	XXStudent-focused activity	XConnections to previous work	XApplication to future work	XAssessment	XClosure
Provide the rationale for your choices in the lesson plan: I wanted to incorporate specific writing, speaking, and listening strategies to develop receptive and productive language skills. Participants need to understand each stage of the bean plant life cycle and the corresponding vocabulary and be able to utilize it in their written descriptions.					
What areas do you anticipate the student to need scaffolding/support? Why? What might be your alternative approaches? Rephrase definitions and provide sentence starters/frames for their written descriptions.					

Teacher's Name: A. Davis	Child's Name: Research Group	Child's Age/Grade Level: 8/3rd
Date: 4/19/18	Tutor Session #: 18 – Investigation 2 Review	Length of Session: 40 minutes

Literacy, Language, & Science standards:
LS1.A – Structure & Function
LS1.B – Growth & development of organisms
LS3.A – Inheritance of traits
LS3.B – Variation of traits
L 4 – Determine the meaning of unknown words
L 6 – Acquire and use domain-specific words
SL 1 – Engage in collaborative discussions
SL 4 – Recount an experience with appropriate facts and relevant descriptive details
RI 3 – Describe the relationship between scientific ideas using language that pertains to cause and effect
W.3.2 – Write exploratory texts to examine a topic and convey ideas and information clearly
ELP.2-3.1 – Construct meaning from oral presentations and literacy and informational text through grade-appropriate listening, reading, and writing
ELP.2-3.2 – Participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments, and questions
ELP.2-3.3 – Speak and write about grade-appropriate literacy and informational texts and topics
ELP.2-3.4-Construct grade-appropriate oral and written claims & support them with reasoning and evidence
ELP.2-3.5 – Conduct research and evaluate and communicate findings to answer questions or solve problems
ELP.2-3.7 – Adapt language choices to purpose, task and audience when speaking & writing
ELP.2-3.8 – Determine the meaning of words and phrases in oral presentations and literacy and informational text
ELP. 2-3.9 – Create clear and coherent grade-appropriate speech and text
ELP. 2-3.10 – Make accurate use of standard English to communicate in grade-appropriate speech and writing

Literacy-based objectives for the session – may use "I can…" statements: "I can measure the growth of the bean seed from the sprouter using string and a ruler" "I can play a matching game with my partner to review vocabulary and scientific concepts from Investigation 2"

Vocabulary: Review for vocabulary for investigation 2 - Strategies, seedling, roots, stem, leaves, cotyledon, nutrients, germination, germinate, fibrous roots, taproots

Texts use by teacher/student during session: No text used during review

Bean seedlings from sprouter, string, ruler, science journals

Lesson Outline - brief narrative or bulleted list. (Include estimated time for each major activity)
Introduction to vocabulary (10 minutes): Students will measure the growth of their beed seedling and record it in their science journals. **WS**
Lesson Body (20 minutes): Students will be given a set of cards, questions in blue and answers in orange. They will work together to match the question with the correct answer as review for their I-Check Assessment on 4/20/18. The questions/answers are as follows:

- What four strategies does a seedling have to help it grow as a young plant? (Roots, stem, leaves, and cotyledon)

- What four things does a young plant need? (water, light, nutrients, and space to grow)
- What is germination? (A seed's early growth)
- Where does fruit develop? (Flowers)
- What are the three purposes of a plant's roots? (take up water, nutrients, and hold the plant in place)
- What does a seed need to start growing? (water)
- What are nutrients? (Food)
- How can you tell a seed has started to germinate? (A root is coming out one side, the seed is swollen, and the seat coat is broken)
- Define germination (when a seed begins to grow)
- Define the purpose of the cotyledon (To provide stored food for the seed to grow and develop roots)
- Picture of fibrous root (match with word 'fibrous root')
- Picture of a taproot (match with word 'taproot') **LS/SS**

Lesson Closing (10 minutes): Inquiry reflection – Students will write two sentences summing up inquiry using the sentence frame: Today, I __________________. I learned _________________. **LS/SS**

Students will share out their reflections using the **LS/SS.**

Assessments/ progress monitoring used in lesson: Students' ability to identify the correct answer to the questions while working with their partner. Their ability to use domain-specific vocabulary in their daily reflections.

Lesson Checklist: Are the following intentionally or explicitly addressed in the lesson?					
XSkills-based activity included/ w/practice	❑ Fluency	XVocabulary	XReading/Writing connection	XComprehension	XChild's Interest/ Motivation
XHigher-order thinking	XXStudent-focused activity	XConnections to previous work	XApplication to future work	XAssessment	XClosure

Provide the rationale for your choices in the lesson plan: I wanted to incorporate specific writing, speaking, and listening strategies to develop receptive and productive language skills. Participants need to review the concepts from Investigation 2 in preparation for their I-Check.

What areas do you anticipate the student to need scaffolding/support? Why? What might be your alternative approaches? Rephrase questions and help them rethink their answers and connections to the questions being asked.