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A QUASI-EXPERIMENTAL STUDY ON THE IMPACT OF EXPLICIT INSTRUCTION OF
SCIENCE TEXT STRUCTURES ON EIGHTH-GRADE ENGLISH LEARNERS' AND NON-
ENGLISH LEARNERS' CONTENT LEARNING AND READING COMPREHENSION IN
THREE INCLUSIVE SCIENCE CLASSROOMS

by

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ABSTRACT

The focus of this quasi-experimental study was to examine the impact of explicit instruction of science comparison and contrast macro text structures plus micro text structures on the content learning, sentence comprehension, and reading comprehension of eighth-grade English Learners (ELs) and non-English Learners (non-ELs) in three inclusive science classrooms. Although the results of this study did not show significant differences between groups in sentence comprehension, reading comprehension, or science content learning, the treatment group increased and maintained their science content learning scores over time, while the scores of the comparison group declined from post-test to delayed post-test. In addition, the researcher sought to determine whether sentence combination scores were a predictor of reading comprehension scores. The results showed that sentence combination scores were good predictors for reading comprehension.

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CHAPTER 1: THE PROBLEM AND ITS CLARIFYING COMPONENTS

Introduction

This study explored the impact of explicit instruction of text structures (both macrostructures and microstructures) on the science content learning, sentence comprehension, and reading comprehension of eighth-grade English Learners (ELs) and non-English Learners (non-ELs, i.e., native English speakers). The treatment was delivered in three inclusive eighth-grade science classes at a public middle school in a large metropolitan school district in the Southeast United States. This chapter discusses the background of the study, the current problems, the purpose of the study, and operational definitions.

Background of Study

Text structures are the organization or arrangement of ideas and their relationships to one another (Armbruster, 2004). Text structures include macrostructures (i.e., genre) and microstructures (i.e., syntax). According to Chen and Donin (1997), knowledge of text structures affects reading fluency and recall in students studying biology in their second language as opposed to studying biology in their native language. There have been similar findings for studies on students in elementary school and middle school. For example, Englert and Hiebert (1984) studied student performance in comprehension when reading expository text of varying text structures, and they found that sixth-graders with more knowledge of text structures performed significantly better on reading comprehension than students with low knowledge of text structure. Text structure techniques increased student content knowledge and

reading comprehension in content areas such as science and social studies (McNamara, Kintsch, Songer, & Kintsch, 1996; Williams et al., 2007). According to research, adolescents benefit from text structure intervention to improve content learning and reading comprehension (McNamara et al., 1996; Meyer, Brandt, & Bluth, 1980).

According to the RAND Report (Snow, 2002), text structures have a large impact on reading comprehension. The representations of text that readers create while reading are crucial for comprehension.

Those representations include the *surface code* (the exact wording of the text), the *text base* (idea units representing the meaning of the text), and the *mental models* (the way in which information is processed for meaning) that are embedded in the text. (Snow, 2002, p. XV)

Readers need more than fundamental reading skills (i.e., phonemic awareness, phonetics, fluency, and vocabulary) to process complex text.

Statement of the Problem

The Critical State of Adolescent Literacy

The National Center for Educational Statistics (NCES) publishes the Nation's Report Card annually to inform the public of the National Assessment of Educational Progress (NAEP) results of U.S. students' performance in various subjects by assessing specific skills germane to the content area. The NAEP reading assessment measures reading comprehension of literary texts, including fiction, literary nonfiction, and poetry, as well as informational texts, including expository, procedural, argumentative and persuasive, and document texts (NCES, 2013a).

According to the NAEP reading assessment, students can achieve three levels of proficiency:

basic, proficient, and advanced (NCES, 2013a). Students performing at a basic proficiency level should be able to perform the following: locate the main idea, identify the theme or author's purpose, make simple inferences, utilize context clues, and state judgments with some support. Further, students performing at a proficient level should be able to perform several tasks, including making and supporting inferences, summarizing main ideas and themes, analyzing text features, connecting parts of the text, and supporting judgments about content and its presentation. Students performing at an advanced proficiency level "should be able to make connections within and across texts and to explain causal relations" (NCES, 2013a, p. 6), to assess the validity of supporting evidence and the effectiveness of the author's presentation, and to analyze and evaluate by stating, explaining, and justifying (NCES, 2013a).

The 2013 Nation's Report Card showed that reading comprehension among eighth-grade students improved by 2% from 2011 to 2013; however, 22% of students in the eighth-grade still read below basic level (NCES, 2013a). In addition, 14 states performed below the nation's average in both fourth and eighth-grade reading (NCES, 2013a). According to the Nation's Report Card of 2013 in the State of Florida, fourth-grade students performed above the nation's average, but eighth-grade students performed below the nation's average (NCES, 2013a). In Florida, 30% of eighth-grade students performed below basic proficiency level, 43% of eighth-grade students performed at reading basic proficiency level while 30% of eighth-grade students performed at proficient level, and only 3% performed at advanced level (NCES, 2013a).

These results indicate that more work needs to be done in order to bridge the reading performance gap. Previous results from the Nation's Report Card Report of 2012 asserted that the racial/ethnic and gender gaps narrowed in reading and math since the first NAEP assessment in 1971 (NCES, 2013b). For instance, in 2008, the performance of students in elementary and

high school remained the same as the previous year, while the performance of students in middle school suggested that the performance gap between Hispanic adolescents and White adolescents narrowed slightly (NCES, 2013b).

The issue now is beyond how well students are doing in comparison to one another. Now, it is an issue of how prepared high school graduates are for college or career. According to the American College Testing's (ACT) *A First Look at the Common Core and College and Career Readiness* report (2010), a representative sample ($n = 256,765$) of 11th grade students from various states was selected and received forms of the ACT Plus Writing (multiple-choice tests in Reading, English, Science, Writing, and Math), whose benchmark scores were used as predictors for college success in freshmen courses at the time (before the Common Core State Standards). The scores of the ACT Plus Writing highlighted that only 38% of tested 11th-grade students met the benchmark scores for overall reading comprehension, while only 31% of the participants performed at a college- and career-ready level with regard to text complexity. The results of the ACT test suggested that too few students were ready for college and career-level reading (ACT, 2010). Further, only 24% of tested students were college and career ready for literacy in science, and 41% of students were college and career ready for social studies (ACT, 2010). More recently, of all ACT test takers, 67% met the college- and career-readiness benchmark for English, 52% met the reading benchmark, 46% met the math benchmark, 31% met the science benchmark, but only 25% of all test takers met the college- and career-readiness benchmarks for all four subjects (ACT, 2010). These test results indicate that adolescents in the U.S. need to work on literacy in content areas to be ready for college.

The Critical State of Adolescent Science Reading Performance

In the 2011 Nation's Report Card in Science (NCES, 2012) publication, the science content for eighth-grade students was organized into three broad content areas: life science, physical science, and earth and space sciences. The NAEP developed the framework for science assessment; thus, students were assessed on how they used their science knowledge and what they were able to do with the content (NCES, 2012). "In 2011, the proportion of assessment time devoted to each science practice at grade eight was 25% identifying science principles, 35% using science principles, 30% using scientific inquiry, and 10% using technological design" (NCES, 2012, p. 2). The NAEP student results were categorized into three proficiency levels: basic, proficient, and advanced. According to The Nation's Report Card (NCES, 2012), a student that exhibits basic proficiency in science has "partial mastery of prerequisite knowledge and skills that are fundamental for proficient work at each grade" (p. 3); a student that is within proficiency level has adequate academic performance and competency of the subject matter; a student that scores in the advanced level has academic performance and content knowledge that goes beyond his or her grade level (p. 3).

Nationally, "The average science score for eighth-grade students was 2 points higher in 2011 than in 2009" (NCES, 2012, p. 5). Although nationally there was an increase in science performance, in 2011, 65% of students were at basic level proficiency (NCES, 2012). Of the students who scored at the basic level proficiency in 2011, 35% were Hispanic students who scored below the 25th percentile (NCES, 2012). In addition, the gap in performance between White students and Hispanic students narrowed by only five points from 2009 to 2011, yet there was still a 27-point gap in performance between White students and Hispanic students (NCES, 2012).

In 2009 and 2011, eighth-grade students in Florida performed below the national average with 43% of students performing below basic proficiency in 2009 and 38% of students performing below basic proficiency in 2011 (NCES, 2012). When ELs were compared to non-ELs, there was a large gap in performance in the State of Florida. In the NAEP science scale range from 0 to 300, in 2009 ELs scored an average of 106 compared to an average of 148 scored by non-ELs (NCES, 2012). By 2011, the gap between ELs and non-ELs had widened, with ELs scoring an average of 101 and non-ELs scoring an average of 151 (NCES, 2012).

Rationale: Why Text Structures?

The Common Core State Standards (CCSS) place higher literacy (reading comprehension, writing, and language) demands on adolescents. “The CCSS propose a leveling the field in academic expectations by back mapping college and career readiness standards that students will build through Grade 12 by starting in kindergarten” (Zygouris-Coe, 2012, p. 36). Although back mapping from college and career readiness provides a detailed insight of what skill high school graduates should have at the end of Grade 12, it also means that the demands for literacy (and math) increase across all grade levels. “The standards were created to intentionally push students to apply knowledge, use higher-order thinking skills, and master complex content” (K. L. Roberts, 2012, para 2). The CCSS equates to making every teacher a teacher of literacy skill regardless of content area taught. The Common Core State Standards’ demand for higher literacy is manifested in several ways: increased text complexity, higher literacy demands in content areas, and increased demands of language and use.

The first manifestation of the higher literacy demands of the CCSS is text complexity (Aspen Institute, 2012). The CCSS uses several factors to assess text complexity: quantitative, qualitative, reader, and task factors. The quantitative factors look at the text’s Lexile (word

length, word frequency, word difficulty, sentence length, and text cohesion) to determine the text's readability. With the CCSS back mapping of standards, the Lexile ranges for grades 2-12 have increased. For example, in 6th-8th grade, the old Lexile range was 860-1010, but now the Lexile range increased to 925-1185. The increase in the Lexile range means that the texts that students in the 6th-8th grades are expected to be able to read and comprehend have longer words, fewer word frequencies, and higher difficulty. The syntax in the text is also more rigorous as the sentence length and text length increase. In addition to having a larger vocabulary, students are also expected to be able to decipher syntax in order to comprehend sentences and texts. The measurement of quantitative factors use formulaic computation to assess text complexity. However, quantitative factors do not account for all types of text complexities.

Because quantitative factors do not adequately account for all types of text complexities, the CCSS uses qualitative factors to assess text complexity (Aspen Institute, 2012). These qualitative factors are on a continuum of difficulty that cannot be automatically scored by formulaic computations. The factors include the text's meaning and purpose, where a text with multiple purposes or meanings is considered more difficult than a text with one meaning or purpose. For example, a dual-purpose text (entertainment and information) would be considered more difficult than a single-purpose text (entertainment or information). Another qualitative factor considered for assessing text difficulty is the language features of the text, such as figurative language. A text with literal language would be considered easier than a text with figurative language, which would require making inferences. Qualitative factors also include text structure: it is more challenging to analyze text that does not follow traditional organization than to analyze text that is conventionally organized.

Beyond text structure difficulty, the qualitative factors of the CCSS also include schemata. If the text makes more assumptions about a reader's prior knowledge or life experiences, that text will be more challenging than a text that has fewer demands on schemata; a text that provides the reader with the information needed to analyze it is less demanding. Another qualitative factor is visual support. Text difficulty is in part contingent on the use of visual support such as graphics, maps, and images. These qualitative factors are used in conjunction with the quantitative factors to provide instructors with a clearer picture of a text's difficulty level.

While the quantitative and qualitative factors provide educators with a clearer picture of a text's difficulty, the reader represents a factor that cannot be ignored. The third factor in the CCSS is the reader and task factor (Aspen Institute, 2012). The reader and task factors consider external factors that may influence the text's difficulty such as motivation and engagement, cognitive demands of the text, schemata, complexity of content, reading skills requirement, and the difficulty level of the task and assessment. When selecting a text, teachers need to assess these factors by asking questions, such as "How challenging is the theme of this text?" The reader and task factors account for several of the language underpinnings demanded by the CCSS, such as the student's ability to focus his or her attention on the text, to remember what was previously read in longer texts, and to use prior knowledge to connect with the text during text analysis.

Another manifestation of the higher literacy demands of the CCSS is literacy demands in content areas. The CCSS have a separate set of standards for literacy in the content areas, history/social studies and science and technical subjects for students 6th grade through 12th grade. The CCSS require content-area teachers to teach their specific content text structure and

other skills germane to literacy in that area. For instance, teachers in content areas have to teach literacy standards in four main categories: summary/main idea, key ideas and details, craft and structure, and integration of knowledge and ideas (Scruggs, Brigham, & Mastropieri, 2013). The literacy standards can become problematic for content-area teachers to address, because teaching reading in content areas is more complex than teaching nonspecific reading strategies, such as summarizing (Schoenbach, Greenleaf, & Hale, 2010). Some content-area teachers may be not prepared to teach literacy skills within their content. In science, the standards demand higher-level text analysis, comprehension skills, complex vocabulary, and scientific writing, which are all troublesome areas for many students (Scruggs et al., 2013), especially students with learning disabilities and nonnative speakers.

According to K. L. Roberts (2012), the CCSS represent a significant increase in language knowledge and use demands. The changes in demands of language knowledge and use affects students with learning disabilities (LD) and English learners (ELs) because the CCSS call for a shift in text language, structure, format, and content. Therefore, ELs and students with LD have to have higher vocabularies in order to meet the higher lexile ranges of the CCSS, knowledge of different text genres (e.g., comparison and contrast, cause and effect) and their structures, and knowledge of a variety of content in order to have ample background knowledge to use during reading.

In addition to the new literacy demands, student performance in past reading and science national assessments establishes a high need for effective instruction of reading for adolescents. According to various research studies, knowledge of text structures aids in reading comprehension (Ehren, 2013; Meyer & Poon, 2001). Because secondary teachers rely on reading of text to develop content knowledge, explicit instruction of text structure is necessary.

Currently, it is possible for students in secondary grades to lack the reading skills to process expository text and construct meaning to meet the demands of the class (Ehren, 2013). Research shows that structural parts of text influences text comprehension (Chen & Donin, 1997; Englert & Hiebert, 1984; Kintsch & Van Dijk, 1978). Structural parts, such as organization and headings, delineate the main components of a text (i.e., the main idea and the supporting details). The structural parts of text and characteristics of the reader interact in a constructive process to extract information or develop meaning from text (Voss & Silfies, 1996). According to van Silfhout, Evers-Vermeul, Mak, & Sanders (2014), “When students read their school text, they may make a coherent mental representation of it that contains coherence relations between the text segments. The construction of such a representation is a prerequisite for learning from texts (p. 1036).” According to Goldman and Rakestraw (2000), readers use knowledge of text structures to process text by using their awareness of text to improve their learning. Although readers develop their knowledge of text structures from experiences, correlated with age and time in school (Goldman & Rakestraw, 2000), students’ knowledge of text structures is incomplete by the completion of high school (Chambliss, 1995). Further, ELs may not have the natural knowledge and experience needed interact with text effectively. According to Moje (2010), the reader brings word recognition knowledge, vocabulary knowledge, background knowledge, and linguistic and textual knowledge. The reader also brings specific abilities: (1) the ability to infer meaning, and (2) the ability to use comprehension strategies. However, ELs may lack one or more of these characteristics, such as linguistic and textual knowledge, background knowledge, and vocabulary knowledge. One approach to enhance the interaction between reader and text is teaching text structures, which includes vocabulary, organizational patterns, and linguistic and textual information.

In summary, the rationale for teaching text structures in three inclusive science classes is as follows:

1. There is a need for research in text structure pedagogy in response to the demands of the CCSS placed on teachers and students.
2. Knowledge of text structures improves reading comprehension (Cervetti, Bravo, Hiebert, Pearson, & Jaynes, 2009; Chen & Donin, 1997; Ehren, 2013; Englert & Hiebert, 1984; Kintsch & Van Dijk, 1978; Meyer & Poon, 2001; Voss & Silfies, 1996).
3. Knowledge of text structures improves content learning (Cervetti, Barber, Dorph, Pearson, & Goldschmidt, 2012; Goldman & Rakestraw, 2000; McNamara et al., 1996; Williams et al., 2007).
4. Knowledge of text structures adds to the repertoire of background knowledge that ELs can use to gain text comprehension (Moje, 2010).

Purpose of Study

The Nation's Report Card shed some light into the current performance of students in the United States on four academic subjects (NCES, 2013a). The report showed the need for effective teaching methods that help students improve their content learning and text comprehension. Research showed that knowledge of text structures had a positive impact on reading comprehension (Cervetti et al., 2009; Englert & Hiebert, 1984; Kintsch & Van Dijk, 1978; Voss & Silfies, 1996). Although there was some research addressing text structures and ELs, the literature in the field is primarily focuses on non-ELs. The purpose of this study was to examine the impact of explicit instruction of macro- and micro- text structures on eighth-graders'

science learning, sentence comprehension, and reading comprehension in three eighth-grade inclusive science classrooms (classrooms with both native and nonnative speakers of English).

Theoretical Framework

Transactional Sociopsycholinguistic View of Reading

This study explored the impact of explicit instruction of macrostructures plus microstructures on eighth-grade ELs' and non-ELs' reading comprehension, sentence comprehension, and content learning in three inclusive science classrooms. The theoretical framework of this study comes from research of theories on reading comprehension and reading comprehension instruction. In this study, the theoretical lenses adopted for reading comprehension comes from the work of Rosenblatt (1994) and Goodman (1994), who viewed reading as a transaction between the reader and the text. The transactional view of reading places the reader as an active participant in the reading process by interacting with the text to extract meaning (Rosenblatt, 1994). According to Rosenblatt, the reader, the context, the setting, and the text all interact, affecting one another and creating meaning. In other words, the interpretation of text may vary among readers due to the differences in their reading transaction. Although Rosenblatt's transactional view of reading explains part of the purpose of this study, it is Goodman's transactional socio-psycholinguistic view of reading that more closely encompasses the interaction that ELs have with text written in their second language, English.

According to Goodman (1994), readers interact with text during a literacy event, an interaction between the reader and the author of the text that can occur in the writing process, the reading process, or within the characteristics of the text. During the interaction, readers tentatively select graphophonics, syntax, and semantic cues to a text as they predict and infer the purpose and main idea of the text. Goodman added, "To get meaning, the reader must assign a

syntactic structure to the text” (p. 1125). In Goodman’s view, clauses are vital to comprehension because they carry the essential surface and deep elements. In other words, a group of clauses carry the macrostructures of a text while individual clauses carry the microstructures of text. In the transactional socio-psycholinguistic view, the reader’s knowledge, experience, and background knowledge impact the interpretation of text. The background knowledge that affects reading can be either content based (i.e., knowledge of the scientific method), or linguistic and text based (i.e., knowledge of syntactic structures, knowledge of organizational patterns). “Readers need to develop a sense of text appropriate to each text type in order [to] use inference and predication effectively” (p. 1128). It is the intent of this study to explicitly teach ELs and non-ELs macrostructures plus microstructures in order to improve their reading comprehension, sentence comprehension, and science content learning.

Gradual Release of Responsibility

The theoretical framework for the approach to intervention in this study was the Gradual Release of Responsibility model (Pearson & Gallagher, 1983). The Gradual Release of Responsibility model embodies Vygotsky’s Zone of Proximal Development (1978) in that it begins with the teacher at the center of the lesson modeling and teaching and slowly guiding the students toward independent learning. The Gradual Release of Responsibility model focuses on instruction and scaffolded support that help students become independent learners and assume more responsibility over time, with less support from the teacher. For this study, the researcher wanted the students to be able to take the concepts learned in the intervention, which used comparison and contrast text structures, and apply them to other text structures, such as cause and effect or problem-solution. However, it was beyond the scope of this study to determine whether students were able to transfer strategies acquired as a result of the intervention.

This study focused on eighth-grade ELs and non-ELs use of the strategies acquired from the intervention during reading comprehension extended response tasks, sentence combination task, and science multiple format exam.

Research Questions

In order to be able to analyze the students in the inclusive classrooms as a whole and be able to analyze ELs individually, this study divided the research questions into three questions addressing the performance of all the students in the study, three questions addressing only the performance of ELs in the study, and one question addressing the predictive relationship between sentence comprehension and reading comprehension. The seven research questions this dissertation studied examined are listed below:

Question 1: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' and non-ELs' science content learning as measured by unit test in three inclusive science classrooms?

Question 2: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' and non-ELs' reading comprehension as measured by the English Language Arts eighth-grade REGENTS in three inclusive science classrooms?

Question 3: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' and non-ELs' sentence comprehension as measured by the TOAL-4 in three inclusive science classrooms?

Question 4: Can reading comprehension scores be predicted by the relationship between sentence comprehension scores and reading comprehension scores in three inclusive science classrooms?

Question 5: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' science content learning as measured by unit test in three inclusive science classrooms based on language proficiency CELLA Reading anchor scores?

Question 6: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' reading comprehension as measured by the English Language Arts eighth-grade REGENTS in three inclusive science classrooms based on language proficiency CELLA Writing anchor scores?

Question 7: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' sentence comprehension as measured by the TOAL-4 in three inclusive science classrooms based on language proficiency CELLA Writing anchor scores?

Research Design

The researcher used a non-equivalent group pre-test–post-test quasi-experimental design (Campbell & Stanley, 1963; Cook & Campbell, 1979; Edmonds & Kennedy, 2013). The researcher used a comparison group that was similar to the treatment group in order to obtain information about the effects of the treatment (Campbell & Stanley, 1963). A quasi-experimental research design was appropriate for this study because of the researcher's inability to control for all variables (i.e., attrition, history, maturation) in an eighth-grade middle school setting. Although the researcher could not control all variables, by using a comparison group, the researcher found that the main effects of the uncontrollable variables affected both the experimental group and the comparison group (Campbell & Stanley, 1963). This study included students in three eighth-grade science inclusive classes.

In order to conduct the study, arrangements were made with the classroom teachers. The researcher administered the text structure treatment in an eighth-grade inclusive science classroom where the science teacher delivered science content as customary. This study had one treatment: explicit instruction of comparison and contrast macro-text structure plus explicit instruction of micro-text structures (i.e., conditional statements, comparative statements, and complex sentences). For comparison purposes, the researcher used two eighth-grade science teachers and their classrooms in the same school as the treatment group. As the comparison group, the researcher used an additional class from one of the teachers whom the researcher was using in the treatment group plus two classes from a third eighth-grade science teacher. Because one of the teachers in the treatment group taught one regular inclusive science class for advanced or honors science class, the researcher was unable to use one class from each teacher. The comparison group did not receive the macrostructure plus microstructure instruction; however, the researcher used the same assessment instruments with both groups.

Assumptions

1. Teachers in the study taught science content without teaching the discourse of science. In other words, the teachers in the study focused on teaching scientific concepts and developing students' content knowledge, and not on how to analyze the language used in science texts.
2. The number of ELs at Washington Middle School (this is a pseudonym to protect the school's anonymity): at least one EL in each intervention and comparison group.
3. ELs' and non-ELs' knowledge of text structures mediated some of the comprehension difficulties that some of the ELs' and non-ELs' in this study had in eighth-grade inclusive science classes.

4. Knowledge of microstructures leads to effective sentence and paragraph comprehension, which facilitates effective comprehension of overall text (macrostructure) for non-ELs and ELs with intermediate to advanced language proficiency.
5. Knowledge of text structures is transferrable.

Scope

Research on reading comprehension strategies is vast. Researchers have blurred the boundaries between reading comprehension strategies as instructional techniques and reading comprehension strategies as student comprehension tools. For this study, the protocol was done from the perspective of reading comprehension strategies as a teaching technique that science teachers can use to provide science literacy instruction. Although teacher techniques used during explicit instruction of strategies can lead to student comprehension tools (i.e., metacognitive strategies), this study did not examine the impact of this intervention on students' metacognition.

Delimitations

Before initiating this intervention study, the researcher identified two conditions that imposed limits on the study. They were:

1. This study used a convenience sampling method to select the school and teachers. Because the school had only three eighth-grade science teachers, it was necessary to include all three in this study.
2. The text-structure strategy was delivered as an add-on to the science curriculum as opposed to integrating it into the curriculum during planning.

Limitations

This study had some inherent limitations. First, because the study took place in one middle school in a large metropolitan school district in the Southeast United States, the student population may not be representative of all classrooms in this state or in the United States, so the findings of this study cannot be used to make general assumptions about other student populations. Further, the study was limited to the explicit instruction of the comparison and contrast macrostructure plus microstructures (i.e., comparative statements, complex sentences, and conditional statements) provided by the researcher. In other words, it may be possible that the results obtained from this study are highly influenced by the researcher's knowledge of literacy, which was knowledge that the science teachers in this study did not have. In addition, the results of this study were also limited by the duration of the study, which included two science units within one macrostructure (i.e., 10 weeks). Research studies that have had a positive impact on middle school students' comprehension included longer interventions (Ehren, 2008; Fisher & Frey, 2014; Vaughn et al., 2013). However, due to the time constraints imposed by the participating school district, this study was conducted over 10 weeks.

Due to the study's between-subjects research design, other inherent limitations to the study included maturation, testing, instrumentation, attrition, history, and selection bias (Edmonds & Kennedy, 2013). Of these threats to internal validity, the researcher addressed the threat of testing by administering one version of the test during pre-test and another version during post-test. The researcher also addressed the threat of instrumentation by using parallel versions of the Test of Adolescent and Adult Language (TOAL-4), the Regents, and science tests. The researcher addressed the threat of selection bias by randomly assigning classes to treatment group or comparison group.

Since knowledge of text structures is correlated with age and time in school (Goldman & Rakestraw, 2000), the biggest threat for this study is maturation. Therefore, the researcher used the comparison group to determine whether the performance of the treatment group was due to the explicit instruction she provided or if it was due to maturation. If the comparison group performed as well as the treatment group, the variance between the pre-test and the post-test may have been due to time spent in school and not due to the intervention. However, if the treatment group performed significantly better or showed a different progression than the comparison group, the variance between the pre-test and the post-test could be attributed to the intervention and not to time spent in school.

Significance of Study

According to the 2011 Nation's Report Card for science, only 21% of students in the eighth-grade were proficient in Science (NCES, 2012). Nationally, Hispanic students make up 35% of the students who scored below the 25th percentile (NCES, 2012). There is a need for improvement in adolescents' science content learning and reading comprehension in order to bridge the gap in student science and reading performance.

One approach that has been researched to work with ELs' and Exceptional Student Education (ESE) students' content-area learning is using a text-structure approach. Text structures embody the organization or arrangement of ideas and the relationships of ideas to one another (Akhondi, Malayeri, & Samad, 2011). When readers are aware of text structures, they can approach reading with a reading plan that aids them in unpacking the meaning of the text (Meyer et al., 1980). Students who used text-structure strategies to discriminate between important information and supporting information were able to differentiate better between relevant information and intruded information (Meyer et al., 1980). The significance of this

study was its contribution to the body of literature on adolescent literacy and reading comprehension. This study also contributed to the body of literature on text structure (both macrostructures and microstructures) and content-area literacy instruction. This study also contributed to the body of literature on reading strategies that aid ELs considering their language proficiency. This study also added to the body of literature on pedagogy because of its incorporation of instruction of science text structures and content learning to meet the Common Core State Standards (CCSS). See Table 1 for examples of English Language Arts (ELA) and writing CCSS for eighth-grade students that this study addressed during the intervention.

Table 1: CCSS Addressed in This Study

Standard	Description	Current Study
CCSS.ELA-LITERACY.RI.8.1	“Cite the textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.” (CCSS)	In the Regents, students had to use text support in order to support their answers in reading comprehension.
CCSS.ELA-LITERACY.CCRA.RL.8.1	“Compare and contrast the structure of two or more texts and analyze how the differing structure of each text contributes to its meaning and style.” (CCSS)	In the Regents, students had to read two texts and compare and contrast them in an extended response.
CCSS.ELA-LITERACY.CCRA.RI.8.5	“Analyze in detail the structure of a specific paragraph in a text, including the role of particular sentences in developing and refining a key concept. CCSS)	In the Regents, students had to read and interpret text.
CCSS.ELA-LITERACY.W.8.1.C	“Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.” CCSS)	In the TOAL, students had to combine sentences into one cohesive sentence.

Definition of Key Terms

Reading Comprehension

Reading comprehension has been defined in many ways; however, there is an acceptable consensus. Gough and Tunmer (1986) examined reading comprehension through the lens of “The simple view of reading.” According to Gough and Tunmer, reading is the product of decoding and comprehension. Gough and Tunmer’s definition of comprehension referred to linguistic comprehension, which they defined as the interpretation of lexical information, sentences and discourse. The simple view of reading does not adequately define reading comprehension, because it reduces reading to a simple calculation of decoding and understanding of language and neglects to include other necessary aspects of reading comprehension such as reading strategies.

One definition for reading comprehension that does include skills beyond decoding is the Construction-Integration (CI) Model proposed by Kintsch (2005). According to Kintsch, reading comprehension involves both the top-down and the bottom-up processes. “Bottom-up models view spoken and written language comprehension as a step-by-step process that begins with the initial detection of an auditory or visual stimuli” (Catts & Kamhi, 1999, p. 4). On the other hand, the top-down model goes beyond the visual stimuli (i.e., decoding and word recognition) and focuses on the role of schemata, inferences, content, and structure to facilitate prediction and hypothesis development (Catts & Kamhi, 1999). Kintsch (2005) proposed that there is an interaction in the top-down and the bottom-up processes. According to Kintsch, text comprehension is highly interactive, and “processes at many different levels interact—the perceptual processes involved in reading or listening, syntactic and semantic analyses, knowledge integration, as well as reasoning processes whenever they are necessary” (p. 129).

According to this perspective, reading comprehension requires students to have multiple skills, such as knowledge of text structure, skills to find the main idea, ability to discern supporting details, and readiness to summarize, among other skills (Watson, Gable, Gear, & Hughes, 2012). In order for comprehension to take place, readers need the ability to make connections within the text to see how all of the pieces of the written text connect to form a whole (Watson et al., 2012). Reading comprehension skills can be divided into micro level skills (i.e., word identification) and macro level skills (i.e., making inferences). At the base of these skills is phonological processing, a crucial skill for decoding words. The ability to decode words affects reading comprehension; however, there are individuals who have proficiency in phonological processing and still have difficulty in reading comprehension, which supports the idea that readers need more than word-level skills for reading comprehension (Watson et al., 2012).

According to the National Reading Panel (2000), reading comprehension is a complex cognitive process that requires vocabulary knowledge to understand the text, and it is an active process where the reader intentionally and thoughtfully interacts with the text (p. 13). Although ample research has been done on the positive impact vocabulary has on comprehension (Hsueh-Chao & Nation, 2000; Laufer, 1998; Nation & Webb, 2010), readers still need other cognitive strategies to aid in comprehension when vocabulary alone cannot yield text meaning. Therefore, for the purpose of this study, reading comprehension is defined as a combination of skills and knowledge used by the reader to extract meaning from text(s).

English Learners

According to the Florida Statutes, an English Learner (EL) is defined as:

1 - a. an individual who was not born in the United States and whose native language is a language other than English;

b. an individual who comes from a home environment where a language other than English is spoken in the home; or

c. an individual who is an American Indian or Alaskan native and who comes from an environment where a language other than English has had a significant impact on his or her level of English language proficiency; and

2. Who, by reason thereof, has sufficient difficulty speaking, reading, writing, or listening to the English language to deny such individual the opportunity to learn successfully in classrooms where the language of instruction is English.

(Florida Statutes 1003.56, 2014)

For the purpose of this study, an EL is defined in accordance with Florida Statutes 1003.56 and in accordance with the participating school district's definition of English Learners. The terms English Learner (EL) and English Language Learner (ELL) are synonymous. In the participating school district, ELs are coded by proficiency levels according to their Comprehensive English Language Learning Assessment (CELLA) scores. For example, the following codes are used in the participating district:

- (1) An LY student is a EL in a specialized classes designed for students with Limited English Proficiency (LEP).
- (2) An LP student is a student who is pending the reading/writing proficiency test; An LF student is a student who has exited the specialized program and is being monitored for two years after exit.
- (3) An LZ student is a student who has completed the two year monitoring.
- (4) And a TN or ZZ is a student who did not qualify for EL services (Title III Annual Evaluation Report 2006 - 2007).

An eligible ELL (LY) 4-12 student is a student who has scored non-English or limited English proficient in an aural/oral state approved test or a student who has scored fluent English proficient, but who scored less than 51% on a state approved reading and/or writing test

(Title III Annual Evaluation Report 2006 - 2007, p. 3).

Text Structures

Text structures are the organization or arrangement of ideas and their relationships to one another (Armbruster, 2004). When readers are aware of text structures, they can approach reading with a reading plan that helps them unpack the meaning of the text (Meyer et al., 1980). Text structures can be divided into two portions, macrostructures and microstructures. For the purpose of this study, the macrostructure of a text is the genre (i.e., narrative, expository). This study focused on only one macrostructure, comparison and contrast. According to Meyer (1985), macrostructures of texts are classified as description, sequence, comparison and contrast, cause and effect, and problem and solution. Similarly, for the purpose of this study, the microstructure of a text refers to the grammar and syntax. Thus, researchers who study microstructures of text are examining sentence components, such as linguistic connectives and sentence combinations (Pearson & Camperell, 1994).

Text Features

Text features are the organizational features authors use to construct their article or chapter. For the purpose of this study, text features included titles, headings, bolded letters, italicized letters, images, charts, diagrams, and captions.

Inclusive Science Classroom

An inclusive science classroom is a classroom that has students of diverse backgrounds, such as ELs who have been mainstreamed and students with learning disabilities (LD) who have been mainstreamed as well. For the purpose of this study, an inclusive science classroom is a general education class of science whose population is diverse in terms of race, ethnicity, language proficiency, and academic performance.

Reading Comprehension Strategies Versus Instructional Strategies

The term *reading comprehension strategies* has been used liberally to mean any strategy that aids in reading comprehension, not distinguishing between reading comprehension strategies as a reader tool to monitor comprehension and aid in establishing a process to fix misunderstandings in comprehension (Davis, 2010), and instructional strategies as teaching tools educators can use to guide students through text comprehension (Davis, 2010). For the purpose of this study, reading comprehension strategies are tools readers can use on their own to increase comprehension of text, and instructional strategies, techniques, or methods are the teaching tools educators use to help students comprehend text.

Explicit Instruction

Explicit instruction was defined by Ellis (2006) as “instruction aimed at inducing learners to think consciously about some sort of rule” (p. 24). For the purpose of this study, explicit instruction is instruction with the intent to raise learner awareness about a specific rule or construct.

Guided practice

According to Burns and Richards (2012), during guided practice the teacher provides the learners with questions that will allow learners to self-direct through a process. For the purpose of this study, guided practice is practice of the approach modeled with the guidance of the researcher. The researcher will guide students using leveled questioning and scaffolding of concepts.

Organization of Study

This study was organized to follow a logical progression. Chapter 1 presented the background for the study, the purpose statement along with the theoretical frameworks, underlying assumptions, limitations, the significance of the study, and definition of key terms, which operationalized several terms for this study.

Chapter 2 contains a review of the literature on reading comprehension and text structures. Chapter 3 delineates the methodology for this study. Chapter 4 presents the analysis for the data collected, and Chapter 5 provides a summary of findings, discussions, and recommendations, concluding the dissertation.

Summary

This chapter presented a synopsis and an outline for the current study, the statement of the problem, the purpose of the study, theoretical framework, research questions, research design, assumptions, limitations, significance of the study, and definitions of key terms. This study examined the impact explicit instruction of macro- and micro-text structures had on eighth-grade ELs' and non-ELs' science learning, production of syntax, and reading comprehension in three inclusive science classrooms.

CHAPTER 2: LITERATURE REVIEW

Introduction

This study investigated the impact of explicit instruction of macro- and micro- text structures on eighth-graders' science learning, sentence comprehension, and reading comprehension in three eighth-grade inclusive science classrooms (classrooms with both ELs and non-ELs). This area of study is important for several reasons, including adolescent performance in national science measures and the gap in literacy of adolescents in the United States. Although adolescent assessment data recorded a small improvement in adolescent reading comprehension from 2011 to 2013 (NCES, 2013a), student performance in national assessments is low. The current changes to adolescents' literacy demands come from the Common Core State Standards (CCSS), which include higher demands for knowledge of text structure.

The current body of literature on reading comprehension is extensive in many areas but scarce in others. The body of literature on reading comprehension literature distinguishes teacher techniques to improve reading comprehension and student metacognitive strategies to improve reading comprehension. It also distinguishes between reading comprehension and content learning approaches for primary grades as well as the demands of text structures when shifting from narratives to expository texts in primary grades. The body of literature on reading comprehension from a broad perspective is extensive, but when looking through the narrow lens

of reading comprehension in science middle school inclusive classes, the body of literature becomes scarce.

Relevant research on adolescent reading comprehension and content learning was explored. This review of the body of literature was centered on the following sub-topics: literacy demands in primary grades versus literacy demands in secondary grades, literacy demands in science classes, language demands for adolescent ELs, metacognitive strategies for reading comprehension, and teacher techniques.

In a meta-analysis of reading comprehension strategies taught to elementary and middle school students, including a student population of 10,765, Davis (2010) found that the greatest impact of reading comprehension was from measures of strategy knowledge and strategy use, with multiple comprehension strategies having a high impact on achievement of students in fourth through eighth grades. Several studies focused on reading comprehension strategies, such as reciprocal teaching, think-aloud instruction, and peer-assisted learning. The studies, however, include the analysis of such strategies on children in fourth grade, with approximately 20% of research on reading comprehension strategies including fourth graders. Only 6% of research included students in eighth grade, and 8% of studies focused on ELs and reading comprehension strategies (Davis, 2010).

Literacy Demands in Primary Grades Versus Literacy Demands in Secondary Grades

Literacy demands for young children differ from the literacy demands for adolescents. In primary grades, the focus is on developing and improving the five core components of the reading process as established by the National Institute of Child Health and Human Development (NICHD) in 2000. These five components are known as the “Fab Five,” and they include phonemic awareness, phonics, fluency, vocabulary, and reading comprehension.

Researchers have examined the development of reading comprehension and found several developmental markers for reading comprehension (Rupley & Willson, 1996; van den Broek, 1989; van den Broek, Lynch, Naslund, Ievers-Landis & Verduin, 2003; Willson & Rupley, 1997). According to van den Broek (1989), children by the age of eight are able to identify the protagonist's goals and intentions. By age nine, children can use text information and pay attention to text content to extract meaning (Rupley & Willson, 1996; Willson & Rupley, 1997), and by age 10, children can understand causal relationships in longer text (van den Broek, 1989). According to van den Broek et al. (2003), children in the third grade are able to infer main ideas from text, but they do so with less accuracy than older children. By fourth grade, children have developed several of the basic processes of reading and writing, but they still need to develop and master literacy practices unique to varying levels, disciplines, texts, and situations (Sipe, 2009).

Kaplan (2013) analyzed the development of reading comprehension of four age groups (ages were correlated to grade levels: fourth grade, seventh grade, eleventh grade, and adults in their 20s and 30s) and found that reading comprehension scores increased from some age groups (fourth grade to seventh grade and seventh grade to eleventh grade) but not from adolescents in eleventh grade to adults. Kaplan (2013) looked at the readers' ability to answer literal questions, inferential question, metatextual questions (going beyond the text), and integrative questions (make conclusions using various parts of the text) when reading either narrative or expository text. She found that children in both third grade and fourth grade were able to answer literal questions but had difficulty answering inferential and metatextual questions in both narrative and expository text, suggesting that children have difficulty making connections from text to the real

world and that cognitively, children are processing reading from a bottom-up approach, attending to only one aspect of text at a time.

Adolescents cannot afford to attend to one aspect of text processing at a time. One reason adolescent need more reading processes and skills is because text becomes more complex as readers get older when it shifts from narrative text to expository text (Akhondi et al., 2011; Wolfe & Goldman, 2005). Narratives are considered easier to follow since they are organized sequentially through the use of successive events (Berman & Katzenberger, 2004; Longacre, 1996). Expository text, on the other hand, requires lexical knowledge in order for the reader to construct relationships that are necessary for recalling content (Wolfe & Goldman, 2005). Expository texts require readers to process textual elements to use as signals of macrostructure organizations (Goldman & Rakestraw, 2000). Beyond the cognitive demands, expository texts are also challenging because they are used to convey information and are commonly used in educational environments (Nippold & Scott, 2013), which limits the readers' exposures to expository text by confining it to the field of teaching and learning (Boscolo, 1990). Expository text requires readers to manage various details from the text while managing uncommon abstract ideas and concepts. Researchers argued that readers must have extensive discourse experience and cognitive abilities in order to meet the demands of expository text (e.g., stylistic devices, textual cues, and structural organizations) (Goldman & Rakestraw, 2000; Meyer & Poon, 2001).

According to Fang and Schleppegrell (2008), expository texts are more abstract and denser than text for children. Researchers argued that reading expository texts requires knowledge of text structures (Ehren, 2013; Meyer & Poon, 2001), vocabulary (Hsueh-Chao & Nation, 2000; Laufer, 1998; Wolfe & Goldman, 2005), background knowledge (Duchan, 2004; Ozuru, Dempsey, & McNamara, 2009), and reading strategies (Collins Block & Pressley, 2003).

The demands for syntax, semantics, schemata, and metacognition are different for adolescents than those for children during reading. Without explicit instruction, readers may not learn how to construct meaning from text (Ehren, 2013) and may find it difficult to read (Fang & Schleppegrell, 2008). Expository texts, especially those in content areas, require additional reading skills and practice.

As a result of the increased text complexity, reading comprehension for adolescents is a complex process that requires multiple simultaneous processes. Adolescents must be able to process to integrate both bottom-up processes and top-down processes in order to identify the overall structure and meaning of the text in its entirety (Perfetti, 1991). In other words, adolescents must be able to simultaneously process words and syntax as well as use background knowledge and make connections in order to make inferences and gain global understanding of text.

The reading comprehension skills required for adolescents need to be explicitly taught to students, especially struggling readers (Ehren, 2013; Rapp, van den Broek, McMaster, Kendeou & Espin, 2007; Roe, Stoodt, & Burns, 1991). Explicit instruction of reading comprehension strategies provides students with a clear understanding of how to use the strategies over a period of time before being able to own the strategies and use them independently (Bluestein, 2010). According to Bluestein (2010), “When we unpack a strategy completely for students, we ensure their abundant internalization of our instruction” (p. 597). However, reading strategies need to be taught one at a time, over a prolonged period of time using the gradual release method, where the teacher teaches the strategy, models it, guides the students to use it, and then allows the students to try it on their own (Block & Pressley, 2003).

A Framework for Reading Comprehension

Due to the higher demands for adolescent literacy, it is critical that adolescents receive effective strategic instruction in order to become strategic readers. With the CCSS focus on text structures and text complexity, adolescent readers need knowledge and multiple skills to be successful readers. First, readers need to understand the demands of the text in order to plan accordingly to tackle it. Readers must be able to bring their experiences with content and their knowledge of text to the reading transaction. For ELs, the requirements are higher. English learners must bring the necessary second language (L2) vocabulary, knowledge of syntax in L2, knowledge of macrostructures in L2, and knowledge of reading strategies, plus their experiences with content matter. The current results in reading performance for adolescents in the United States shows that students are struggling to meet the demands of literacy (NCES, 2013a).

The reading comprehension model for this literature review comes from Goodman's (1994) transactional socio-psycholinguistic view of reading. According to Goodman, reading is an interaction between the reader and the characteristics of text. During the interaction, the reader is assigning microstructure cues to text to aid in the prediction of the text's purpose and main point. From Goodman's view, sentence clauses are instrumental in carrying essential pieces of information that contribute to the macrostructures of text. As such, it is the reader's content, linguistic, and text-based knowledge along with the reader's experiences that impact the interpretation of text.

Goodman's model (1994) provides a framework for the reading comprehension process and highlights the need for linguistic, text, and content knowledge, but non-ELs and ELs may struggle to achieve a successful reading transaction for several reasons. For ELs the need for linguistic background knowledge in their L2 is critical; without linguistic proficiency ELs may not be able to access any reading strategies (Laufer, 1998) even if they possess such strategies in

their first language. For both ELs and non-ELs, another roadblock in the reading transaction may be lack of fundamental reading skills typically acquired in primary grades (Fang & Schleppegrell, 2008). As noted in the socio-psycholinguistic model, reading is a transaction between the reader and the text. This review highlights research on reading comprehension as it pertains to adolescent readers, both ELs and non-ELs.

Adolescents' Reading Comprehension

Reading comprehension during the adolescent years is a complex process that is impacted by properties of the text and characteristics of the reader (McNamara et al., 1996). To mediate the challenges of reading comprehension for adolescents, teachers must explicitly teach reading strategies (Barber et al., 2005; Ehren, 2013; Klingner, Boardman, Eppolito, & Schonewise, 2012; Staskowski & Creaghead, 2001). Research on teaching reading strategies to improve adolescent reading comprehension have focused on strategies that improve background knowledge (Duchan, 2004; McNeil, 2012; Ozuru et al., 2009), vocabulary (Cain & Oakhill, 2011; Goodwin, Gilbert, Cho, & Kearn, 2014; Nassaji, 2006; Seifert & Espin, 2012), questioning (Carlson et al., 2014; Ehren, 2008), and text structures (McNamara et al., 1996; Pearson & Camperell, 1994). In a six-month intervention study, Gayo et al. (2014) explored the impact of strategic and metacognitive reading instruction on 49 fifth graders and 45 sixth graders who received explicit instruction of reading strategies using *Aprender a Comprender*. The participants received 60-90 minutes of instruction once a week for six months. The results of this intervention study revealed that there was a statistical difference in reading comprehension for fifth graders and sixth graders. The researchers also found a statistically significant difference in the students' use of planning strategies, and they were able to continue using the strategies over time.

Research concludes that to provide students with effective reading comprehension strategies, teachers must explicitly teach strategies and how to use the strategies (i.e., how to use prior knowledge to set a purpose for reading) (Fielding & Pearson, 1994). According to Duke and Pearson (2008), teaching reading comprehension strategies needs to use a balanced approach where students receive both explicit instruction of the strategy and time to practice using the strategy. Several research studies found that vocabulary is critical to achieve reading comprehension (Collins Block & Pressley, 2003; Hsueh & Nation, 2000; Laufer, 1998). However, adolescent reading comprehension requires more than word-level processing (Collins Block & Pressley, 2003; McLeod & McLaughlin, 1986; Snow, 2002). Researchers have found that proficient readers are active readers who use strategies during reading (Collins Block & Pressley, 2003). Proficient readers use various strategies, such as prediction, questioning, visualization, implementation of prior knowledge, self-monitoring, summarizing, and seeking clarification (i.e., rereading, using reference materials), during reading (Collins Block & Pressley, 2003). The strategies that proficient readers use are typically unseen because they are metacognitive processes. However, poor readers do not use such strategies (Fisher & Frey, 2014; Piper, 1994). Research has shown that students benefit from explicit comprehension strategy instruction (Collins Block & Pressley, 2003; Duke & Pearson, 2008; Zhang, 2001) implement over a prolonged period of time because readers need time both to learn and to apply the strategy during reading (Ehren, 2008). According to Vacca and Vacca (2005), reading strategy instruction follows four essential steps:

- (1) teachers must explain the usefulness of the strategy, explain when it is to be used, and recap the steps necessary to apply the strategy;
- (2) teachers must demonstrate how to implement the strategy through think-aloud;

- (3) teachers must provide guided practice and opportunities for peer modeling and think-aloud;
- (4) teachers must create opportunities where students can apply strategies independently (pp. 46-47).

The steps delineated by Vacca and Vacca (2005) were echoed in Duke and Pearson (2008), except Duke and Pearson emphasized that guided practice using the strategy needed to be taught using the Gradual Release of Responsibility model.

“Successful reading comprehension depends not only on readers’ ability to access appropriate content and formal schemata. It also depends on their ability to monitor what they understand and to take appropriate strategic action” (Casanave, 1988, p. 283). Reading comprehension requires the concomitant factors of phonological awareness, vocabulary knowledge, fluency, and cognitive awareness. There is a link between cognitive awareness and reading comprehension (Ferrer et al., 2007). Reading comprehension requires readers to have metacognitive skills that allow them to know information that affects reading but is outside the text. For example, readers have to have knowledge of what they and others think about the subject (Westby, 2004). In addition, metacognition extends to the knowledge of texts where readers have to be aware of the various demands of texts (Westby, 2004). In other words, the reader knows that the demands of an expository text are different from those of a narrative text or knows the difference in demand between nonfiction and fiction.

According to Westby (2004), “Metacognitive knowledge includes information that students know about themselves as learners, the nature of the material they are to learn, the task demands, and expected outcomes” (p. 402). It is important to note as text types and complexity levels increase, so do the cognitive demands for older students, which, in turn, require students to

have more metacognitive skills. Once the readers are cognizant of the different linguistic, cognitive, and strategic demands each text poses, they can learn to self-regulate during reading. Self-regulation is the student's ability to check his or her progress during reading, set task goals, acknowledge self-competencies as they are needed for the task at hand, and adjust by selecting and implementing strategies to successfully handle the task of reading (Westby, 2004).

Adolescents need learner tools to use during reading in order to meet the demands of text structures, background knowledge, and vocabulary knowledge (Westby, 2004). These knowledge types come together to assist in academic reading comprehension, such as making inferences about the text and identifying the author's purpose. However, the implementation of strategies varies from reader to reader. Several research studies have noted that a Matthew Effect ("the rich get richer and the poor get poorer") exists in the implementation of strategies during reading. Good readers implement effective reading strategies to their reading while poor readers do not (Stanovich, 1986).

The difference in readers' languages may impact their use of strategies. Mokhtari and Sheorey (2002) examined the differences in the self-reported use of reading strategies by ELs and non-ELs during academic reading. They suggested that metacognitive strategies are intentional strategies readers implement to monitor and manage their reading, and cognitive strategies are strategies readers implement to correct any misunderstanding with the text.

In a longitudinal study, Kolić-Vehovec, Zubković, and Pahljina-Reinić (2014) explored metacognitive developmental changes of reading strategies and attitudes towards reading of 175 participants ages 10 to 14. The researchers assessed the students in the Spring of their fourth grade, again in the Spring of their sixth grade, and once again in the Spring of their eighth grade. They found a continuous development of metacognitive knowledge of reading strategies. The

researchers attributed the variance to attitudes toward academic reading and recreational reading, so when attitudes toward recreational and academic reading were high, the scores were high as well.

Metacognitive strategies aid in language learning for ELs. According to Zhang (2001), ELs learn best in a well-structured environment with pedagogical support, sufficient time, and opportunities to develop strategies necessary for meaningful learning. ELs benefit from explicit metacognitive strategies that aid in language development. Although ELs may have a model of language and strategies for learning, ELs with low language proficiency may not be able to utilize some strategies because of limitations imposed by their lack of language proficiency. Nevertheless, reading strategies are crucial for adolescent reading comprehension of text. Table 2 compares studies on instructional strategies.

Table 2: Studies on Instructional Strategies

Author(s) (year)	Samp. Size (N)	Grade or Age	Control or comparison Group Y/N	Strategy	Dosage	Length	Results
Bos et al. (1989)	50	Mean age 16:2	Yes	Strategic Feature Analysis (FSA)	50 minutes	Two days	Adolescents with LD performed better in vocabulary measures. Prior knowledge was a significant contributor to reading comprehension. There were no differences in content learning or instruction type over time.
Klinger & Vaughn (1996)	26	7 th 8 th	Yes	Reciprocal Teaching	40 minutes a day	27 days	Both students in reciprocal teaching with cooperative groups and students in reciprocal teaching cross-age tutoring improved in reading comprehension of social studies text. No significant difference between groups.
Cantrell et al. (2010)	365	6 th 9 th	Yes	Learning Strategies Curriculum (LSC)	50-60 minutes/ 5 days a week	One year	Sixth graders showed a significant reading comprehension.
Vaughn et al. (2011)	782	Ages 15-17	Yes	Collaborative Strategic Reading	50 minutes a day/ twice a week	18 weeks	Students in the treatment group outperformed students in the comparison group on standardized reading measures.
Barber et al. (2015)	287	6 th 7 th	No	USHER	45 minutes/ 5 days a week	One year	Sixth grade ELs' self-efficacy was a predictor for reading comprehension. Teacher support impacted reading comprehension scores in social studies.

Macrostructures and Reading Comprehension

The macrostructure of a text can affect reading comprehension and the ease of reading (Cervetti et al., 2009). Some researchers claimed that reading comprehension of narrative text and expository text are different, with expository text being more difficult to comprehend than narrative text (Graesser, Singer, and Trabasso, 1994). According to White (2012), genre-specific cues that contain predictable structural elements, such as chronological order in a narrative, facilitates finding the information needed to answer comprehension questions in national assessments. Englert and Hiebert(1984) posited that comprehension of expository texts was related to grade level and reading ability, and in a study of 76 third graders and 70 sixth graders they found that knowledge of discourse type impacts reading comprehension of expository texts.

Expectations of a genre may trigger reading comprehension strategies that are specific to a genre (Zwaan, 1994). Zwaan explored how the knowledge of the macrostructure of texts impacts reading comprehension. Zwaan, studying 36 undergraduate Dutch students, sought to analyze the differences between two narrative text types, news and literary. He examined the participants' performance in four test categories: (1) text sentences, (2) close paraphrases of text sentences, (3) inferences, and (4) distractors. The literary text entailed more complex processing because it required retaining irrelevant pieces of information in the active state longer due to the information's potential-but as-yet-unknown relevance to the overall text. In contrast, the news text entailed simpler processing because irrelevant information could be discarded faster. Zwaan found that students in the news condition were able to construct stronger causal-situation representation than the students in the literary condition. According to Zwaan (1994), the findings were due to the participants' expectation of the text:

Reader's expectation that they were reading literary stories caused them to allocate more resources to surface-level and text base-level processes, whereas the expectation that they were reading news stories caused other readers of the same text to allocate more resources to the construction of a causal-situation model. (p. 930)

In other words, the knowledge of macrostructures of text aided readers in establishing appropriate expectations for text reading, which allowed readers to use the appropriate resources to establish text comprehension (Zwaan, 1994).

According to Chambliss (1995), text structures can influence the organization of a reader's response. In a study of 71 high school students, including approximately 40 ELs, Chambliss analyzed the readers' ability to recognize the argument pattern. Utilizing several factors (i.e., claim familiarity, claim position, text signaling, text replicate, order, and text structure) in the study, Chambliss (1995) found, "regardless of task or measure, text structure strongly and consistently affected reader's responses" (p. 790). Chambliss (1995) also assessed 60 participants' ability to identify the claim of an argument. The results of the second experiment showed that competent readers use alternative strategies for identifying the claim when the claim is not explicitly stated; for instance, readers used the patterns in the content to support what they assumed the claim to be. Last, using 51 participants, Chambliss conducted an experiment to determine whether participants can construct the argument's gist. Chambliss found that the text's complexity affected the students' organization of their response, so students mimicked the text's pattern to construct their response. Overall, Chambliss' findings suggest that text structure and summaries located in the conclusion aid effective readers in understanding the meaning of the text. In addition, the argument's schemata along with text cues help effective

readers link the claim and evidence into their construction of the main idea of the text (Chambliss, 1995).

Armbruster et al. (1987) assessed the impact of text structures on 82 fifth-grade struggling readers (the participants were reading at least one grade below grade level). The students were put into either the structure training group or the comparison group. The structure training group comprised three conditions: (1) structure training, (2) summarizing, and (3) discussion. The intervention took place over 11 consecutive school days for 45 minutes each day. The researchers found that students in the structure training group improved their ability to identify and write about the main idea of a text when reading silently. In addition to the differences between groups, the researchers also found differences between literacy levels. Students with higher literacy performed better than students with intermediate or low literacy in written summaries measures, with the students in the treatment group receiving higher ratings. These results suggest that teaching text structures allows students to improve both comprehension of text and ability to write about the main propositions of the text.

Microstructures and Reading Comprehension

Comprehension of microstructures may affect reading comprehension because as the complexity of sentence structures increases, individuals may decode and interpret the sentences in multiple ways (Gennari & MacDonald, 2008). For one, syntax impacts adolescent reading comprehension (Abrahamsen & Shelton, 1989; Guthrie, 1973; White, 2012). According to White (2012), syntactic structures can both facilitate and inhibit reading comprehension in national assessments. White found that syntactic cues, which highlighted information, facilitated reading comprehension, yet syntactic embedding and propositional density—sentences that included subordinate clauses that represented a proposition—inhibited comprehension. According to Fang

and Schleppegrell (2008), syntax is more germane for adolescent reading comprehension than for child reading comprehension because expository texts for adolescents uses more grammatical devices and becomes more distant, impersonal, and authoritative. For instance, expository scientific text contains more passive voice and declarative sentences among other sentence structures that differ from the sentence structures in narrative text. Syntax has a positive effect on reading comprehension, especially when it is combined with semantics (Seifert & Espin, 2012).

Gennari and MacDonald (2008) attempted to investigate two things: “(a) whether object relative clauses display parsing and semantic indeterminacy as they unfold over time, analogous to more traditional syntactic ambiguities, and (b) whether the activation of various competing interpretations (indeterminacy) can account for comprehension difficulty” (p. 162). According to Gennari and MacDonald (2008), the constraint-based approach claimed that both structural and semantic indeterminacies are activated analogously. Gennari and MacDonald (2008) suggested that, “Independent of structural ambiguity, semantic and syntactic indeterminacies may emerge from activation of several alternative structures” (p. 164). In other words, students may experience sentence comprehension difficulties due to alternative text structures and alternative interpretations. In addition, Gennari and MacDonald argued that students had difficulty processing infrequent and unexpected sentence structures because more frequent alternatives competed with rare structures. It is the occurrence or scarcity of occurrence of complex, difficult micro-text structures that make sentence comprehension in content areas such as science difficult (Pyburn & Pazicni, 2014).

To exemplify the focus on microstructures, Nation and Snowling (2000) investigated the factors that affect syntactic awareness skills in children (n=30: 15 struggling readers and 15 normal readers) ages six to 11. Matching the participants by age, decoding skills, and nonverbal

ability, the researchers assessed syntactic comprehension using reversible and nonreversible passive sentences (reversible: *John was kicked by Mary*, which can also be *Mary was kicked by John*; in nonreversible sentences this is not a possibility), and they assessed syntactic comprehension using reversible and nonreversible passive sentences along with a medium, such as *John kicked the ball to Mary*. To assess the participants' syntactic awareness skills, Nation and Snowling (2000) scrambled some of the sentences, played the sentences for the participants, and asked them to correct the sentences orally. The results identified that the participants' ability to correct the word order was sensitive to the syntactic complexity of the sentence and semantic factors.

Similar to the findings of Nation and Snowling (2000), Mokhtari and Thompson (2006) examined the relationship between syntactic awareness and reading comprehension, specifically, the participants' awareness of syntactic structures and their ability to manipulate those structures. The researchers sampled fifth-grade readers ($n = 32$), of whom some may have been students with learning disabilities, to find out whether difficulties in reading were associated with syntactic awareness and whether syntactic awareness influenced reading fluency. Using the *Test of Language Development-Intermediate* (TOLD-II: 3) to evaluate syntactic awareness and use of various aspects of grammatical and syntactic abilities, the NAEP'S *Integrated Reading Performance Record* (IRPR) to assess reading fluency, and the *Gates-MacGinitie Reading Test* and the *Oklahoma Criterion-Referenced Reading Test* to assess comprehension, the researchers found that oral reading fluency was significantly related to the participant's level of syntactic awareness (Mokhtari & Thompson, 2006). The researchers also found that syntactic awareness had a positive relationship with levels of comprehension.

Knowledge of syntax grows with the natural development of children and continues to develop into adulthood, but age is not a reliable predictor of syntactic development (Nippold, Mansfield, & Billow, 2007). Syntactic development in adults is guided by intellectual stimulation because unlike children who acquire new syntax as they are exposed to language, adolescents and adults have to synthesize existing structures to produce longer structures with multiple utterances (Nippold, 1998). While development of syntax is a natural process, individuals with LD have difficulty in processing syntax (Ward-Lonergan, Liles, & Anderson, 1999). Researchers have found that there is a difference between the syntactic complexity in expository discourse and that of narrative discourses when individuals were asked to produce language (Nippold et al., 2007; Ward-Lonergan et al., 1999). According to Nippold et al. (2007), the type of topic and question influences the use of syntactic structures. Nippold et al. (2007) sought to investigate syntactic complexity in expository discourse to establish a normative base for the genre by age, and they found developmental differences between groups. They also found that the speaker's knowledge and interest in the topic impacted the syntax complexity in their response.

Hay and Moran (2005) found differences between the syntactic complexities of responses based on type of discourse. The researchers also found differences in the use of propositions, episodic structure components, and global story components between individuals with LD and individuals without LD. Students with reading disabilities can improve reading accuracy and comprehension performance. Gillon and Dodd (1995) implemented a six-week long intervention where the students ($N = 10$) were divided into two equal groups and received 12 hours of training on phonological awareness using a metalinguistic approach and semantic-syntactic training using a thematic approach to expand vocabulary and sentence structure knowledge. Within the groups,

one group received phonological training first and then semantic-syntactic training, while the second group received the training in reverse order (Gillon & Dodd, 1995). Upon analysis, the researchers found that once the students received the direct instruction on spoken language through phonological and semantic-syntactic intervention, the participants increased in both reading accuracy and reading comprehension, $t(9) = 2.764, p < .05$.

Another method to mediate syntactic difficulty is to use syntactic cues to help with comprehension of sentences. According to Guthrie (1973), when participants in a study were faced with an alternative for a verb or a function word, they used syntactic cues; however, when the participants were faced with a noun or modifier alternative, they relied on semantic/lexical cues. The purpose of Guthrie's 1973 study was to compare the reading comprehension rates of good readers to poor readers during silent reading. In addition, he sought to answer the question, "To what extent are syntactic cues used differently by good and poor readers in silent reading?" (p. 295). Guthrie (1973) assessed the differences between poor readers and good readers by comparing 12 students with learning disabilities to 12 students without disabilities. In addition, to compare the students with disabilities to peers of comparable capacity, Guthrie had an additional group of 12 students without disabilities who were younger than the students with disabilities. The students with disabilities were mixed in terms of disabilities; some of the students had low IQs while others had normal IQs but another disability. Guthrie (1973) required the children to read a passage silently and select an alternative within a set of three vertical alternatives. The alternatives occurred in nouns, verbs, modifiers, and function words. Guthrie (1973) found that there was a difference between students without disabilities and students with disabilities in reading performance of the seven maze activities ($F = 63.45, df = 2/33, p < .01$). In addition, Guthrie (1973) found that syntactic responses were lower for nouns

and modifiers than for function words and verbs ($p < .05$). Guthrie's findings suggest that syntax and semantics work together to aid in sentence comprehension.

Another concomitant factor that may play a role in the effective use of syntax to aid in sentence comprehension is memory. Because semantics affects the use of syntax for comprehension, Batey and Sonnenschein (1981) assessed reading problems in children with learning disabilities (LD) to determine whether reading problems were caused by problems in decoding the written prose. They evaluated three possible hypotheses for reading problems in children with LD: (1) attentional deficit, (2) memory deficit, and (3) syntactical awareness. The participants for the study included 18 children with LD and 18 children without an LD. To assess the differences between the two groups of participants, the researchers matched the participants by initial decoding skills, not by chronological age. The children with LD were an average age of 12 years and 3 months while the children without an LD were an average age of 7 years and 9 months (Batey & Sonnenschein, 1981). Since the purpose of the study was to investigate the role of attention, memory, and syntactic awareness on the decoding aspect of reading, the researchers taught all of the participants the words that would be in the passage individually until each participant reached a mastery threshold of three consecutive errorless trials (Batey & Sonnenschein, 1981). The students were randomly assigned a passage with normal English syntax or a passage with a scrambled English syntax, which the participants read immediately after reaching the mastery threshold and again one week later (Batey & Sonnenschein, 1981). Batey and Sonnenschein (1981) found that children with LD took longer to reach mastery threshold in vocabulary learning [$t(34) = 2.97, p < .01$]. In addition, the researchers found that although the children with LD had mastered the vocabulary words in the paragraph prior to reading, they still performed more poorly than children without an LD, specifically in the

repeated measure ($p < .05$) (Batey & Sonnenschein, 1981). The researchers attributed the reading difficulty with decoding a written prose to problems in retrieval, not attentional deficit or syntactic awareness. On the other hand, the researchers conceded that although syntax plays a role in reading comprehension, it did not play a role in decoding written prose.

According to Pearson (2013), in order for readers to process syntax, they must mentally process some content first. In a study of 64 third- and fourth-grade middle-class proficiency readers, Pearson sought to determine how linguistic variables affect the way children comprehend verbal data. He found that when students had to process information and provide an output, the presence of cues in text yielded the presence of cues in output, and the absence of cues in text still yielded the presence of cues in output, but with higher errors in output. This provides insight into how syntax is processed and how it influences reader responses. Pearson (2013) argued that the findings of this study had pedagogical implications that did not support the notion that the difficulty of text can be reduced by eliminating subordinating constructions or reducing sentence length.

Discourse Markers

Microstructures refer to syntax and to the discourse markers used to combine sentences. Discourse markers are words that signal relationships between clauses; these connectives help readers construct meaning (van Silfhout et al., 2014). Syntactic structures, such as compound sentences or compound-complex sentences, may use conjunctive adverbs to establish the relationships between independent clauses; in such case the conjunctive adverb would be the connective. Proficient readers use connectives to establish coherence, and their experience with text helps them construct coherence even in text that scarcely uses connectives, such as academic textbooks (van Silfhout et al., 2014). According to van Silfhout et al. (2014), text using a

continuous layout and connectives helps students read faster and achieve higher reading comprehension scores. White (2012) highlighted the usefulness of discourse markers in his study of national assessments tasks and analysis of how text features and structures either facilitated or inhibited students' correct response. White found that discourse markers acted as facilitators of meaning because they highlighted and demonstrated relationships between ideas in the text.

Text Features

Text features can aid students in reading comprehension. For example, "text headings may signal the organizational structure of the text," and "different typefaces alert students that a word is important" (Sheridan-Thomas, 2008, p. 173). According to White (2012), if text features are irrelevant, unclear, or misleading, they may act as an inhibitor of comprehension; for example, if the bolded letters in the text are not germane for overall comprehension or for responding to comprehension questions. White separated text features into typographical devices and organizational devices. Regarding typographical devices, she posited,

The use of typeset matters such as boldface, italics, font size, and so forth to highlight some words in the text; such devices are facilitators if they direct attention to task-relevant information but inhibitors if they direct attention to irrelevant information.
(p. 146)

Similarly, the researcher explained that organizational devices such as bullet points, colons, arrows, and alignment highlight relationships among various parts of the text. Readers using the text-feature strategy need to apply other strategies, such as questioning, to benefit from text features.

Literacy Demands for Science

The shift in literacy demands from primary grades to secondary grades entails a new focus. In primary grades, children are prepared for the reading process by focusing on the Fab Five, but in secondary grades, the focus is shifted toward disciplinary content and an array of difficult texts and writing tasks (Sipe, 2009). “Many adolescents do not understand the multiple dimensions of content-based literacies. Adolescents may struggle with reading in some areas and do quite well with others” (Sipe, 2009, p. xiii). As the focus on literacy in secondary grades shifts to content-area learning, adolescents need help from teachers to develop the necessary skills for specialized academic literacy (Sipe, 2009).

Content-area literacy is more complex for several reasons. Literacy in content area is intended to teach readers specific content-related concepts. These concepts range from concrete to abstract. The difficulty in understanding these concepts is directly related to the abstractness of the concept; “The more abstract the concept is, the more difficult it is to learn” (Roe et al., 1991, p. 201). In addition to the abstractness of the concepts, content-area literacy includes an array of unfamiliar subjects, which adolescents do not encounter in their personal lives (Moje, 2010; Roe et al., 1991). Content-area literacy is also complex because of the high number of infrequently used words and specialized vocabulary present in content-area texts. Beyond vocabulary, Roe et al. (1991) explained that content-area authors compact a large number of ideas into a few sentences, so readers have to read each word in order to maintain understanding of the content read. Authors also use complex organizational styles to express relationships between ideas and maintain the readers’ attention. Readers can comprehend more of the text when they can identify the organization of the text and can approach the text accordingly (Meyer et al., 1980; Roe et al., 1991).

According to Sheridan-Thomas (2008), content-area teachers should use multiple text sources to supplement or replace textbook readings, because textbooks may be challenging for some students to comprehend. Text complexity adds to the difficulty of keeping students engaged in reading texts. Many adolescents have reading-comprehension difficulties due to semantic knowledge, disciplinary knowledge, discursive knowledge, and pragmatic knowledge demands (Moje, 2010). Adolescents need to have developed academic vocabulary, concepts, text structures, and purpose for each content area. According to Valencia, Wixson, and Pearson (2014), the text, the task, and the reader interact, and the text needs to be tied to the task in order for the reader to process the information needed to accomplish the task. This text and task interaction takes into account the demands of the task. It also takes into account the task-relevant features of the text to identify what features make a text and task scenario more or less difficult than another (Valencia et al., 2014).

Instructional Strategies for Promoting Content Learning

Numerous studies have explored reading comprehension strategies for promoting content learning with readers in primary grades. Research supports the integration of content teaching and literacy instruction in a content area to enhance content learning (Cervetti et al., 2012). Cervetti et al. (2012) explored the difference in content learning between a science-only class and a science-literacy class of 94 fourth graders. The science-literacy group was taught scientific concepts through reading text, writing notes and reports, hands-on investigation, and frequent discussions of content. The researchers found that students receiving science-literacy instruction performed significantly better than the students in the science-only class in the measures of science understanding, science vocabulary, and science writing, suggesting that science and

literacy aid in content learning. The findings of this study serve as support for integrating content-area literacy with content-area concepts to improve content learning.

Schemata

Content-area reading comprehension requires a variety of processes that occur simultaneously when reading, including predictions, schemata activation, inferencing, and metacognition (Perfetti, 1991; Roe et al., 1991). “A schema is a cognitive structure or organization of the knowledge one has related to an idea, thing, or concept” (Roe et al., 1991, p. 83). Schemata can be content based or textual based. Content-based schemata are the frame of reference and background knowledge the reader has about the subject. Textual-based schemata represent the readers’ knowledge of the structure of the text (i.e., the macrostructures and microstructures).

Knowledge of content-based schemata or background knowledge affects reading comprehension (Duchan, 2004; Ozuru et al., 2009). Reading comprehension does not simply refer to the ability to decode text; it also refers to the connection between current knowledge and prior knowledge (McNeil, 2012; Ozuru et al., 2009). In essence, the schemata theory posits that comprehension is a two-part process; the first part refers to the linguistic aspect needed for decoding the text, and the second part refers to the conceptual aspect that is needed to connect current information to prior knowledge (Duchan, 2004). Background knowledge facilitates recollection of the information read on a specific topic (Dochy, Segers, & Buehl, 1999; Dole, Valencia, Greer, & Wardrop, 1991). According to Rosa-Lugo, Mihai, and Nutta (2012), “Reading comprehension takes place when the reader decodes the information contained in the text in written form and utilizes background knowledge to integrate and interpret the decoded

information” (p. 172). English learners can use background knowledge to mediate some of their language-proficiency deficits (Chen & Donin, 1997; Taboada, Townsend, & Boyton, 2013).

In addition to content-based schemata, readers can use text-based schemata to tackle the reading task. Readers can use their knowledge of text structures to predict where information will be presented. For example, in a research paper the reader can expect the beginning of the paper to provide justification for the study and establish a purpose.

One factor that makes the text’s organization evident is the text coherence, which contributes to the organization of the text . McNamara et al. (1996) analyzed the impact of text coherence on reading comprehension by manipulating texts. McNamara et al. (1996) provided 36 participants three different text conditions, varying in cohesion. The researchers found that participants who were good readers were able to rely on background knowledge to extract comprehension from microstructures and use them to create macrostructures in order to make sense of the text even when the text lacked cohesion. Poor readers, however, benefited most from texts with high cohesion for text comprehension. These findings suggested that text structures and content background knowledge play a crucial role in comprehension.

Vocabulary

In addition to schemata, researchers have explored the impact of vocabulary on content learning and reading comprehension. Although vocabulary affects text comprehension and learning, it does not work in isolation. Many researchers have found that students with higher vocabulary levels perform better in reading comprehension tasks than students with low vocabulary levels (Cain & Oakhill, 2011; Nassaji, 2006; Seifert & Espin, 2012). Laufer (1998) noted that reading comprehension is not possible without an understanding of the vocabulary in the text. Researchers have argued that a minimum of 95% coverage of vocabulary is required in

order for comprehension to take place (Laufer & Nation, 1995); it has also been argued that 98% coverage of vocabulary is optimal (Hsueh-Chao & Nation, 2000). In other words, for every 100 words a student reads, he or she would need to know 98 of the words. Although these figures provide a glimpse of hope for tackling the challenge of teaching reading, teaching students new vocabulary words does not mean that they automatically gain higher reading comprehension. Researchers such as Laufer (1998) and Hsueh-Chao and Nation (2000) placed a greater influence on vocabulary knowledge over comprehension by stating that reading comprehension is not possible if the reader cannot understand the meaning of the words in the text. Laufer (1998) argued that a reader needs to understand the information itself before being able to delineate reading concepts, such as the main idea and supporting details. Laufer (1998) added that in order for English learners (ELs) to use reading strategies, they needed adequate levels of vocabulary.

Laufer's view on inaccessibility to reading strategies (1998) was supported by Nassaji's study in 2006. In a study of intermediate English Second Language (ESL), adult learners ($n = 21$) having diverse first-language backgrounds, Nassaji (2006) found that individuals with higher levels of lexical skills used effective inference-making strategies while individuals with low levels used fewer and less effective strategies ($\chi^2 = 11.85, df = 2, p < 0.01$). Nassaji also found that the depth of vocabulary knowledge had an impact on the success of reading strategies used, suggesting that vocabulary knowledge positively affects reading comprehension by providing the access to skills needed for the reader to make predictions, interpret, and connect known and unknown parts of the text. Nassaji's study is crucial for understanding the role of vocabulary in content-area learning because of the high number of infrequent and abstract words used in content areas such as science.

Vocabulary knowledge is a conglomerate of knowledge of word meaning, grammar, and phonology (Pasquarella, Gottardo, & Grant, 2012). Pasquarella et al. sought to examine the relationship between decoding and vocabulary knowledge in ELs and non-ELs in ninth and 10th grade. They found that vocabulary knowledge was the only predictor for reading comprehension for non-ELs while both decoding and vocabulary knowledge were predictors for ELs. According to Pasquarella et al. (2012), for ELs with low proficiency decoding accounted for individual difference in reading comprehension and for ELs with high proficiency vocabulary was instrumental in reading comprehension.

To show the effect of unknown word density on reading comprehension, Hsueh-Chao and Nation (2000) altered a reading passage of 673 words by replacing low-frequency words with nonsense words and simplifying the text, and they administered it to 66 adult ELs. They found that the more unknown words in the text, the poorer the reading comprehension. One implication of this study for teachers is that they need to select appropriate text for students in order to facilitate their understanding of the text. Reading comprehension not only requires other skills and strategies, but it's also affected by other factors such as background knowledge and reading strategies available to the reader (Laufer, 1998).

One factor intertwined with vocabulary knowledge is the use of inference strategies. According to Nation and Webb (2010), "the ability to derive a meaning [of] a word from context clues is an essential part of reading skill" (p. 78); however, students need adequate levels of reading in order to be able to use strategies. Nassaji (2006) found that individuals with higher levels of lexical skills used effective inference-making strategies while individuals with low levels used fewer and less effective strategies. Furthermore, Nassaji (2006) found that the depth of vocabulary knowledge had an impact on the success of reading strategies used. Vocabulary

knowledge positively affects reading comprehension by providing the skills needed for the reader to make predictions, interpret, and connect known and unknown parts of the text.

Making predictions, connections, and interpretations is a challenge for students with LD. Students with LD, unlike typical middle school students, may still need to work on decoding and word recognition, but nonetheless their reading tasks at the middle school level have high cognitive demands. It is important to examine the effect of other skills, such as vocabulary knowledge, on reading comprehension. Seifert and Espin (2012) found that teaching vocabulary and fluency in combination affected reading comprehension of science text in students with LD, strengthening the notion that neither vocabulary learning nor fluency can work in isolation to achieve adequate levels of reading comprehension in adolescents. Similarly, in a longitudinal study, Cain and Oakhill (2011) examined the reading development of 102 students beginning at age seven to eight, and found that word reading and reading comprehension were constant over time; in other words, poor readers continued to learn vocabulary and develop reading comprehension skills but at slower rates than good readers (Cain & Oakhill, 2011). In addition, the findings supported the claims of Nation and Webb (2010) in that students who had higher reading comprehensions increased their vocabulary through reading while students with inadequate reading comprehension did not benefit from such contribution (Cain & Oakhill, 2011).

Vocabulary knowledge is multi-dimensional. According to Schreuder and Baayen (1997), analyzing a word into its constituent parts (prefix, root word, suffix) allows readers to add syntactic and semantic information to their vocabulary repertoire. Goodwin et al. (2014) sought to explore how knowledge of root-words along with reader and word characteristics contribute to the lexical representation of morphologically complex derived words. Goodwin et al. (2014)

found that knowledge of root-word meaning was the main contributor for reading morphologically complex derived words. The second main contributor was knowledge of root-word morphology. In other words, readers with knowledge of root-word meaning and root-word morphology are more likely to manipulate morphological units to support literacy, especially when reading an unknown word (Goodwin et al., 2014).

Macrostructures and Content Learning

Due to the complexity of text in content areas, especially in science, researchers have studied the impact of text manipulation on content learning and have found that cohesive texts impact content learning. Armbruster et al. (1987) analyzed the change in reading-comprehension scores between students who received text-structure instruction and students who did not. The researchers provided 82 fifth-graders instruction for 45 minutes a day over 11 consecutive days. Students in the treatment group received text-structure instruction using social studies text, and they received rationale for the use of text structures as a reading strategy. The researcher found that the treatment group performed better than the comparison group in content learning and summarizing. The students in the text-structure group performed better when the text was present as a reference during testing than when the text was withheld. The findings of this study suggest that using text structures as a reading-comprehension strategy help students learn more content and identify more main points from the text.

Some researchers have found that there are differences in the reading comprehension of a narrative text and that of an expository text (Cervetti et al., 2009). According to Cervetti et al. (2009), genre, topic, and purpose for reading impact comprehension of content. In a study of 74 students ($n = 28$ students in the summer before fourth grade, and $n = 46$ students in the first month of fourth grade) of which 32 students were ELs and 44 were not designated as ELs,

Cervetti et al. (2009) found that the students had increased comprehension for key science information in the expository version of the story compared to the fictional narrative version of the same story. Students received two topics, one on the habitat of snails and one on the erosion of rock into sand; both topics were written as fictional narrative and informational text. The topic on snails had 14 key ideas while the topic on sand had 10 key ideas that were presented in the text. Although the researchers analyzed the topic of snails to be easier to comprehend, the informational text for the sand topic yielded higher comprehension of the ten key science information, $F(1, 72) = 10.57; p < .01$. The findings of the Cervetti et al. (2009) study showed that informational text contributed to content learning while the fictional narrative text yielded longer retelling than the informational text.

Mautone and Mayer (2001) examined the influence of signal words, such as transitions and conjunctions, on students' understanding of scientific explanations within three conditions: (1) text-based environments, (2) speech-based environments, and (3) narration-and-animation multimedia environments. According to Mautone and Mayer (2001), participants who received the signaled text in the text-based environment were able to use the information learned to solve new problems, thus transferring what they had learned, which the researchers deemed to be a measure of learner understanding. Although Mautone and Mayer did not find significant difference in understanding of a scientific explanation, they reasoned that the visual layout and structure of the paragraph may have aided the participants in the nonsignaled group with comprehension of the text. The findings of Mautone and Mayer (2001) then support the idea that the macrostructure of a text, which includes the genre as well as the layout, aids in the comprehension of the text.

Literacy Demands for English Learners

The literacy demands for adolescent ELs is high. ELs are expected to master vocabulary and grammar in their second language as well as comprehend content in classes that are taught in English (Carnegie Corporation of New York, 2010). The gap between ELs language proficiency and the demands of content-area classes and the demands of language arts and reading classes widens as the students get older (Nutta, Strebel, Mokhtari, Mihai, & Crevecoeur-Bryant, 2014). In order for teachers to accommodate the language proficiencies of ELs and meet academic standards, they have to implement various strategies that aid ELs in vocabulary development, grammar knowledge, and content knowledge, which will aid ELs in overall language development. Teachers cannot rely solely on an EL's ability to use reading strategies to aid in metacognitive processes such as correction of misconceptions and definition of unknown vocabulary through context clues, because lower language proficiency may hinder access to reading strategies (Chen & Donin, 1997; Hsueh-Chao & Nation, 2000; Laufer, 1998).

In a meta-analysis of reading comprehension in the second language and its correlates, Jeon and Yamashita (2014) found that second-language grammar knowledge had the highest correlation with reading comprehension at a $r = .85$ and vocabulary knowledge had the second strongest relationship at $r = .79$. The researchers also found a strong correlations between reading comprehension and first-language ($r = .50$) reading comprehension, and between listening comprehension ($r = .77$) and reading comprehension. Another factor that Jeon and Yamashita (2014) recognized as having a strong correlation was second-language decoding. Other correlates Jeon and Yamashita highlighted were phonological awareness, orthographic awareness, morphological awareness, working memory, and metacognition, but their relationship to second-language reading comprehension was low. In fact, the researchers argued that metacognition was the lowest with $r = .32$.

Language proficiency in a second language (L2) may affect second language reading comprehension (Cummins, 1981). Academic content requires higher linguistic knowledge to process infrequently encountered vocabulary and complex syntactic structures to extract meaning (Cummins, 2000). Academic content also demands competence in extracting meaning from dense and abstract language found content specific discourse (Taboada et al., 2013). In a study of 25 fifth-grade ELs and 63 sixth-grade ELs, Taboada et al. (2013) examined the relationship between reading engagement and general reading comprehension. They also explored the relationship between the students' second language proficiency and general reading comprehension as well as reading comprehension in science. The researchers found that for fifth- and sixth-grade ELs reading engagement mediated the relationship between second-language proficiency and general reading comprehension (Taboada et al., 2013). The researchers also found that reading engagement also mediated the relationship between language proficiency and science vocabulary and reading comprehension in science (Taboada et al., 2013), suggesting that teachers can help ELs understand content-area discourse by making the content more enticing and engaging.

Taboada (2012) explored the differences in science reading comprehension of 93 fifth-grade students of varying language-proficiency levels and the impact of science vocabulary, general vocabulary, and text-based questioning on science reading comprehension. The participants were students studying English as a Foreign Language (EFL), ELs, and English-only speaking students. Taboada (2012) found that the EFL group performed lower in all measures as compared to ELs and English-only students. She also found that general vocabulary, science vocabulary, and text-based questioning impacted reading comprehension in all three groups, and the differences were significant between the groups. Taboada (2012) also found that there was

no significant difference between English-only students and ELs in academic vocabulary and text-based question and their impact on science reading comprehension. These findings suggest that students with intermediate language proficiency can utilize their knowledge of academic vocabulary and text-based questioning as resources during content-area reading.

Chen and Donin (1997) sought to determine whether second-language proficiency impacted discourse text processing in a biology college class with 36 ELs (18 biology majors, and 18 engineering majors). Providing the engineering students with a biology text, the researchers assessed background knowledge. The researchers differentiated between the students by language-proficiency levels based on their scores on the Michigan Test of English Language Proficiency, placing them into two groups: (1) low intermediate to intermediate, and (2) high intermediate to high. The researchers provided texts in both the participants' first language and second language. The researchers found that students with low background knowledge and low language proficiency read slower and recalled less than students with higher language proficiency, more background knowledge, or both. They also found that students with high background knowledge recalled more than students with low background knowledge. These results corroborate the existing research that students with higher proficiency level have access to reading strategies, while students with low proficiency do not have the linguistic proficiency to utilize such strategies even if they have it in their first language (Chen & Donin, 1997).

According to Nutta et al. (2014), teachers must become familiar with students' language proficiency levels according to WIDA descriptors in order to effectively select modification strategies for ELs. The WIDA descriptors focus on what ELs can do versus their language deficit (Nutta et al., 2014, p. 119). Some of the modification strategies teachers in both language arts

and content areas can use for ELs are text simplification and elaboration, leveled questioning, sentence frames, and word banks. In addition to these modifications, teachers can help ELs improve their academic performance by providing them with nonverbal and verbal support during instruction.

Instructional Strategies

“Instructional strategies are used by teachers to help students improve their text comprehension” (Davis, 2010, p. 27). An instructional strategy can become a reading-comprehension strategy if the teacher intends to teach the students the strategy in hopes that the students would use the strategy when needed to tackle text (Davis, 2010). According to Tierney and Cunningham (1984), there is a distinction between instruction that improves the understanding of text and instruction that improves the ability to apply knowledge of strategies to texts. Pearson and Gallagher (1983) noted that scaffolding instruction improves student learning by gradually releasing the responsibility of making sense of the text by initiating, applying, and managing strategies from teacher to student. Some instructional strategies segue into individualized reading-comprehension strategies when teachers use instructional strategies such as modeling and coaching to explain to students what strategies are, how they work, and how they are used (Duffy et al., 1987).

Duffy et al. (1987) explored the impact of explicit teacher explanation of mental acts associated with strategic reading. In a study of 10 third-grade teachers (nine teaching in urban setting and one teaching in a suburban setting), teachers received six two-hour training sessions through the academic year. The trainings focused on providing teachers with information on what to recast, how to make explicit statements about the mental process, and how to organize the statements throughout the class. The researchers found that students in the group receiving

explicit instruction of mental acts became more aware of the need for strategies during reading and aware of the content of the lesson. The researchers also found that students became more aware of strategy use for reading comprehension, and in a delayed post-test students maintained their reading performance. This study supports the idea that teachers can use explicit instruction of metacognition as an instructional strategy to improve reading comprehension.

“Students’ level of content knowledge will affect how students employ strategic knowledge, and the level of strategic knowledge will affect how students operate on the content” (Bos & Anders, 1992, p. 235). Bos and Anders (1992) found that interactive strategies, such as semantic mapping, semantic feature analysis, and semantic/syntactic feature analysis, were effective instructional strategies for content-area reading comprehension and concept understanding. In addition, the researchers found that the participants gained more knowledge between pre-test and post-test and were able to maintain the knowledge in a one-month-delayed post-test (Bos & Anders, 1992). To assess the impact of using interactive teaching and learning strategies for text comprehension and content learning, Bos and Anders (1992) conducted a three-phase study with 42 bilingual elementary children with learning disabilities and 61 students in junior high school with learning disabilities during phase one. During phase two, the researchers assessed 47 bilingual elementary students and 53 students in junior high school. The first phase included students’ receiving instruction from the researchers in different instructional interventions. The second phase was a five-week systematic program of staff development for special education teachers where the teachers received feedback on their practice sessions and their videotaped instruction. The third phase of the study was modifying the interactive teaching strategy, so that during cooperative learning students would use interactive learning strategies (Bos & Anders, 1992). During the feedback process, the teachers reflected on their teaching as

they continued to instruct students, so that the teachers could place more emphasis on the strategic knowledge needed (Bos & Anders, 1992). Then the teachers taught one chapter or section a week using these two interventions, semantic mapping and semantic/syntactic feature analysis, which required the students to complete a relationship chart and cloze sentences (Bos & Anders, 1992). Overall, the researchers found that the interactive strategies, which combine cognitive and metacognitive strategies, were effective in increasing text comprehension and concept understanding.

In a two-part study, McNamara et al. (1996) explored the impact of text reading on a key-word sorting task with 36 participants in seventh through ninth grade. In part one of the study, the researcher sought to explore the possibility that organization of knowledge would change after reading by providing the participants with key-word note cards for them to sort before reading the text. Once the participants read the text, they were encouraged to read it twice, and then the participants were asked to sort the key-word note cards one more time. The results did not yield a difference in the change of sorting patterns, but they did find that participants improved in text recall. These findings suggest that vocabulary instruction before text reading improves text comprehension.

Klingner and Vaughn (1996) explored whether reciprocal teaching with cooperative groups helped 26 seventh- and eighth-grade ELs with LD improve reading comprehension more than reciprocal teaching cross-age tutoring. The researchers provided the students with 15 days of 40-minute instructional sessions on reciprocal teaching, which covered several reading strategies (prediction, summarization, question generation, and clarification). After the instructional sessions, the researchers provided the students with 14 days of practice using reciprocal teaching with either cooperative groups or cross-age tutoring. The researchers did not

find a significant difference between groups, but they did find that the majority of students in both groups improved their reading comprehension scores from pre- to post-tests.

Vaughn et al. (2011) examined the impact of strategic reading instruction for 400 middle school students with an age range of 15-17 and compared it to a comparison group of 382 students on reading comprehension. The researchers provided the teachers with 18 hours (three days) of professional development, three days of on-going professional development of 1.5 hours throughout the academic year, and in-class coaching and support. The students in the treatment group received 50 minutes of reading-strategy instruction using the Collaborative Strategic Reading approach twice a week for 18 weeks of the school year. The Collaborative Strategic Reading approach covered reading comprehension strategies for pre-reading, during-reading, and post-reading. The teachers taught the text's vocabulary before reading, activated prior knowledge, and used text features to organize the text before reading. The during-reading strategies included restating the main idea and finding and fixing misunderstandings through strategies such as re-reading. The post-reading strategies included questioning and writing summative statements. After four to six weeks of instruction, the students were put into cooperative groups. Upon analysis of the data, the researchers found that students in both the treatment group and the comparison group had increased in fluency. However, the students in the treatment group performed better than the comparison group on standardized reading measures.

Klingner et al. (2012) examined the impact of teaching students reading strategies. In a review of literature on teaching reading strategies, the researchers found that teaching a reading approach that had multiple components worked well for adolescent. The effectiveness of this strategy—Component Reading Instruction model (CSR)—was its combination of reciprocal

teaching and cooperative learning. Teachers who want to implement this strategy in their classroom have to explicitly teach reading strategies, develop a monitoring routine, and enhance reading comprehension through cooperative grouping and cooperative learning. In the review, Klingner et al. (2012) found that CSR improved comprehension.

In a one-year intervention study, Barber et al. (2015) examined the reading comprehension changes in struggling readers using three seventh-grade and 10 sixth-grade teachers to implement explicit reading strategy instruction using the United States History of Engaged Reading (USHER). There were 133 sixth-graders in the study along with 154 seventh graders who received explicit reading strategy instruction using USHER. USHER focused on comprehension of history texts through a fusion of cognitive and engagement practices. The program also included explicit vocabulary instruction and used authentic text for students to practice. The students received 45 minutes a day/ five days a week of instruction of history according to USHER. After a year, the researchers found that self-efficacy in sixth-grade ELs was a predictor for reading comprehension. They also found that teacher support was related to the students' engagement, which included use of strategies, for both ELs and non-ELs in sixth grade, but only for non-ELs in seventh grade.

Similar to Barber et al. (2015), Cantrell, Almasi, Carter, Rintamaa, and Madden (2010) conducted an intervention study over one academic school year on sixth and ninth graders' reading comprehension when taught using the Learning Strategies Curriculum (LSC), an adolescent reading intervention program. The study included 24 content-area teachers who received professional development on LSC over the summer for 2.5 days and six half days of on-going professional development during the school year. The 365 students in the intervention group received their regular language arts class plus 50-60 minutes of LSC a day. At the end of

the school year, the students in the intervention group were compared to 290 students in the control group. The researchers found significant difference with significant gains in the sixth-grade intervention groups' reading comprehension as measured by a standardized test and a significant difference in strategy use as measured by self-report procedures. The results were not the same for the ninth grade intervention group, suggesting that more research needs to be conducted on reading strategies for ninth graders.

Instruction that aids in reading comprehension (i.e., understanding text) paves the way for improving comprehension abilities (i.e., applying knowledge of reading strategies), but this process takes time. In a comparative meta-analysis of common instructional intervention approaches from reading education and science education, Guzzetti, Snyder, Glass, and Gamas (1993) found that science teachers can ignite conceptual changes in students by providing them with additional text that refutes the students' preconceptions of scientific concepts or by using multiple strategies that cause cognitive conflict, causing the students to re-conceptualize scientific concepts. In this meta-analysis, the researchers found that reading instructional approaches in science classes that relied solely on the textbook, a nonrefutational text, as a single intervention showed no efficacy. According to Guzzetti et al. (1993), research on instructional strategies used in science classes for content learning reflects the use of multiple strategies at a time. One pattern the researchers found was that the strategies could be clustered into a learning cycle with phase one as the exploration phase, phase two as the term introduction, and phase three as the concept application. In phase one, the students are exploring the science concepts and activating prior knowledge with little guidance. In phase two, the teachers lead the instruction and show students refutations to inspire conceptual change. In phase three, the students are independently synthesizing the information they know and the information the

teacher provided into new applicable information. This multiple instructional strategic approach to content learning resembles the instructional approach to reading and to the Gradual Release of Responsibility Model.

In an article of practical evidence-based reading strategy instructional practice, Wexler, Reed, Mitchell, Doyle, and Clancy (2015) proposed a strategic instructional routine designed to address the demands of the CCSS in content-area classes. In the instructional routine, teachers in secondary grades can follow four steps: (1) explicit instruction of background knowledge, (2) explicit instruction of vocabulary, (3) explicit instruction of main idea identification and analysis with additional time to practice with peers, and (4) ample opportunities for students to discuss and interpret the text.

Text Structures as Instructional Strategies

Before the importance of expository text structures is discussed, it is important that a common definition for text structure be discussed. Text structures are the organization or arrangement of ideas and their relationships to one another (Armbruster, 2004). When readers are aware of text structures, they can approach reading with a reading plan that helps them unpack the meaning of the text (Meyer et al., 1980). Initially, young children are exposed to narrative text structures, but by third and fourth grade the focus on narrative text structure diminishes and expository texts are introduced (Akhondi et al., 2011). The shift to expository text is important because expository texts are denser and longer than narrative texts, and expository texts contain a lot of information that students must retain. In addition, as readers get older, text complexity increases due to the use of more than one type of text organization, use of a variety of sentence types, and use of more abstract vocabulary words. “Structural elements in expository texts vary; therefore, it is important to introduce students to the components of

various texts throughout the school year” (Akhondi et al., 2011, p 369). Further, teaching text structures is an effective step towards teaching readers how to improve their reading achievement (Akhondi et al., 2011). According to Akhondi and colleagues (2011), “Students’ reading comprehension skills improve when they acquire knowledge of texts’ structural development and use them properly” (p. 368). Readers can use text structure features to locate and organize information (Akhondi et al., 2011). For instance, readers can use the organizational pattern (i.e., macrostructure) of text to identify the location of the main idea and essential information. Readers can also use syntax to establish the relationship between ideas. Knowledge of both macrostructures and microstructures is essential for comprehension of text.

The importance of text structures for adequate levels of reading comprehension for adolescent students can be examined from either a macro perspective or a micro perspective. A macro perspective analyzes text structure from its genre, such as problem-solution and cause-effect structures, whereas a micro-structure focuses on sentence-level comprehension such as the syntactic comprehension of nonreversible passive sentences (Nation & Snowling, 2000) or understanding relative clauses and their contributions to the overall meaning of the sentence.

According to McNamara et al. (1996), text coherence affects text comprehension. In the second part of their study, McNamara et al. (1996) provided their 36 participants with three different text conditions, varying in cohesion. They found that participants who were good readers were able to rely on background knowledge to extract comprehension from microstructures and use them to create macrostructures in order to make sense of the text. Poor readers, however, benefited most from texts with high cohesion for text comprehension. These findings suggest that knowledge of text structure and content background plays a crucial role in comprehension.

Dole, Brown, and Trathen (1996) analyzed the impact of two different explicit instruction of reading strategies of 67 early adolescents (39 fifth-graders and 28 sixth-graders) in a five-week intervention study with seven-week delayed post-test. The researchers randomly assigned the participants to one of three groups: (1) story content instructional strategy, (2) strategy instructional treatment, and (3) a basal control. The students in the story content instructional strategy received 10-15 minutes of instruction Monday through Thursday on pre-reading strategies, such as activating prior knowledge through teacher questions, reading a story map outline of the text selection, and explicit vocabulary instruction. The students in the strategy instructional treatment received 10-15 minutes of instruction Monday through Thursday on text structures and conditional knowledge (i.e., why is this strategy useful?), making predictions and writing predictions down, and constructing story maps. In addition to the strategies, the teachers for the strategy instructional treatment group implemented the Gradual Release of Responsibility (Pearson & Gallagher, 1983) approach and provided the students with less support over time. The basal reading group received the same story selections and served as a comparison group. The researchers found that students in the strategy instructional treatment performed significantly better than the other groups in reading comprehension measures.

Text structure is another variable that affects reading comprehension. In the body of available literacy research, there is much disagreement over what counts as text structure. Some researchers view text structure from a microstructure perspective while others view it from a macrostructure perspective. It is essential to classify both structures. The microstructure of a text refers to grammar and syntax. Researchers who study microstructures of text are examining sentence components, such as linguistic connectives and sentence combinations (Pearson & Camperell, 1994). Second, the macrostructure of a text is found in its genre (e.g., narrative,

expository). According to Meyer (1985), text structures are classified as description, sequence, comparison and contrast, cause and effect, and problem and solution.

Gaps in Literature of Reading Comprehension

There are several gaps in literature of teaching reading comprehension to eighth-graders, especially eighth grade ELs. Several studies have looked at teaching reading comprehension strategies to readers in primary grades while fewer studies looked at eighth graders (Davis, 2010). Research on reading comprehension has examined the impact of microstructure comprehension on reading comprehension, but there is a lack of research on the impact of microstructures on content learning. Several studies have also looked at the impact of macro text structures instruction on science content learning, but there is a lack of research on the impact of macrostructures plus microstructures on content learning, reading comprehension, and sentence comprehension, especially its impact on ELs.

Summary

This chapter provided an overview of a representative body of literature on young children's and adolescents' reading comprehension. In this chapter, the researcher also examined various skills necessary for developing reading comprehension, including how text structures can affect students' reading and comprehension.

CHAPTER 3: METHODOLOGY

Introduction

This chapter delineates the methodology for this study. It also explains the purpose of the study, its research design, the participants, and related validity. This chapter also provides a detailed description of the study procedures and a description of the measures taken to safeguard validity.

Purpose of the Study

The purpose of this quasi-experimental study was to determine the impact of explicit instruction of macrostructure plus microstructure on eighth-grade ELs' and non-ELs' science content learning, reading comprehension, and sentence comprehension in three inclusive classrooms.

Participants

The target population for this study was ELs in inclusive classrooms. The researcher used a convenience sampling method for the study. The researcher reached out to networks within a large metropolitan university and a large metropolitan school district in the Southeastern United States. The researcher met with the principal at a Title I middle school, with 87% students on free and reduced lunch and the following demographics for the student population: 75% Hispanic, 14% White, 8% Black, 2% Pacific Islander, and 2% multi-racial. The researcher discussed the proposal with the principal. As a result of the meeting, the school principal

identified three science teachers willing to participate in the study. The teacher who was assigned to the treatment group continued to teach the science content as prescribed by the eighth-grade science curriculum, while the researcher provided students with explicit instruction on text structure, including the comparison and contrast macrostructure and microstructures: (1) comparative statements, (2) conditional statements, and (3) complex sentences.

The participants for this study were eighth-grade middle school students. More specifically, the students were of diverse population, including non-ELs and ELs in eighth-grade attending a large metropolitan school district in Southeastern United States. In order to achieve a medium effect size with a statistical power of .80 at a 95% confidence, a minimum of 64 students were needed in each group (Cohen, 1992). Since the maximum number of students in a class at the participating district is 22, this study needed at least three classes for each group in the study. The total number of classes for this study was six, for a final count of 132 participants. The participants were divided into two groups: Group one comprised three classes (66 students) assigned to the treatment group—i.e., the science content, plus text structure group—and group two was of three classes (66 students) for the comparison group. In practicum, the researcher conducted the study in three classes as the treatment group and three classes as the comparison group for a total of 54 students in the treatment group and 61 students in the comparison group.

Research Design

To assess the relationship of explicit instruction of macrostructures and microstructures of text on eighth-grade ELs' and non-ELs' content learning, reading comprehension, and sentence comprehension in inclusive science classrooms, the researcher used a non-equivalent group pre-test–post-test quasi-experimental design (Campbell & Stanley, 1963; Cook & Campbell, 1979). The study used a comparison group that was similar to the treatment groups in

order to obtain information about the effects of the treatment (Campbell & Stanley, 1963). A quasi-experimental research design was appropriate for this study because of the inability to control for all variables in a middle school setting. Although the research could not control all variables, by using a comparison group, the researcher expected to find that the main effects of the uncontrollable variables affected both the experimental groups and the comparison group equivalently (Campbell & Stanley, 1963). The participating district had several comprehensive forms of instruction for ELs, including English for Speakers of Other Languages (ESOL), one-way developmental bilingual education (K-3), two-way developmental bilingual education (K-8), and sheltered instruction (K-12). The participating school used a different form of instruction for ELs, the immersion approach, which is “designed for language majority students. Students receive subject matter instruction in their second language to develop second language proficiency while learning content” (Zygouris-Coe, 2001, p. 7). Because the participating school used an immersion approach to EL education, this study used students in middle school mainstream science classes. The students varied in language proficiency and reading and writing abilities.

In order to conduct the study, arrangements were made with three classroom teachers. The first teacher was both in the treatment and the comparison group. Specifically, the first teacher’s second and fifth periods were used as part of the treatment group, and her sixth period was used as apart of the comparison group. The second teacher was used only in the treatment group because he taught only one section of science during third period, and the rest of the time he taught advanced science. The third teacher’s sixth and seventh periods were used as part of the comparison group.

The treatment for this study was a two-fold process: (1) explicit instruction of comparison and contrast macro-text structure, and (2) micro-text structures, specifically conditional statements, comparative statements, and complex sentences. To assess the science text, the researcher examined the microstructures of the science units used in the study and coded the microstructures to find patterns in the text. After assessing the science text used in the classrooms, the researcher found three common types of microstructures: (1) conditional statements, (2) comparative statements (3) complex sentences. The three common microstructures found in the book were the microstructures explicitly taught in the intervention. Conditional statements were used mainly to express relationships between two concepts and to illustrate a concept. For example, “**If** there are two objects moving at the same speed, **then** the one going faster will have more kinetic energy” (McDougal, 2012a, p. 275). Comparative statements were used to compare concepts or objects. For instance, “The average kinetic energy of particles in the warmer object **is greater than** the average kinetic energy of the particles in the cooler object” (McDougal, 2012a, p. 257) (see Appendix H for student writing sample II). Complex sentences were used in explanations of concepts; for example, “**As** the particles collide, some of the kinetic energy of the particles in the warmer object is transferred to the cooler object” (McDougal, 2012a, p. 257) (see Appendix H for student samples).

Research Questions

Main Question 1: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs’ and non-ELs’ science content learning as measured by unit test in three inclusive science classrooms?

Main Question 2: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs’ and non-ELs’ reading comprehension as

measured by the English Language Arts eighth-grade REGENTS in three inclusive science classrooms?

Main Question 3: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' and non-ELs' sentence comprehension as measured by the TOAL-4 in three inclusive science classrooms?

Main Question 4: Can reading comprehension scores be predicted by the relationship between sentence comprehension scores and reading comprehension scores in three inclusive science classrooms?

Main Question 5: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' science content learning as measured by unit test in three inclusive science classrooms based on language proficiency CELLA Reading anchor scores?

Main Question 6: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' reading comprehension as measured by the English Language Arts eighth-grade REGENTS in three inclusive science classrooms based on language proficiency CELLA Writing anchor scores?

Main Question 7: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' sentence comprehension as measured by the TOAL-4 in three inclusive science classrooms based on language proficiency CELLA Writing anchor scores?

Instrumentation

To examine the effect of teaching text structures, both macrostructures and microstructures, eighth-grade ELs' and non-ELs' on reading comprehension, sentence

comprehension, and content learning in inclusive science classrooms, several assessments were necessary. First, the researcher was interested in examining the effects of instruction of microstructures on participants in the treatment group, especially participants for whom English was a second language. In order to establish the students' English language proficiency levels, the researcher used the CELLA. The CELLA is an exam given to students who speak a language other than English at home and whose first language is a language other than English. The exam assessed the four domains of language (reading, writing, speaking, and listening) in English for students whose first language is not English. The scores for the CELLA were anchored into scales with all the scales being centered at Level B with an average score of 700 and a standard deviation of 40 (ETS, 2005). As a result, the CELLA was divided into four anchor point scales for speaking and listening where Anchor Point one was 620 points, Anchor Point two was 660 points, Anchor Point three was 700 points, and Anchor Point four is 740. For reading and writing, the CELLA used the same four anchor points but added an additional anchor point: Anchor Point five with 780 points (ETS, 2005). Although the CELLA was not administered during the study, the results of tests were collected to be used as a covariate with performance on sentence comprehension, reading comprehension, and content learning to determine proficiency levels impact scores and to be used to establish the performance of ELs based on their language proficiency.

To assess the relationship between teaching text structures and sentence combination, the researcher used the sentence combining subtest of the Test of Adolescent and Adult Language – fourth Edition (TOAL-4). The TOAL is a norm-referenced test used to compare individuals' language abilities to the abilities of their peers. The purpose of the TOAL was to identify issues in language proficiency and determine areas of strengths and weaknesses in an individual's

language ability (Hammill, Brown, Larsen, & Wiederholt, 2011). For the purpose of this research, the researcher used the TOAL to identify the students' ability to manipulate language through sentence combinations and to determine whether students were able to manipulate language in a more complex fashion after intervention. Therefore, the sentence comprehension subtest of the TOAL was divided into a pre-test and post-test and analyzed by looking at sentence type, grammar, comprehensibility and logical order of ideas.

To explore the relationship between teaching text structures and general reading comprehension in adolescents, the researcher used the English Language Arts eighth-grade REGENTS test. The English Language Arts eighth-grade REGENTS is an achievement test designed to measure student literacy through the use of three short-response questions and one extended-response question. The short-response questions required students to answer an inferential question with textual support (CTB, 2006). Similarly, the extended-response question requires students to comprehend and analyze two related texts by synthesizing ideas and drawing evidence from both texts to support their answer. In addition, the extended-response question requires students to demonstrate their ability to compose a comprehensive and coherent essay using textual evidence for support (CTB, 2008). The REGENTS was selected as a measure for reading comprehension because it enabled the researcher to test comparison and contrast macro-text structures.

The researcher measured students' content knowledge using a unit test from ExamView Pro on Foundations of Physics (Serway & Faughn, 2006) (see Appendices L, M, and N) and a unit test from McGraw-Hill's *Glencoe Physical iScience Modules: Waves, Sound, and Light, Grade 8* for the electromagnetic waves pre-test and post-test (McGraw-Hill, 2007) (see Appendices O and P). ExamView Pro is software with a variety of test banks on physics that

was developed by Serway and Faughn (2006). Using ExamView Pro, the researcher selected questions for the sound waves pre-test and post-test using a variety of testing methods, including fill-in-the-blank, matching, and multiple choice. The electromagnetic waves pre- and post-test were composed of six multiple-choice questions each.

Other sources of data are student samples and informal general observations on the fidelity of the study made by the researcher and the doctoral assistant.

Validity

A non-equivalent group pre-test–post-test quasi-experimental design was a good research design for measuring the variance between-subjects. An advantage of this design was the pre-test, because it provided a baseline that could be used to compare the effects of the treatment, and it also provided a means to assess for homogeneity (Edmonds & Kennedy, 2013). Although this research design had some advantages, it was not without threats to validity.

Some of the threats to external validity included stimulus characteristics and setting, and context-dependent mediation (Edmonds & Kennedy, 2013). According to Edmonds and Kennedy (2013), the threat to external validity of stimulus characteristics and setting is defined as, “The unique factors involved in providing the treatment or intervention, such as the setting and researchers” (p. 6). For this study, the researcher administered the treatment only to the treatment group; this was a unique factor that could make it difficult to replicate the study. In this case, the researcher was a language teacher with a M.Ed. in Language Arts and ten years of experience teaching English reading and writing to diverse populations. The researcher may have more preparation on text structures than a typical science middle school teacher. Second, there was a threat to external validity, context-dependent. Context-dependent mediation is defined as, “Mediating variables related to outcomes differ between contexts or settings”

(Edmonds & Kennedy, 2013, p. 6). For this study, the researcher used the participating school district and school's eighth-grade science curriculum and related science materials (i.e., unit test) used to assess content learning before and after the treatment. It may be possible for variances in content learning to occur using other textbooks.

In addition to the threats to external validity, this study also had some threats to internal validity, such as attrition and selection bias. First, the threat to internal validity of attrition is defined as, "The loss of participants during the term of the experiment" (Edmonds & Kennedy, 2013, p. 5). This study took place during the beginning of the academic year, and during the year some students moved to other classrooms or other schools. Second, Edmonds and Kennedy (2013) defined the selection bias threat to internal validity: "Selection bias results when researchers do not use a systematic assignment technique to assign participants to conditions" (p. 5).

Procedures

The procedures of this intervention are described below. This section will provide a description of how the intervention began, how it was implemented, and how it was assessed. The researcher conducted the intervention of explicit instruction of text structures in science with eighth-grade EL students in mainstreamed inclusive classrooms through the duration of two science units (sound waves and electromagnetic waves), for a total of nine days of intervention and four days of testing. The text structure instruction was integrated into science content learning every Tuesday and Thursday, with the exception of days when the school was closed or the students were taking standardized exams, such as the benchmark tests.

Participating teachers taught the same science content to both the treatment group and the comparison group. The treatment group received science content plus text structure instruction

from the researcher two (2) days out of the week for a total dosage of 450 minutes for periods two and five, and 424 minutes for period three. On Monday, Wednesday, and Friday of the weeks during the study, students in the intervention group received science instruction from their science teacher. Similarly, the comparison group received science content instruction five days a week as they would typically receive it. Prior to the beginning of the study, the researcher administered the pre-test to both the treatment and the comparison groups. At the conclusion of the study, the post-tests were administered.

The week after the pre-test began, the students were off Thursday and Friday, so the participating teachers were administering the first marking period final exam Tuesday of that week and the researcher was unable to begin the intervention until the subsequent week on Tuesday. One week after the researcher initiated the intervention, the students took the science benchmark exam, so no intervention was administered that Tuesday. During the seventh week after the researcher initiated the intervention the school was closed the entire week for a national holiday. On the 10th week of the study, the students took the second marking period science final exam, so the researcher had to administer the post-test half a week before anticipated. The total hours of intervention lost due to other school activities and holidays were 5.8 hours (350 minutes).

This study required two groups: the treatment group and the comparison group. It also required two assessment phases, a pre-testing phase and a post-testing phase. The students in the intervention group received nine instructional lessons. The procedures for this study were described in this section through a narrative from the researcher. The fidelity measures for this study were done by having a doctoral student attend the classes and observe the researcher and

by narrative notes that the researcher took after each session. The doctoral assistant completed fidelity charts during the sessions to document the observations (see Appendices F and G).

According to Davis (2010), the reading strategies that had the best impact on reading comprehension were analysis/reflection, graphic organizers, and previewing. This study used these three strategies in the following ways: the researcher modeled text structure (i.e., macro structure and micro structure) analysis through think-aloud, utilized graphic organizers (see Appendix H) to extract information from the text to create relationships between concepts, and used text features (i.e., heading, subheading, bold font, images, and captions) to preview the text before reading.

The Science Teachers

The researcher met with the principal and the science department head during the summer to discuss the intervention. At that time, the principal selected the teachers who would participate in the study. The researcher reached out to the teachers to collaborate with them before the school year began; however, both teachers were out of town during the summer and would not be back until the beginning of school. During pre-planning, the researcher met with the teachers to talk about the intervention and to ask for insight on ways to collaborate with the teachers, but the science teachers were not interested in collaborating with the researcher in teaching literacy in the science class. The researcher was able to get the teachers to agree to share weekly information regarding the pacing and topics of the units.

Language Support

In addition to the modeling of text structures, the researcher also provided the ELs in the study with language support on an as-needed basis. The researcher used teacher tools such as

translations with additional explanation of concepts, leveled questioning, and vocabulary lists that included both science vocabulary and procedural vocabulary (i.e., words that ELs need to know in order to be able to perform tasks, such as compare, contrast, analyze, and provide) (Nutta et al., 2014).

Focus on Process

For the writing events in this intervention study, the researcher focused on a process-approach rather than product-approach to the study. According to Schmidt and Harriman (1998), the focus on process-approach versus product-approach is contingent on the purpose for writing. For this particular study, the researcher looked at writing as a process because she wanted to provide the students with the flexibility to apply the knowledge of text structures as they deemed appropriate or as they were linguistically capable of applying it. The researcher explicitly taught writing as a process during several phases. For example, during phase IV the students worked on writing a one-sentence summary that would be used as a thesis statement; during phases III and VIII, the students worked on topic sentences as their points of comparison. In other words, the students used the information they organized in the comparison and contrast organizer to extract a thesis statement, topic sentences, and supporting details, which they used to write their essay during phase IX.

Macrostructure

This intervention focused on only one macrostructure: comparison and contrast. To explicitly teach comparison and contrast text structure, the researcher taught the point-by-point comparison organizational pattern during phase III and the subject-by-subject comparison organizational pattern during phase VII. To teach the point-by-point, the researcher used a

comparison and contrast graphic organizer and modeled how to list important ideas of a topic or concept. To model how to use the graphic organizer, the researcher used the topic of longitudinal and transverse waves, which was part of their science curriculum and had been recently covered by the teachers according to their pacing of instruction. The students had already read the chapter on longitudinal and transverse waves during class time with the science teacher. In order to generate content for the comparison and contrast graphic organizer, the researcher used the four to five statements the students had added to the “know” column of the *KWHL* (what I **K**now, what I **W**ant to know, **H**ow I will research the information, and what I **L**earned) chart (see Appendix H), and modeled, through a think-aloud, how to determine whether a statement was a point of similarity or a point of difference between the two subjects; then the researcher modeled how to integrate two examples using that information into the comparison and contrast graphic organizer. For example, transverse waves move perpendicular to the direction the wave travels, and longitudinal waves move parallel to the direction the wave travels, so the researcher would say these two sentences aloud and ask aloud, “Do these two wave type move in the same direction?” Then the researcher would answer herself, “No,” if none of the students answered, and she would then say, “Well, that means these two statements are a point of difference between longitudinal waves and transverse waves.” This process took approximately seven minutes. The students were tasked with determining if the remaining statements were points of similarity or points of contrast. During that time, the researcher provided the students with guided practice by walking around and providing feedback and guidance to groups of two to three students at a time. This process took approximately five minutes. Once the statements in the *KWHL* had been analyzed, the researcher tasked the students with identifying at least one more point of comparison based on the textbook chapter.

This was a time for independent practice; however, the researcher provided ELs with low language proficiencies additional language support and guidance by providing them with feedback in their native language or through leveled questioning. At this time, students had approximately seven minutes for independent practice. Because of this the researcher continued the instruction of point-by-point comparison in phase IV of the study. At the end of phase III, most of the students had completed the graphic organizer with points of comparison and contrast.

The second part of point-by-point macrostructure instruction focused on extracting the information the students had organized in the graphic organizer to produce a thesis statement and 10-12 sentences comparing and contrasting the two concepts. To do this, the researcher modeled how to use the information in the graphic organizer. Using a think-aloud, the researcher reasoned how three points of comparison can be summarized into one major idea. For example, three points of comparison for sound waves and electromagnetic waves were the difference in movement, the difference in speed, and the difference in how they are measured. The researcher took these three points of comparison and said,

If sound waves and electromagnetic waves are different in how they travel, how fast they move, and how they are measured, then I can write an unspecific summary of this and state, “Sound waves and electromagnetic waves are different in three ways,” or I can write a specific summary and state, “Sound waves and electromagnetic waves are different in how they are measured, how they move, and how fast the move.”

Traces of this explicit instructions are found in Appendix H in the comparison and contrast graphic organizer’s summary portion at the bottom. This took approximately five minutes. At this time, the researcher allowed the students time for independent practice for the students who had the ability to do so but provided guided practice for students who needed more support, and

provided guided practice with language support for ELs with low language proficiency. Most students had constructed their summary statement within approximately five minutes.

Once the students had a one sentence summary, the researcher modeled how to organize a long paragraph using a point-by-point comparison by using the *Direction of Waves* fill-in-the-blank activity the students had completed as part of the bell work/review and using think-aloud to illustrate how the ideas were arranged in the paragraph. This process took approximately ten minutes. The students were then tasked with writing their own long point-by-point paragraph on transverse and longitudinal waves (see Appendix H, student writing sample IV). For the students who had yet to complete the graphic organizer or had not begun one, the researcher had them complete those steps first and provided those students with guided practice and language support if needed. Because producing written text can take longer, students were given approximately 30 minutes for the writing task or for completing missing steps in the process.

The second organizational comparison and contrast pattern taught in this intervention was during phases VII and VIII. The second organizational comparison and contrast pattern was the subject-by-subject organization of text (see Appendix H). Because the science textbook for this class covers topics using a subject-by-subject organizational pattern, during phase VII, the researcher used the textbook to identify the points of comparison in each paragraph.

Microstructures

For the instruction of microstructures, the researcher analyzed the text for text structures used to compare or to contrast ideas. In addition to analyzing the text, the researcher also considered the type of text structures the students would need in order to be able to construct comparative text. The researcher identified three microstructures: complex sentences, conditional statements, and comparative statements. To teach the microstructures, the researcher

kept the same type of structure encountered in the text. The conditional statements explicitly taught in the intervention were constrained to only those using an *If...then* construction. For example, *If short electromagnetic waves have high frequencies, then long electromagnetic waves have low frequencies.* The complex sentences explicitly taught in this intervention were constrained to complex sentences that used subordinating conjunctions as sentence openers in a subordinate clause followed by an independent clause construction. For example, *Although all electromagnetic waves have different wavelengths, they all travel at the speed of light.* Complex sentences where the subordinate conjunction was located in the middle of the sentence were not explicitly taught in this intervention, although they were at times present in the texts from the textbook. The comparative statements explicitly taught in this intervention were restricted to constructions that used comparative adjectives to make comparisons between subjects. For example, *X-ray waves are shorter than microwaves.* For comparative statements, the researcher added to the construction by adding more subjects to the comparison without the use of superlative adjectives. For example, *X-ray waves are shorter than microwaves but longer than gamma waves.* This construction was followed by comprehension questions, such as *Of these three types of waves, which is the shortest wave?* The instruction of comparative statements was limited to only this type of construction.

Description Intervention

Initially, the researcher planned to administer the intervention over eight weeks three days out of the week, but the participating teachers were willing to commit to two days and not three. After the researcher obtained agreement and approval from the principal, the teachers, and the county to implement the intervention two days a week over a macrostructure unit, which

encompassed two science units, factors beyond the researcher's control (teacher days off, holidays, and testing) cut the time spent on intervention to 450 minutes.

The initial intent of the study was to collaborate with the content-area teachers to create and implement an intervention approach that was integrated into the science curriculum. The researcher emailed the teachers over the summer, but the teachers were unavailable over the summer until pre-planning at the beginning of the school year when the researcher met with the teacher for the first time. After the initial meeting the researcher had with the teachers, it became evident that the researcher would have to find her own text and science assessment because the teachers were not as forthcoming with information as the researcher had hoped. The teachers did provide the researcher with the pacing of the classes, so that the researcher could ensure that pre-testing was administered before students began to cover the topic.

Before the intervention began, the researcher analyzed several eighth-grade physical science texts to identify common structures and find texts with evidence of macrostructures. She examined eight textbooks and six ninth-grade textbooks and realized that eighth-grade textbooks lacked ample texts with macrostructures, yet the review questions in the books call for the use of macrostructures. For instance, in *Fusion* the concepts are presented individually, but the students are asked to complete tasks such as, "Why do we see lighting before we hear the accompanying thunder?" (McDougal, 2012a, p. 198). Such questions call for several complex processes (i.e., comprehension of the information, mental comparison of concepts, and knowledge of text structures) to construct an answer. The ninth-grade books had more text structures, but they also had more complex science concepts that extended beyond what the science objectives were for the class, so those textbooks were not used as a primary source of reading for the class. The classroom teachers informed me that they did not use the assigned textbook all the time; instead,

they used other reading materials. Later, the teachers explained that they thought the textbook was too easy for the students, so they had the students read the textbook but they supplemented the reading with additional text. As a result, the researcher used the textbook along with compare and contrast graphic organizers and text that she constructed (see Appendix H) to show the students how to analyze information and construct meaningful text.

Phase I: Pre-testing

Objectives: To establish a reading comprehension, sentence comprehension, and content-area knowledge baseline.

Description: The first day of the pre-testing phase, the researcher showed up to the school early to prepare. The first treatment group was going to be second period. When the bell rang, the researcher and the doctoral assistant entered the classroom. The teacher had already written the bell work on the board, so when the students arrived, she instructed them to disregard the board and pay attention to the researcher. This reaffirmed the teacher resistance to the intervention. The researcher introduced herself quickly and briefly explained the purpose for being there and the purpose of taking a pre-test. She then administered the REGENTS pre-test (see Appendix C). She instructed the class to follow along as she read the instructions on the inner page aloud. Once she finished reading, she read a translated version of the instructions aloud and instructed the students to perform their best. Some students asked the researcher to translate the questions or the text, and she instructed them to try their best. Other students asked the researcher if the exam was going to be factored into their grade to which she replied, “No,” but encouraged them to try their best.

On the second day of the pre-testing phase, the researcher administered the TOAL Sentence Combination sub-test (see Appendix I) first in order to read the directions of how to

combine sentences to the class, and provide the instruction in Spanish. She informed the students that they had the entire period to finish the TOAL, but that after 25 minutes she would administer the science pre-test (see Appendix L), and they had the entire period to do both exams. The students were calmer this time, and the teachers were non-participatory.

Notes on discussion: Several of the students inquired about the usage of grades for the assessment. They wondered whether the scores would count against them for their science class grade. The researcher explained that the grades did not count against them and encouraged them to do their best on the exam. This inquiry implied that some of the results were affected by student motivation and perception to complete the tasks.

Notes on intervention: The week after the pre-testing phase, the students were taking the nine-week Benchmark Test in the science class on Tuesday, and the Thursday of the same week was a county holiday. This meant that the intervention would not start until a week and a half after the pre-testing phase.

Phase II: Introduction to Strategic Reading

Objectives: The objectives for this lesson were to introduce the concept of strategic reading in science classes and to introduce text features and graphic organizers as pre-reading strategies.

Background knowledge activation/review(5 minutes): To build interest, the researcher began the lesson by asking the students personal questions about reading (e.g., “How many of you read books, magazines, or blogs?”). Then she asked them about the strategies that they use when they reach a difficult part in the text, and as they shared what they do, she created chart of reading strategies or shared strategies that had been taught before. The students were given two minutes to write down their responses in their notebooks, and then the researcher asked them to

share their answer with the class. As students shared answers, the researcher wrote the answers on the board on a classification organizer divided by pre-reading strategies, during-reading strategies, and post-reading strategies (see Appendix H). This process took approximately three minutes. The researcher then added text features, macrostructures, and microstructures strategies as reading strategies to help understand text.

Modeling (15 minutes): To model the idea that readers have to select appropriate strategies for reading, the researcher provided the students with different text-based scenarios (e.g., reading a magazine versus reading a Facebook status update or reading a science book). The researcher used an article from a Scholastics magazine in the class and using think-aloud modeled a mental discussion on how to tackle this text/what strategies would be useful. The researcher then used the class textbook to model how the discussion may be different for that type of text. She explained that some strategies, such as the use of text features, can be used for both types of texts. The researcher then used page 173 of lesson one in unit three of the science textbook (McDougal, 2012a) to model using text features, specifically headings and bolded font, as a pre-reading strategy to write down an outline of how information is organized in the text on the board. The researcher explained that this outline can be a mental model of how the text is organized. The researcher also used think-aloud to model using text features, specifically using captions and images, to determine what information is clarified or available to support the text. To ensure that vocabulary did not hinder EL participation or understanding, the researcher provided them with a list of vocabulary words with simplified definitions and translations.

Guided practice (20 minutes): The students were then assigned page 176 and were asked to use text features as a pre-reading strategy to create an outline of the text. The researcher guided the students through the process by asking students questions about the headings,

subheadings, bolded font, and captions of images in the text. Together the researcher and the students created an outline for page 176. To ensure that all students understood the concept, the researcher assigned the students page 177 to repeat the process. She then provided students who were struggling with the process additional guided practice. She walked around the classroom working with small groups of students at a time. Once she had worked with every group of students, she asked the students to share the process as a whole group. The researcher guided the students by questioning. For example, the book has an image of a leaf on ocean waves, so the researcher asked “*What is the purpose of the image with the leaf on the water?*” The researcher expected the students to respond by using the caption next to the image, which stated, “A passing wave gives this leaf an up-and-down ride” (McDougal, 2012a, p. 177). She wrote student responses on the board in an outline and clarified that the image and caption are explaining that waves transfer energy.

Independent practice (10 minutes): The students were then assigned page 178 for independent practice. Although the students were assigned page 178 as independent practice, the researcher provided ELs with low language proficiencies with additional language support and guided practice. The researcher guided the students through the use of questions (e.g., “Can sound travel if there is no air?”). The book had a picture of toy making noise inside an upside-down glass and a picture of someone who seemed not hear the sound, so just by the image and the caption, which explains that sound needs air to travel, the students can successfully answer the question. For ELs with low language proficiency, this question is feasible because it is a yes/no question which requires receptive knowledge and does not place high demand on productive knowledge (i.e., knowing what to say).

Language support for ELs: The researcher used leveled questions (i.e., yes/no, one word responses, choice responses) as an instructional strategy to prompt the students to content-area-based answers (Nutta et al., 2014). She also used translations of instructions and vocabulary.

Materials used:

- Vocabulary handout with definition and translations
- Fusion science textbook
- Researcher-created PowerPoint
- Classification graphic organizer
- White board and markers

Notes on discussions: During student responses for strategies they used during reading, some students shared that if the text is too difficult they stop reading and move on to another text or activity.

Notes on intervention:

The researcher realized that she had to use simpler leveled questions (i.e., yes/no, one word responses, choice responses) as an instructional strategy to prompt the students to content-area-based answers (Nutta et al., 2014). Several students in period 2 and period 5 had low English language proficiency.

Observations: During this phase, the researcher realized that some of the images and captions in the book require explicit instruction of the deeper content implications. No one in any of the intervention classes was able to explain that the image of the leaf on the ocean was demonstrating the concept that the waves transfer energy, not displace it.

Phase III: Using Pre-Reading Strategies and Introducing Text Structures

Objectives: The objectives for this phase were to analyze the comparison and contrast macrostructure using point-by-point comparison, utilizing a graphic organizer to extract information from text, and identifying discourse markers.

Background knowledge activation/Review (5 minutes): The students had to use text structures to pre-read page 179, specifically looking at the headings, images, and captions, and create a brief outline of information for the content on the page. The researcher reviewed the outline students created for the background knowledge activation/review and created one outline for the class from the responses the students provided.

Modeling (10 minutes): The students received a *KWHL* (what I **K**now, what I **W**ant to know, **H**ow I will research the information, and what I **L**earned) chart as a pre-reading instructional strategy. Using the think-aloud stage, the researcher modeled how to complete the first three columns of the chart (the K, W, and H columns). The researcher provided one item for each column. For example, “*I know that sound waves need a medium to travel, but I want to know if some mediums allow sound waves to travel faster than other mediums. I can research my answer by conducting an experiment.*” Following the think-aloud, the researcher explained how to use the *KWHL* chart as a guide for reading science text. After modeling how to use the *KWHL* chart, the researcher provided the students with guided practice.

Guided practice (15 minutes): The students were instructed to share what they know about sound waves as the researcher wrote down their answers on the board to create a class *KWHL* chart on the board. Once the researcher and the students completed the *K* column, they moved on to the *W* column. For the *W* column, the researcher provided a lot of assistance because students were unsure of what they would want to know about sound waves, so the researcher had to provide them with additional support to guide them through the idea that based

on what information they already know, they can think of things they would want to know. The students completed the H column with little guidance, listing several resources for information. The researcher then instructed the students to turn back to pages 178 and 179 and using the text feature strategies add to either column *K* column or column *W*.

Background knowledge activation (5 minutes): After the students had added at least two ideas to the *KWHL* chart, the researcher asked students for words they have read or used to compare and contrast two things. As the students shared answers, the researcher wrote the answers on the board, creating two columns, one for comparison and one for contrast.

Guided practice (10 minutes): The researcher provided the students with a comparison and contrast graphic organizer (see Appendix H), and instructed students to turn to page 179 and identify parts in the text where transverse waves and longitudinal waves are compared or contrasted. As the students viewed page 179, the researcher used think-aloud and questioning to guide the students through identification of points of comparison to add to the compare and contrast graphic organizer. The researcher and the students extracted four points of comparison: ways to transfer energy, speed of wave, direction of travel, and type of waves.

Independent practice (5 minutes): To wrap up, the researcher instructed the students to add what they learned about transverse waves and longitudinal waves onto their *KWHL* chart.

Language support for ELs: The researcher used leveled questions (i.e., yes/no, one word responses, choice responses) as an instructional strategy to prompt the students to content-area-based answers (Nutta et al., 2014). She also used translations of instructions and vocabulary. The *W* column was challenging for some students because there were several students who had just moved into the US less than six months previously, so their background knowledge was quite different, and their difficulty with polysemous words became evident. One student shared

in Spanish, “Me gustaría saber porque algunas olas son mas grandes” (*I would like to know why some waves are bigger*), which the researcher interpreted as asking why waves (i.e. electromagnetic waves versus sound waves) differ. However, that is not what the student meant. The student was referring to ocean waves, which the researcher then replied that oceans waves are a type of wave, but not necessarily sound waves. For ELs, the researcher continued to ask leveled questions to ensure that there were no further misconceptions. She began with yes/no questions for the students who did not speak English. She provided choice questions, and one-word responses.

Materials used:

- Vocabulary handout with definition and translations
- Fusion science textbook
- Researcher-created PowerPoint
- Comparison and contrast graphic organizer
- White board and markers

Notes on discussion: The students during this phase answered any explicit question that the researcher asked. Because of the goals of this phase and time constraints, the students were not allowed to have open and extensive discussions with the class or researcher.

Notes on intervention: This phase of the intervention was very researcher driven; the majority of time was spent on guided practice. This may be because the researcher introduced too many objectives for this lesson.

Phase IV: Using Pre-Reading Strategies, Macrostructure Features, Discourse Markers, and Microstructures

Objectives: The objectives for this phase were to use knowledge of macrostructure and compare and contrast organizer to arrange content ideas.

Background knowledge activation/ Review (5 minutes): To recap strategies previously covered in class—discourse markers, comparison and contrast (macrostructure), and conditional statements—the researcher had students work on the *Direction of Waves* handout (see Appendix H). The students, independently, practiced establishing the relationship between sentences and science terms.

Modeling (5 minutes): After the students completed the paragraph, the researcher gave them a copy of the graphic organizer. Using the compare and contrast graphic organizer the researcher and the students had completed for longitudinal waves and transverse waves, the researcher remodeled how to extract information from the text to input into the graphic organizer using think-aloud.

Guided practice (10 minutes): The information on pages 186 and 187 were different ways to describe a wave, so this was a bit challenging for some students. For the entire class, the researcher provided guided practice on how to identify points of contrast through questioning and using the text features defining key words in the text. The students overall responded quickly to the guided practice for this concept, so they were allotted more independent practice time. However, low-proficiency students needed more support, so during this phase low-proficiency ELs were provided with guided practice while other students worked independently.

Independent practice (30 minutes): The researcher gave students the rest of the period to complete the entire graphic organizer individually using the content on pages 186 and 187.

Language support for ELs: The researcher used leveled questions (i.e., yes/no, one word responses, choice responses) as an instructional strategy to prompt the students to content-area-based answer (Nutta et al., 2014), and more guided practice. She also used translations of instructions and vocabulary.

Materials used:

- Vocabulary handout with definition and translations
- Fusion science textbook
- Researcher-created PowerPoint
- Comparison and contrast graphic organizer

Notes on discussion: Because the intent of this phase was to provide ample time for independent practice of concepts previously taught and readdressed, discussion was restricted to individual conversations between students and the researcher. Many of the discussions were with ELs who were struggling with the language.

Notes on intervention: This phase was intended to provide ample independent practice for students to work on the approach taught in phase III.

Phase V: Using Strategies Before and During Reading and Analyzing Comparative Statements

Objectives: The objective of this phase was to identify and analyze surface code and text base elements of microstructures

Background knowledge activation/Review(5 minutes): The researcher began by reviewing text features. She used a question-answer approach to review. For example, she asked students, “What is a good strategy to use if you want to ‘skim’ an article?” As students answered the questions, she created a list on the board with the strategies and their uses.

Modeling (10 minutes): The researcher introduced the students to conditional statements for extracting information. She used sentence examples from a ninth-grade physical science book, *Science Spectrum Physical Science*, that she had explored as a possibility for the text of the study but rejected because it included more challenging concepts and mathematical equations (McDougal, 2012b). For example, “If you swim with your head underwater, you may hear certain sounds very clearly” (McDougal, 2012b, p. 520). The researcher explained the surface code of conditional statements. She explained how the use of the word **if** illustrated a conditional statement, making the subsequent information only true as long as the conditional statement was met. After establishing the syntactic knowledge of a conditional statement, the researcher modeled how to use text-based information in syntactic structures to extract meaning that contributes to the overall macrostructure. The researcher used the same example, “If you swim with your head underwater, you may hear certain sounds very clearly” (McDougal, 2012b, p. 520) to analyze the sentence. The researcher use questioning and think-aloud to model analysis of syntax for the students. The researcher took out the KWHL that was completed in class during phase III and asked, “What do we know about how sound waves travel?”. She provided an answer aloud derived from the KWHL chart.

After guided practice of conditional statements, the researcher then introduced comparative statements as a reading strategy. Although the textbook does not have many comparative statements explicitly written, in order to get students to write effective comparisons and establish cohesive relationships, they have to learn how to connect concepts through writing. An example of comparative statements in the text is “Higher-frequency waves lose energy more readily than lower-frequency waves” (McDougal, 2012a, p. 188). For comparatives, the researcher used the basic construction _____ *is faster than* _____, and to increase

complexity, she added _____ *is faster than* _____, *but slower than* _____.

The researcher modeled how to think through the comparative construction through think-aloud and questioning. Because the comparative structures were not as prevalent as conditional statements in the text, the research modeled how to construct using simple comparative structures such as _____ *is heavier than* _____, and then modeled how to analyze the sentence to extract meaning through questions such as *which of these two is heavier?* This question was also used to help students arrange the ideas correctly in the comparative.

Guided practice (30 minutes): The researcher provided the students with several sentences from the textbook's unit on waves, and the students had to analyze the sentence. The students were given:

1. "If waves hit a barrier three times in a minute, they transfer an certain amount of energy to the barrier. If waves of the same amplitude hit a barrier nine times in a minute, they transfer more energy in that minute" (McDougal, 2012a, p.188).
2. "If you measure a wave at a point farther from the source, you measure less energy" (McDougal, 2012a, p.189).
3. "If you move the end of a spring toy up and down, a wave also travels along the spring" (McDougal, 2012a, p.179).

As guided practice, the researcher had the students read through each statement and either from mental recollection or from the KWHL chart answer the following questions:

1. What do I know about the transfer of energy of waves?
2. What do I know about a wave's amplitude?
3. What do I know about measuring a wave?
4. What do I know about how waves travel?

Once the students answered these questions, then the researcher provided the students with another set of questions for Sentences 1 in order to gain comprehension of the microstructures as they relate to abstract science concepts, because the idea expressed in number one is more complex than the ideas in sentences two and three, which were answered after the first set of questions.

1. How much transfer of energy occurs when a wave hits a barrier?
2. Why is more energy transferred if waves of the same amplitude hit a barrier nine times?

Once the students answered the questions, the researcher explained the importance of understanding sentences and the information they convey because they can be important pieces of information about the content.

After modeling how to identify, construct, and analyze comparative statements, the researcher provided the students with the construction:

1. *A sound wave travels faster through _____ than through _____, but slower through _____.*
2. _____ *has greater force than _____, but not _____.*

The researcher guided the students through the fill-in-the-blank comparative construction.

Additional guided practice was provided for ELs.

Independent practice (10 minutes): The students were provided with the following comparative and conditional statements and questions for independent practice.

1. “Particles in hot air move faster than particles in cold air” (McDougal, 2012a, p. 190)
 - a. What does this statement tell us about the speed of a wave?
2. Waves usually travel slower in dense objects than in dense liquids.
 - a. Why do waves travel slower in dense objects?

3. “Waves travel faster in solids than in liquids, and faster in liquids than in gases”
(McDougal, 2012a, p. 190).

a. What does the medium have to do with the speed of a wave?

4. If you cover a ringing phone with a glass jar, you will not hear the phone ring.

a. Why can't you hear the phone?

b. What do sound waves need to travel?

Language support for ELs: The researcher used leveled questions (i.e., yes/no, one word responses, choice responses) as an instructional strategy to prompt the students to content-area-based answers (Nutta et al., 2014). She also used translations of instructions and vocabulary.

Materials used:

- Vocabulary handout with definition and translations
- Fusion science textbook
- Researcher-created PowerPoint
- Comparison and contrast graphic organizer
- White board and markers

Notes on discussion: When students, both ELs and nonELs, were asked leveled questions to scaffold complex concepts, the students were able to answer questions correctly.

Notes on intervention: Students needed more time for independent practice, but the textbook was poor in comparative statements, so the students were exposed to more conditional statements than comparative statements.

Phase VI: Using Strategies Before and During Reading

Objectives: The objectives for this phase were to obtain the post-test results from all students in the study and to obtain the pre-test scores for the electromagnetic waves unit test.

Background knowledge activation/ Review (*times varied by period see note on intervention*):

Modeling: There was no modeling or guided practice during testing.

Independent practice: Students took the post-test on sound waves and the pre-test on electromagnetic waves.

Language support for ELs: The only language support provided to ELs during this phase was translation of the directions.

Materials used:

- Sound waves post-test
- Electromagnetic pre-test

Intervention notes: For Phase VI, the researcher administered the sound waves post-test (see Appendix M) and the electromagnetic waves pre-test (see Appendix O). The students took between 25 and 40 minutes to complete the tests. Once all the students had finished the tests, the researcher reviewed text features, text structures, discourse markers, conditional statements, and comparative statements for the remainder of the period. The students in second period took 30 minutes to complete the test, so the researcher reviewed with them for 20 minutes. The students in third period completed the test in 25 minutes, but the teacher asked us to allow the students to prepare for their science project, so the researcher did not get to review with this period. Students in fifth period took 40 minutes to complete the tests. It took them longer to settle down after lunch where they took part in a performance.

Phase VII: Using Strategies to Read and Write About Science

Objectives: The objectives of this phase were to identify comparison and contrast macrostructures, using the subject-by-subject organization, and to analyze complex sentences.

Background knowledge activation/Review(5 minutes): Using page 198, the researcher reviewed comparative statements, discourse markers, and conditional statements. As a review of the use of strategies, the students were asked two questions that could be answered by looking at the text features.

1. How do electromagnetic waves travel?
2. Define radiation.

Modeling (10 minutes): Because the article selected for this phase of the study had vocabulary that was obtained from another source outside of the textbook, the researcher explicitly defined the vocabulary word and provided the students with a simpler definition for each word in a vocabulary handout. After the researcher had provided all students with the vocabulary handout, she reviewed key vocabulary in the article the students were going to read for class (i.e., biomagnetism, compass, electromagnetic radiation, faraday cage, magnet, and migration).

Once the students had the vocabulary handout, the researcher handed out *The Effects of Electromagnetic Waves on Birds* (see Appendix H). The researcher gave the students some background information about the topic in the article and instructed the students to read the questions, use text features to understand the organization of the article, read the article, and highlight the key points that help answer the questions. The researcher gave the students five minutes to scan the article and become familiar with the organization. She asked the students to share their analysis of the structure of the text. The students provided two valid observations of the text: (1) The heading indicated that the article was going to talk about electromagnetic waves, and (2) the bolded font had all the vocabulary from the list on the article. This observation was accurate since the article itself did not have a lot of text features. She then instructed the students

to read along with her, and she modeled think-aloud as she read the text. The researcher used the highlighted version of the article (see Appendix H) to put on the overhead to show how the reader interacts with the text in order to gain text comprehension.

Guided practice (10): The article has several questions after the end of the article, so students were instructed to answer those questions. The researcher guided the students through the first two questions. She read the question aloud, through think-aloud thought about what the question was asking her, and then modeled going back into the text to find a response or support for a response. The researcher reviewed the answers with the students and discussed text parts, such as the thesis and topic sentences, and explained their purpose in text. For ELs, *guided practice* was approximately 20 minutes.

Independent practice (15 minutes): The article has a secondary section defining electromagnetic radiation, so students were tasked with reading this portion independently and answering the questions that followed. As the students were engaged with the text, the researcher walked around and helped the students who needed help.

Modeling (10 minutes): After the students completed the rest of the seven questions in the article independently, there were 10 minutes left of class, so the researcher introduced the students to complex sentences, focusing on complex sentence structures that begin with a subordinating conjunction. For example, *when light shines on a surface, it can reflect off the surface*. When the researcher analyzed the microstructures used in the textbook, the researcher found that for complex sentences the author used complex sentence constructions that began with subordinate clauses such as *when* and *as*. For example, “When the particles are more densely packed, they resist motion more” (McDougal, 2012a, p. 190) and “As the wave travels through more of the medium, more energy is lost to the medium” (McDougal, 2012a, p. 188).

For this phase, the researcher focused only on complex constructions beginning with *when* and *as*. The researcher modeled through think-aloud the analysis of the surface code of the following sentence:

1. “When the particles are more densely packed, they resist motion more” (McDougal, 2012a, p. 190)
2. “As the wave travels through more of the medium, more energy is lost to the medium” (McDougal, 2012a, p. 188).
3. “As each wavefront moves farther from the source, it becomes larger” (McDougal, 2012a, p. 189).

The researcher explained how the subordinating conjunctions *when* and *as* express cause and effect relationships between the two clauses.

Language support for ELs: The researcher used leveled questions (i.e., yes/no, one word responses, choice responses) as an instructional strategy to prompt the students to content-area-based answers (Nutta et al., 2014). She also used translations of instructions and vocabulary. She provided ELs with a list of vocabulary words with simplified definitions and translation.

Materials used:

- Vocabulary handout with definition and translations
- Fusion science textbook
- Researcher created PowerPoint
- Article: The Effects of Electromagnetic Waves on Birds
- White board and markers

Notes on discussion: The non-EL students interacted with the text well. They were more interested in interacting with this text than the information from the textbook. When the

researcher reviewed the questions, she realized that the students struggled with question 5 the most. Question 5 required students to infer and justify. For this question, the researcher provided guided instruction.

Notes on intervention: The students were able to complete the article, which served as independent practice of text structures analysis and provided insight onto their comprehension of the text. After the students had completed the article, there were ten minutes left of the period, which was enough time to introduce the surface code analysis of complex sentences beginning with *when* and *as*. The students did not have time for guided practice or independent practice of complex sentences.

Phase VIII: Analyzing Text for Evidence in Macrostructure and Microstructures

Objectives: The objectives for this phase were to use knowledge of text structures to complete the comparison and contrast graphic organizer for essay writing and to analyze the text-based meaning of complex sentences needed for writing a comparison and contrast essay.

*Background knowledge activation/Review (15 minutes):*To review complex sentences, the students were given the same two sentences from the previous phase (sentence three was not included because it used the same question pattern as number two), but students were asked questions to reveal the deep meaning of the sentence.

1. “When the particles are more densely packed, they resist motion more” (McDougal, 2012a, p. 190)
 - a. What happened to particles when they are packed?
 - b. Do they move fast? Or do they move slow?
2. “As the wave travels through more of the medium, more energy is lost to the medium” (McDougal, 2012a, p. 188).

- a. What impacts the transfer of energy?
- b. Does it make a difference if the medium is solid, liquid, or gas?
- c. If it does make a difference, explain why.

Once the students answered these questions, they were given another concept to review: discourse markers. To review discourse markers, the researcher provided the students with a list of discourse markers and instructed them to put them into one of three categories: comparison, contrast, or conditional. Examples of the words included in the list were *although*, *when*, *but*, *also*, *if*, *like*, *as*, etc. After 10 minutes, the researcher reviewed the answers for the questions and engaged the students in discussion about the deep meaning of complex sentences using *as* and *when* (see notes on discussion at the end of this phase description).

Modeling (15 minutes): The students had already used the graphic organizer several times and received ample researcher guidance, so for this phase the researcher spent less time on modeling this strategy and more time modeling extracting information to compare. Since electromagnetic waves and sound waves were presented in two different chapters, the students were tasked with going back and forth between chapters. The instructor modeled writing down the current content knowledge on sound waves and electromagnetic waves on two separate columns. The researcher modeled asking questions to recall information about the content. For example, the researcher asked, “How fast do waves travel?” and a student blurted, “That depends on the type of wave.” The researcher took that response and asked the follow up question, “What different types of waves are there?” The researcher used this approach to generate two pieces of information for each subject. The researcher added these two points of comparison onto comparison and contrast graphic organizer and added examples of each. She then shared a comparison and contrast essay she had constructed to model the use of discourse markers and

macrostructure using the topic of electromagnetic waves and sound waves. The researcher provided the students with a copy of the essay, projected the essay with review marks on the overhead, and explained each part of the essay. The researcher purposefully used two points of comparison and explanations that were more commonly found in ninth-grade textbooks to ensure that when students were given independent practice to write their own essay, it would be original.

Guided practice (10 minutes): After modeling the use of the graphic organizer and thinking aloud through the analysis of the essay, the researcher provided more guided practice to students who did not have a good grasp of how to use the graphic organizer and how to identify the structures. For ELs, the researcher provided more guided practice, leveled questions, and simplified the task by giving them a series of questions that they could answer using the text. The answers to those questions were ordered in a way that would allow students to add their responses to the graphic organizer. For example, *does a sound wave need a medium to travel? Can an electromagnetic wave (EM) travel without a medium?* The researcher showed the students that the answers to these questions can be added to the graphic organizer and used to compare sound waves and EM waves.

Independent practice (10 minutes): The researcher handed the students a compare and contrast graphic organizer and tasked them with comparing electromagnetic waves and sound waves independently.

Language support for ELs: The researcher used leveled questions (i.e., yes/no, one word responses, choice responses) as an instructional strategy to prompt the students to content-area-based answers (Nutta et al., 2014). She also used translations of instructions and vocabulary.

Materials used:

- Vocabulary handout with definition and translations
- Fusion science textbook
- Researcher created PowerPoint
- Comparison and contrast graphic organizer
- White board and markers

Notes on discussion: The students struggled to identify the deeper meaning of these sentences even with the questions to guide them. This provides insight into the students' ability to understand the deeper relationships or meaning that sentences carry in content-area text.

Notes on intervention: The majority of the students were allotted only 10 minutes to complete their essay, but they needed more time.

Phase IX: Using Strategies for Reading Comprehension

Objectives: The objective for this phase was to independently practice using text strategies for reading comprehension to provide a written response.

Background knowledge activation/Review (5 minutes): Since most of the students had already the comparison and contrast graphic organizer comparing electromagnetic waves and sound waves, the researcher reviewed how to use the graphic organizer to extract information for writing by asking the students to look at their graphic organizers and provide one similarity and one contrast between sound waves and electromagnetic waves.

Modeling (5 minutes): The researcher used the students' response to create one cohesive sentence of a microstructure already taught in the intervention using both the similarity and the difference in the sentence. For example, *Although electromagnetic waves and sound waves can travel through a medium, electromagnetic waves can also travel without a medium.* To aid in the

writing process, the researcher wrote several comparison discourse markers on the board so that students would have a point of reference when they were writing their own structures.

Guided practice: The researcher walked around the room, observing students. Once she observed a student struggling with writing (e.g., the student was looking at the paper and not writing or the student asked for help), the researcher provided the student with guided practice. The guided practice was not provided to the entire class during this period, only to those students who were struggling with the writing or students who asked for assistance.

Independent practice (40 minutes): The students worked on their essay.

Language support: The researcher provided the ELs with leveled questions and translation.

Materials:

- Science textbook
- Notebook paper
- Pen or pencil

Notes on discussion: This phase focused on writing, so only minor discussions took place as a group, and individual discussions were forms of corrective feedback from the researcher to the students regarding their writing.

Notes on intervention: Because students did not have ample time to write their responses during the previous session, the researcher dedicated this session to writing. She wanted the students to be able to use the strategies and content learned and practice writing an effective response comparing both concepts, since the textbook used in the class did not explicitly provide the students with such detailed comparisons. As the students wrote their responses, she walked

around working with students as needed. She looked at their drafts and provided explicit feedback. A student writing sample was added to Appendix H.

Observations: As the researcher walked around, she noticed one trend in student writing. She noticed that some students, despite the graphic organizer with the relationship between ideas delineated, referred to the textbook and mimicked the style of writing the textbook used, which lacked cohesion. When the researcher asked those students to make sure that they included some of discourse markers written on the board to establish relationships with ideas, they were able to easily add connections to simple concepts that were explicitly distinguished in the book but struggled with connecting the more abstract concepts. This observation supports the assertions by Chambliss (1995) that the text students read influences their text writing patterns. This observation also has implications for the need for more cohesive texts to provide students with a way to access deep conceptual relationships between abstract concepts.

Phase X: Post-Testing

Objectives: The objectives for this phase were to collect performance information on three measures: reading comprehension, sentence comprehension, and content learning.

Background knowledge activation/Review: There was no review or background knowledge activation during this phase.

Modeling: There was no instructional modeling during this phase.

Guided practice: There was no guided practice during this phase.

Independent practice: Students had to independently take several assessments. They had the entire class period to complete the tasks.

Language support: The researcher provided ELs with translations of directions.

Materials:

- REGENTS reading comprehension test
- TOAL sentence comprehension sub-test
- Science unit tests: delayed sound waves test and electromagnetic waves post test.

Notes on discussion: No discussions took place during this phase.

Notes on intervention: The students took their first post-test, the sound waves post-test, during Phase VI. During the first day of the post-testing phase, the researcher administered the REGENTS post-test (see Appendix D). She instructed the class to follow along as she read the instructions on the inner page aloud. Once the researcher finished reading the instructions in English, she read a translated version of the instructions aloud, and she instructed the students to perform their best. Some students asked the researcher to translate the questions on the text, and she instructed them to try their best.

On the second day of the post-testing phase, the researcher administered the TOAL Sentence Combination sub-test (see Appendix J) first in order to read the directions of how to combine sentences to the class, and provide the instruction in Spanish. She informed the students that they had the entire period to finish the TOAL, but that after 25 minutes she would administer the science pre-test, and they had the entire period to do both exams. The students took all period since this time the science post-test was composed of 16 questions—six questions on electromagnetic waves (see Appendix P) and 10 questions on sound waves (delayed post-test) (see Appendix N).

Materials

Several materials were used in this study.

1. The school's adopted science textbook, *Fusion* (McDougal, 2012a).

2. Manipulated text (see Appendix H)
3. Comparison and contrast graphic organizer (see Appendix H)
4. Science unit test (see Appendices L–P)
5. TOAL-4 sentence subtest (see Appendices I and J)
6. Sentence combination rubric (see Appendix K)
7. REGENTS pre-test and post-test (see Appendices C and D)
8. Reading/writing rubric (see Appendix E)

Researcher

To ensure that adequate attention was given to macrostructures and microstructures, the researcher, a certified teacher in English for grades 6-12 and with ample experience in teaching ELs, conducted all sessions of the intervention for the treatment group.

Teacher Meeting

Before beginning the study, the researcher emailed the participating teachers to discuss ways to collaborate, but the teachers were on vacation over the summer and were not going to be back until August. In August, the researcher met with the teachers to obtain information regarding the science unit, lesson plans, pacing, and the materials the teachers used to teach (i.e., additional resources). At the meeting, it was evident that the teachers were compliant and cooperative, but they were not interested in collaborating with the researcher. The researcher met with the teachers in the intervention group every week to ascertain pacing of the science content to ensure that the teachers had not begun a new unit. By keeping track of their pacing, the researcher was able to administer the science content pre-tests and post-tests for the units on sound waves and electromagnetic waves. The researcher met with the teachers in the

comparison group only during the assessment phase of the study and four occasions when the researcher observed the science classes in the comparison group.

Assessment Phases

There were two major assessment phases for this study, a pre-test phase and a post-test phase. During pre-testing, students in both groups took the REGENTS, TOAL-4, and the unit test over the course of two days during science class. Post-testing was conducted in the same fashion as pre-testing—all assessments given over the course of two days. Administration of assessments was done by the researcher, the researcher's assistant (a doctoral student), or both. All of the pre-tests were administered by the researcher. One post-test was administered by the research assistant because the researcher was administering a post-test to the comparison group during the same time of day.

Pre-testing

The pre-test was administered to all students (in both groups) who were present during the pre-testing dates that were set and agreed to by the classroom teachers prior to the beginning of the study. First, the students took the REGENTS pre-test (see Appendix C) on day one of intervention. Although when the Regents is administered officially, the students are given 60 minutes, plus an additional 10 minutes prep time, students were given one class period to complete the REGENTS or as much of it as possible. Day 2, the students took a 10-question unit pre-test on sound waves (see Appendix K) and 15 questions of the sentence combining subtest of the TOAL-4 (see Appendix H). On day 8, the students took an electromagnetic waves pre-test (see Appendix N).

Post-testing

Day 16, students in the comparison group took the REGENTS post-test, and day 17 students in the intervention group took the REGENTS post-test (see Appendix D). Students who were present during pre-testing participated in post-testing during the post-testing dates. Just like the pre-test, students were given one class period to complete the REGENTS or as much of it as possible. Then on day 18, both groups took the 15 questions of the sentence combining subtest of the TOAL-4 (see Appendix I) and the post-test on Electromagnetic waves (see Appendix O). The students took the post-test for sound waves day 8 (see Appendix L), and they took the delayed post-test on sound waves day 18 (see Appendix M).

Instructional Lessons

All instructional sessions for both the comparison and the experimental group were conducted during eighth-grade science classes. There was no instruction on text structures for the comparison group. The time frame of the study was determined by the amount of time that it takes to complete one structure unit (e.g., comparison and contrast) in the eighth-grade science curriculum, typically 8-12 weeks. For this study, the structure unit encompassed two science topics, sound waves and electromagnetic waves. To measure content learning, the classroom teacher in the treatment group taught the curriculum as typically done, and to measure the impact of instruction on text structures, the researcher taught the text structures two days out of the week. By comparison, the comparison group received science content through typical class instruction as taught by the classroom teacher.

Before starting the intervention, the researcher administered pre-tests over a two-day period, beginning with the REGENTS on the first day and the TOAL-4 and unit test on the second day. The time spent on pre-testing and post-testing was not counted toward time spent on

intervention. The intervention comprised 10 instructional lessons. Every instructional lesson used the Gradual Release of Responsibility model (Pearson & Gallagher, 1983), where the researcher demonstrated how to identify, analyze, and comprehend text structures and then gradually relinquish responsibility to the students in an attempt to make them independent learners. As prescribed by the Gradual Release of Responsibility model, this intervention targeted the comparison and contrast macrostructure and three targeted microstructures (comparative statements, complex sentences, and conditional statements), guided instruction, collaborative learning (both whole class and small group), and independent work. Descriptions of the intervention and fidelity are located in Appendix G.

Fidelity

To safeguard the fidelity, the fidelity of implementation was assessed by a doctoral assistant in the same program as the researcher, using a fidelity checklist constructed by the researcher for this protocol (see Appendix F). The trained doctoral assistant was present in all sessions at the school for two out of the three class periods of intervention. The researcher adhered to the intervention protocol 99% of the time, with the exception of the omission of using a graphic organizer to diagram complex sentence structures during Phase VII (see Appendix F).

In addition to using the fidelity checklist, the researcher safeguarded fidelity by taking informal notes on observations and keeping a daily log of when the intervention was implemented, how it was implemented, and how the students reacted to the intervention. The informal notes were used to provide informal observation data about the implementation.

The study was conducted at a local middle school with three teachers, one of whom had a class period as part of the treatment group and another class period as part of the comparison group. Due to this and to the fact that the three teachers are part of the same local middle school,

it is not possible to assert that no part of the intervention approach was present in the comparison groups. The teachers, however, were asked not to use any of the intervention approaches during the study. The researcher observed four science classes of the comparison group—two classes with teacher one and two classes with teacher two. During the four observations, the teachers did not use any of the instructional strategies from this protocol.

Variables

There are several variables in this study. The dependent variables for analysis are the students' scores on sentence comprehension, scores on reading comprehension, and scores on science unit test. The independent variables include student designation (EL or non-EL), group designation (intervention group or comparison group), and language proficiency scores among ELs (CELLA scores) and the 2013 FCAT scores.

Data Analysis

To establish test-retest reliability on the REGENTS reading scores, the researcher used a Cronbach's coefficient alpha, which indicated the average correlation among the items of the scale (Pallant, 2010). To statistically control for the effect of literacy as indicated by FCAT scores of the 2014, the researcher used an Analysis of Covariance (ANCOVA) to determine the effect of literacy scores as established by the FCAT on the students' test results on the reading comprehension test, science content unit test, and sentence combining subtest. Similarly, the researcher used an ANCOVA to determine the effect language proficiency has on the reading comprehension test, science content unit test, and the sentence combining subtest; for this analysis the researcher used the CELLA scores. Lastly, to answer the research questions, the

researchers used a Multivariate Analysis of Variance (MANOVA) to compare the intervention group and the comparison group on several different, but related, dependent variables.

Limitations

The potential limitations to this study are related to the research design, sample selection, length of intervention, instrumentation, and participants. There are threats to both internal validity and external validity. First, because the researcher did not randomly select participants, there is a possibility for interaction of selection and a possibility of regression, which threaten the internal validity of the study. However, the researcher did randomly assign treatment to class periods in order to reduce the likelihood of this threat and the threat of regression. The researcher cannot make general assumptions about eighth-graders or ELs since the sample was small and restricted to one location. The study was limited both by its location and by the science curriculum used. In addition, because the researcher administered the intervention, there was a possibility of stimulus characteristic and setting limitation. The study was limited by who administered the intervention and the researcher's knowledge of language. Further, the study was limited because of the amount of time spent on interventions. Because using text structures to aid in reading comprehension and content learning was a cognitive strategy, students needed extensive amounts of time to learn the strategy and apply the strategy. Thus, the 450 minutes spent on intervention was not enough time for students to understand the effectiveness of using a reading strategy (Ehren, 2008).

Summary

This chapter presented the research design for this study and the data analysis to be discussed in greater detail in chapter 4.

CHAPTER 4: DATA ANALYSIS

This study investigated the impact of teaching macro-text structures plus micro-text structure on content learning, reading comprehension, and sentence combination in eighth-grade science classes. This chapter delineates the analysis of the data collected to answer research questions. This study used a non-equivalent group pre-test–post-test quasi-experimental design. To answer the research questions, the researcher used Repeated Measures Analysis of Variance and a regression.

This chapter is organized in the following manner:(1) description of participants; (2) description of time spent on intervention; (3) missing data; (4) description of the assessments and grading;(5) Inter-rater reliability; (6) an analysis of data per question; and (7) a discussion of the findings.

Description of Participants

The participants of this study were eighth-grade students in science classes at the participating middle school. A total number of 115 students participated in the study. However, due to missing data, 10 participants were excluded, resulting in a final total of 105 participants. The demographic sample of participants in the study was composed of 93 Hispanic students, 18 Caucasian students, and 4 African-American students. Sixty-five girls and 50 boys participated in the study. Fifty-four students were in the treatment group, and 61 in the comparison group. The students were in six different science classes, with one of three science teachers. There were

three classes assigned to the treatment group and three assigned to the comparison group. The groups were unequal in size and language proficiency.

Description of Intervention

Several factors altered the initial proposed timeline for the intervention. Because of grade-level science testing, benchmark testing, and school days off, the time spent on intervention was approximately 7.50 hours (450 minutes), with approximately 3.5 hours (215 minutes) spent on pre- and post-testing. Descriptions of the instructional phases of the intervention are delineated in Appendix G and a narrative of phases was provided in chapter 3.

During the course of the intervention, the student population in the study changed. Some of the students that began the intervention did not finish because they either transferred to another school or they moved to another science class. In this study, there were no students who moved from the treatment group to the comparison group. However, there were students who moved before the post-test or moved into the class after the pre-test. Similarly, some of the students were transferred from another school into either the treatment or comparison group after the study began. For instance, 37 of the participants were excluded from the reading comprehension analysis because they were either missing the pre-test or the post-test. Also, 43 of the participants were excluded from sentence comprehension measure due to missing data. Last, only 66 participants were included in the electromagnetic waves quiz and only 71 participants were included in the sound test.

Description of Assessment and Rating

English Language Arts REGENTS

The English Language Arts eighth-grade REGENTS' exam was scored using a five point scale (see Appendix E). The written responses were scored holistically. Students received a score of a five if their responses addressed the question completely, showed thorough interpretation of the text, made connections to real life, elaborated on ideas clearly, used relevant and accurate information and examples from the text, organized ideas logically, used appropriate transitions or other devices, and used varied sentence structures with some above-grade-level vocabulary (ELA REGENTS).

Students received a score of four if their response answered some of the question, addressed some essential elements of the text, demonstrated literal interpretation of the text mainly, provided some examples and details from the text, contained minor inaccuracies in interpretation of the text, attempted to organized the response logically, and used simple sentences with predominantly basic vocabulary (ELA REGENTS).

Students received a score of three if their response answered only part of the question, addressed few essential elements of the text, demonstrated gaps in understanding of the text, made some connections with little elaboration or development, provided few examples and details from the text, showed an attempt to organize their response, and used simple sentences and basic vocabulary predominantly (ELA REGENTS).

Students received a score of two if their response fulfilled some requirement of the question, addressed basic elements of the text with little support to demonstrate complete understanding of the text, included some inaccurate details, provided very little support from the

text, showed little organization, and used simple sentences, minimal vocabulary, and fragmented thoughts.

Students received a score of one if their response answered only part of the question, demonstrated only partial understanding of text, provided little or no text-based evidence, made no connection, included inaccurate information, lacked focus, focused on minor details, showed little organization, used minimal vocabulary, and indicated fragmented thoughts (OAS).

Students received a score of zero if they did not answer any of the questions or the response is completely incorrect, incoherent, or inaccurate (OAS). For this study, Regent scores were given holistically. All scores were added up, and then divided by three to provide an overall score for analysis. Students could not score a half point, such as a 2.5, so any student whose score had a decimal point received a score to whole number.

CELLA

The anchor points used in the CELLA have specific descriptors of the student's language ability in all four language domains, but for this study, the focus is on reading and writing. The descriptors for the each anchor point for reading are described in Table 3.

Table 3: CELLA Reading Anchor Points

Anchor point	Points	Description
Anchor Point 1	620	A student can decode short words, recognize most common sight words, understand the basic concept of print, read simple sentences and respond to some questions regarding text meaning (ETS, 2005).
Anchor Point 2	660	A student can independently read short passages on an array of topics in simple language, and can answer explicit and literal questions regarding the text (ETS, 2005).
Anchor Point 3	700	A student can independently read text written using simple language with fluency, answer explicit and implicit questions regarding the text, read short passages written in moderately complex language, and answer some comprehension questions (ETS, 2005).
Anchor Point 4	740	A student can read moderately complex text with complete comprehension, read more complex text with partial comprehension, and make simple inferences of complex text (ETS, 2005).
Anchor Point 5	780	A student can use vocabulary and syntactic knowledge to distinguish subtle differences in meaning, read linguistically complex text with adequate comprehension, answer questions requiring synthesis of text, inference making, identification of important details, and finding the implied main idea (ETS, 2005).

The anchor points on the CELLA for writing are described in Table 4.

Table 4: CELLA Writing Anchor Points

Anchor point	Points	Description
Anchor Point 1	620	A student demonstrates understanding of the relationship between some phonemes and graphemes, and writes dictated words and letters with some errors.
Anchor Point 2	660	A student demonstrates knowledge of phonics, and is able to write dictated words with accuracy as well as generate original description and interrogative sentences with appropriate punctuation (ETS, 2005).
Anchor Point 3	700	A student can write original narrative and descriptive paragraphs using basic vocabulary and with errors that may interfere with communication.
Anchor Point 4	740	A student can write narrative, descriptive, and personal opinion paragraphs using adequate vocabulary but with grammatical errors or distinguished by the use of simple sentence structures to avoid errors. A student at Anchor Point 4 is developing his or her writing ability in other genres, such as comparison and contrast.
Anchor Point 5	780	A student can write paragraphs in an array of genres with well-developed vocabulary, control of grammar and conventions, and usage of advanced grammatical structures (ETS, 2005).

The CELLA scores were collected to use as covariates; however, using one CELLA score (i.e., oral, writing, or reading) over another CELLA score resulted in an insignificant covariate for reading comprehension. When the three scores interacted with group, it was then that the CELLA became a significant covariate for sentence comprehensibility $F(1, 24) = 4.71, p < .05$ and it accounts for almost 27% of the variance. Similarly, there was a significant interaction between group and sentence comprehensibility when controlling for CELLA reading scores [$F(1, 24) = 4.82, p < .05, \eta^2 = .271$] and also when controlling for CELLA writing scores [$F(1, 24) = 5, p < .05, \eta^2 = .277$]. These results must be interpreted with caution because there is a large disparity between students in the comparison group who had CELLA scores ($N = 8$) and those in the treatment group with CELLA scores ($N = 17$).

TOAL: Sentence Combination Subtest

The TOAL Sentence Combination subtest had 30 questions (see Appendix H for pre-test and Appendix I for post-test). The exam was divided into 15 questions each to fit into the time constraints of the classroom. The students were given the first 15 questions for the pre-test and the second 15 questions for the post-test. The exam was designed to progressively become more complex, so for analysis purposes the sentence problems were paired up after the exams were administered. The sentences were paired up using two steps: (1) the number of words provided for students to combine, and (2) the number of sentences provided for students to combine. For instance, if a problem on the pre-test had 16 words and three sentences to combine, it was paired up with a problem that had 16-19 words and three sentences to combine. The number of ideas to combine became the crucial measure of comparison.

Each of the sentences was given four scores: (1) sentence type, (2) grammar, (3) comprehensibility, and (4) logical order (see Appendix J). First, the sentences were analyzed for sentence structure (see Appendix D). Second, the sentences were analyzed for grammar and coded for any errors. Third, the sentences were analyzed for comprehensibility. Essentially, the researcher wanted to know whether the sentences were easy to understand and whether the meaning was clear. Last, the students were given a logical order score. The researcher looked at word arrangement and idea logic, whether the student arranged the ideas logically and used appropriate conjunctions to express ideas effectively. In addition, the researcher took into account a student's use of the sample sentences. If the student did not combine the sentences but did change the order of ideas, the student was evaluated for sentence combination, because he or she did show intent to combine sentences but did not fully combine the ideas.

Inter-Rater Reliability

The reading comprehension REGENTS exams were graded by three raters. One rater was the researcher for this study. Another rater held a Bachelor of Art in English Literature and was a student writing coach at a private university. The third rater was a doctoral student at a large metropolitan university in the Department of World Languages. Each rater scored each short and extended response in the REGENTS exam independently. There was very good internal consistency between the raters [$\alpha = .92$].

Statistical Measures

Two statistical measures were used to analyze the data: (1) Repeated Measures Analysis of Variance (ANOVA), and a (2) Regression. Each statistical measure has its own set of assumptions that must be met in order to avoid making incorrect analyses of the data.

Repeated Measures ANOVA

A repeated measures ANOVA was used to analyze the reading comprehension scores, both science content exams, and the paired sentence combination scores. A repeated measures ANOVA requires the assumption of sphericity: “The variance of the population difference scores for any two conditions are the same as the variance of the population difference score for any other two conditions” (Pallant, 2010, p. 253).

Regression

A Bivariate Linear Regression was used to predict reading comprehension scores. According to Pallant (2010), the sample size for a regression should be about 15 participants per predictor; there are at least 15 participants per predictor. In addition, several assumptions must be met in order to use the regression. First, the dependent variable is normally distributed in the

population for each level of the independent variable. Second, the population variances of the dependent variables are the same for all levels of the independent variable. Third, the cases represent a random sample from the population and the scores are independent of each other's scores from one individual to the next.

Results

In this chapter, the data were analyzed according to each research question. Each question is delineated and followed by an analysis of the data as it pertains to each question.

Research Questions

Question 1: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' and non-ELs' science content learning as measured by unit test in three inclusive science classrooms?

To measure the impact explicit instruction of macro-text structures plus micro-text structures had on science content learning, the researcher used a repeated measures test for the pre-test, post-test, and delayed post-test for the sound waves unit tests. The results indicated that there was a significant effect over time $F(2,128) = 20.30, p < .05$, and this effect accounts for approximately 24% of the variance over time (see Table 5 for descriptive data on means and standard deviations). Although there was a significant effect over time, there was no significant difference between groups $F(1, 64) = 1.17, p > .05$, accounting for less than 2% of the variance in score. Further, there was a significant interaction effect between sound scores and group $F(2,128) = 4.3, p < .05$, accounting for approximately 6% of the variance.

Although the difference between groups was not statistically significant, the students in the treatment group retained science information over time as measured by a delayed post-test where as students in the comparison group regressed close to their pre-test score.

Table 5: Sound Waves Test Descriptive Statistics

Test	<u>Treatment group</u>		<u>Comparison group</u>		<u>Total</u>	
	N	M (SD)	N	M (SD)	N	M (SD)
Sound pre-test	33	2.5 (1.2)	33	3.2 (1.7)	66	2.8 (1.5)
Sound post-test	33	3.9 (1.3)	33	4.5 (1.4)	66	4.2 (1.4)
Sound delayed post-test	33	3.9 (1.2)	33	3.4 (1.5)	66	3.66 (1.4)

Figure 1 depicts the sound waves test pre-test to delayed-post trajectory.

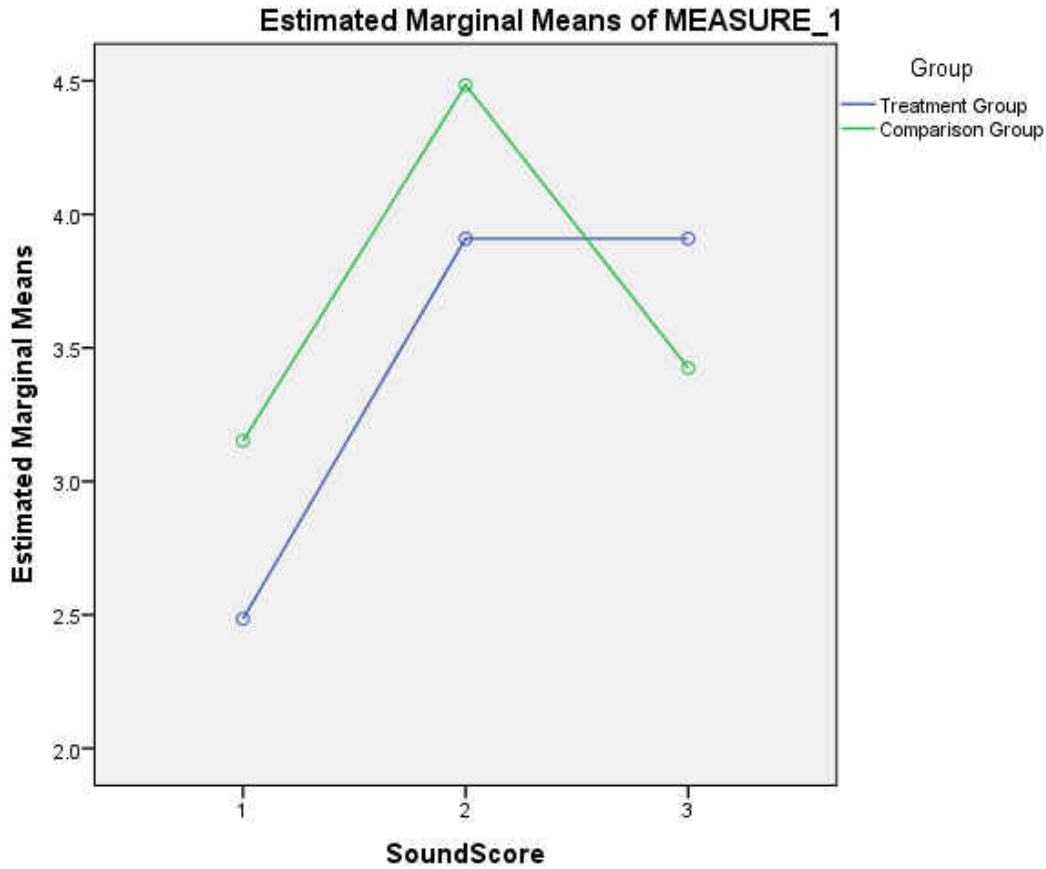


Figure 1: Sound Waves Group Comparison

In addition to the sound wave unit tests, the researcher administered a pre-test and post-test for a unit on electromagnetic waves. The researcher found that there was a significant difference in pre-test and post-test of electromagnetic wave test $F(1,69) = .35, p < .05$, accounting for almost 15% of the variance. However, there was no difference between groups $F(1, 69) = .31, p > .05$ and it explained less than 1% of the variance in score. In addition, there was no interaction effect $F(1, 69) = .31, p > .05$; it, too, accounted for less than 1% of the variance in score (see Table 6 for descriptive statistics, mean and standard deviation). This may be due to the brevity of the exam—only six questions.

Table 6: Electromagnetic Waves Descriptive Statistics

Test	Treatment Group		Comparison Group		Total	
	<u>N</u>	<u>M (SD)</u>	<u>N</u>	<u>M (SD)</u>	<u>N</u>	<u>M (SD)</u>
EM Pre-test	34	3.1 (1.6)	37	3.2 (1.7)	71	3.1 (1.7)
EM Post-test	34	3.8 (1.7)	37	4.1 (1.7)	71	3.9 (1.7)

Question 2: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' and non-ELs' reading comprehension as measured by the English Language Arts eighth-grade REGENTS in three inclusive science classrooms?

To determine whether explicit instruction of macro-text structures plus micro-text structures have an impact on reading comprehension, the researcher used a repeated measure test and found that there was a significant difference in reading comprehension pre-test and post-test $F(1, 77) = 4, p < .05$, which accounts for almost 6% of the variance in scores. Although there was a significant difference in reading comprehension scores, there was not a significant difference between groups $F(1,77) = .23, p > .05$, accounting for less than 1% of the variance in score. Further, there was a significant interaction effect $F(1, 77) = 14.9, p < .05$, accounting for 16% of the variance in score (see Figure 2 for graph of interaction and see Table 7 for descriptive statistics, mean and standard deviation).

Table 7: REGENTS Descriptive Statistics

Test	Treatment Group		Comparison Group	
	<u>N</u>	<u>M (SD)</u>	<u>N</u>	<u>M (SD)</u>
REGENTS Pre-test	39	1.6 (.7)	40	2.0 (.8)
REGENTS Post-test	39	1.7 (.8)	40	1.5 (.7)

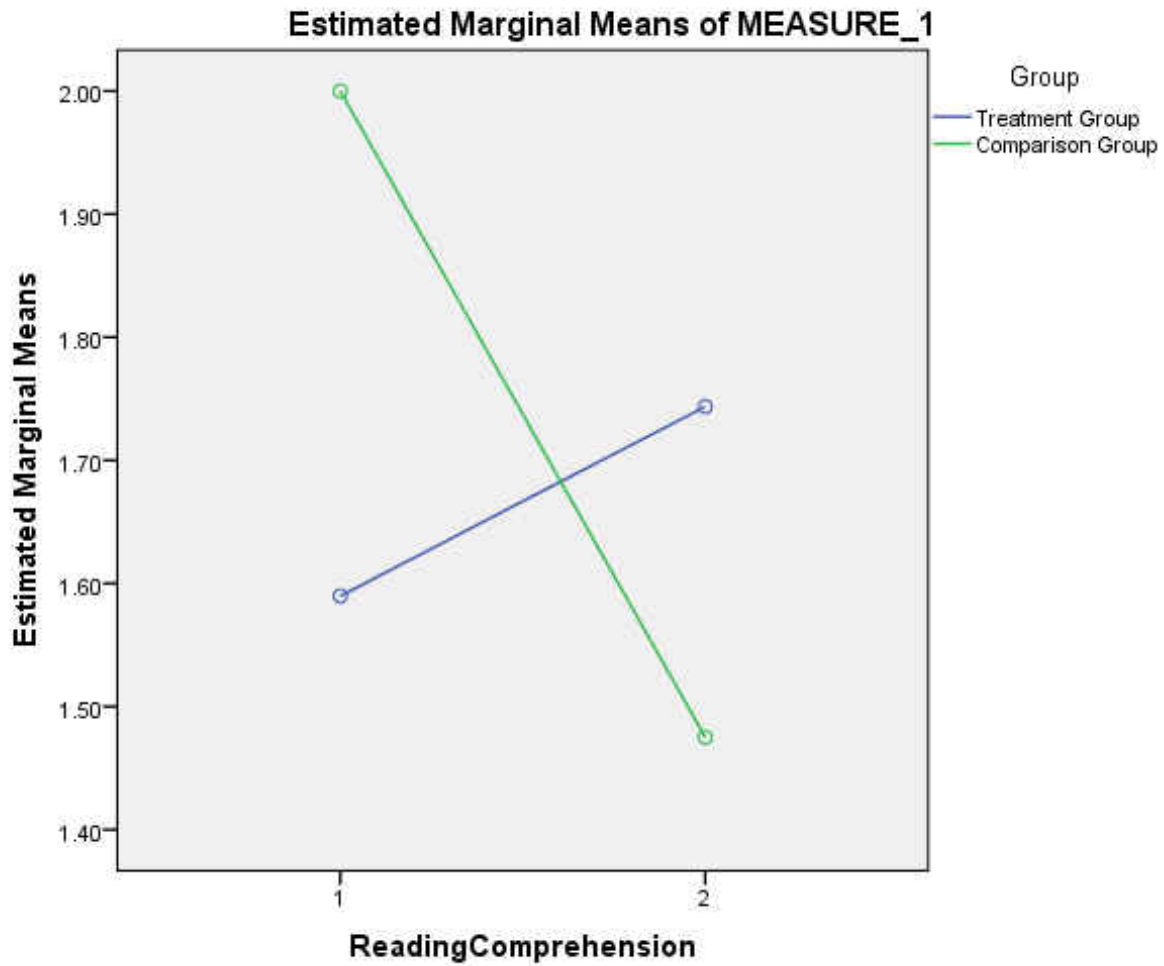


Figure 2: REGENTS Results Group Comparison

Figure 2 illustrates the change in scores from pre-test to post-test for each group. The means for the comparison group declined drastically from pre- to post-test while the means for the treatment group increase moderately from the pre- to post-test. This may be due to the differences in text. Although the comprehension questions were parallel for extended response, the reading selections for the pre-test were fiction (narratives) while the reading selections for the post-test were nonfiction (expository). This would also suggest that the decline should be evident in both groups, yet the treatment group improved even with the different text selection.

Question 3: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' and non-ELs' sentence comprehension as measured by the TOAL-4 in three inclusive science classrooms?

To analyze the impact of explicit instruction of macro-text structures plus micro-text structures on sentence comprehension, the researcher paired up sentences by word count and number of ideas given for combinations to have an equivalent pre-test and post-test. Then the researcher combined the four scores of sentence combination (sentence type, grammar, comprehensibility, and logical order). The researcher then conducted repeated measures for sentence combination and found a significant interaction between sentence combination score and group $F(1,70) = 7.51, p < .05$, which accounts for almost 10% of the variance in score ($\eta^2 = .097$). Although there was a significant interaction between sentence combination and group, there was no significant difference between groups $F(1,70) = .406, p > .05$, accounting for less than 1% of the variance in score ($\eta^2 = .006$) (see Table 8 for descriptive statistics, mean and standard deviation).

Table 8: Sentence Combination Test (TOAL) Descriptive Statistics

Test	<u>Treatment Group</u>		<u>Comparison Group</u>	
	<u>N</u>	<u>M (SD)</u>	<u>N</u>	<u>M (SD)</u>
Pre-test	40	19.40 (4.0)	32	18.23 (5.0)
Post-test	40	16.83 (5.6)	32	19.18 (4.3)

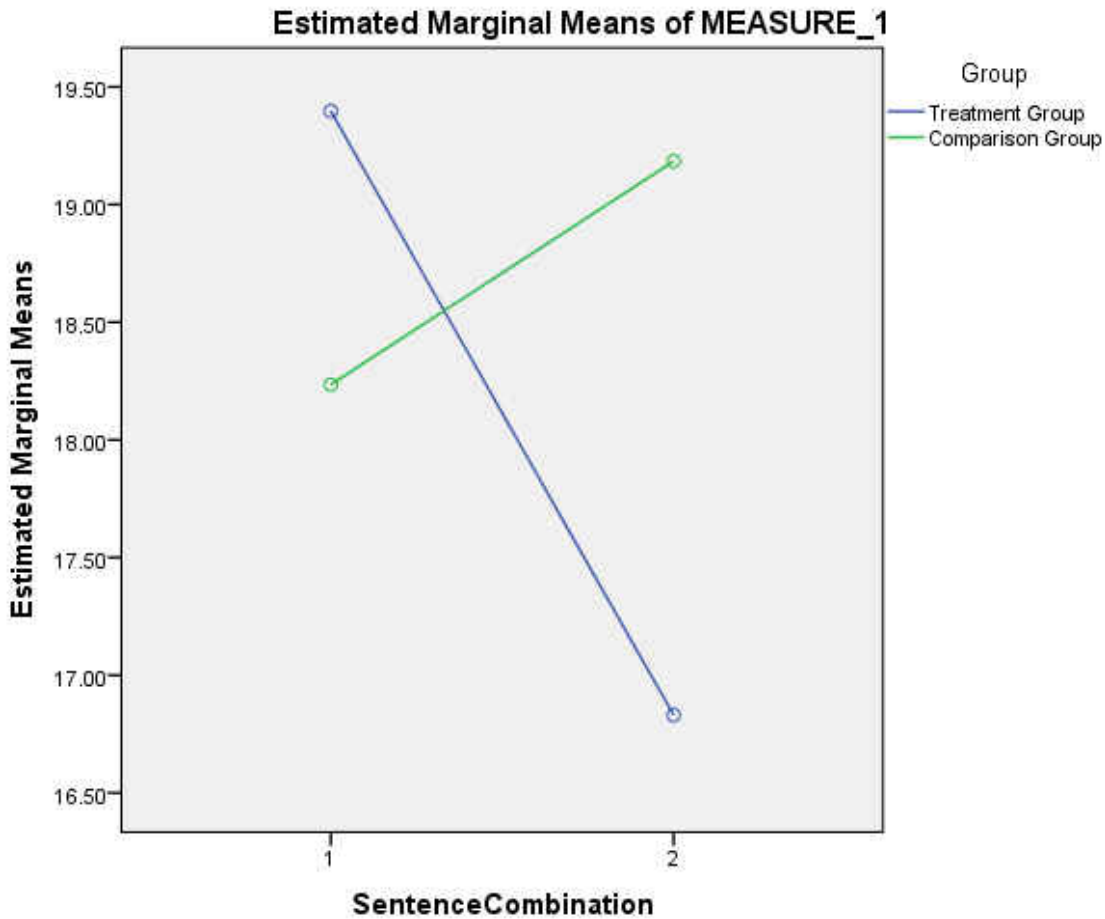


Figure 3: Sentence Combination Group Comparison

Figure 3 illustrates the change in mean from the pre-test to the post-test for each group. The treatment group in this case regressed. As illustrated in Figure 3, the scores for the treatment group declined drastically from pre-test to post-test while the scores for the comparison group increased moderately from pre-test to post-test. This may be due to the complexity of the ideas the students had to combine. Although the sentences were paired by word and sentence count, the complexity of ideas was not taken into consideration.

Question 4: Can reading comprehension scores be predicted by the relationship between sentence comprehension scores and reading comprehension scores in three inclusive science classrooms?

$H_0: (\beta_1 = 0)$ Sentence combination scores cannot predict reading comprehension scores.

$H_1: (\beta_1 \neq 0)$ Sentence combination scores can predict reading comprehension scores.

To establish whether the relationship of sentence comprehension and reading comprehension serves as a predictor for reading comprehension scores overall, the researcher conducted a linear regression. There was a significant predictive relationship between reading comprehension and the four components of sentence comprehension (sentence type, grammatical error, comprehensibility and logical order of ideas) $F(4, 74) = 3.20, p < .05$. However, no individual predictor significantly predicted the score for reading comprehension. In other words, none of the four components of sentence comprehension scores (sentence type, grammatical error, comprehensibility, and logical order of ideas) can predict reading comprehension scores. The sum of all four components of sentence comprehension is calculated as one score, and correlated with reading comprehension scores, there was significant predictive relationship between reading comprehension and the sum of the four components of sentence comprehension $F(1,77) = 4.2, p < .05$, accounting for nine percent of the variance ($r^2 = .091$).

The relationship between sentence combination scores is explained using the following regression formula: $Y = \beta_0 + \beta_1X \rightarrow Y = .93 + .04$ (the sentence comprehension score). Based on the information, the researcher extrapolated that as sentence combination scores increased the reading comprehension scores increased as well; thus, the null hypothesis was rejected.

Table 9: Predictors

Model	β
Constant	.93
Sum of components	.04

Question 5: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' science content learning as measured by unit test in three inclusive science classrooms based on language proficiency CELLA Reading anchor scores?

To determine whether the ELs in the study followed the same patterns as the group of participating students as a whole, the researcher analyzed only the ELs that had CELLA Reading scores. The researcher analyzed the scores of the ELs with CELLA reading scores and separated them by groups to conduct an ANOVA Repeated Measures analysis. Upon preliminary research the researcher found a significant difference between Reading Scales, which were CELLA Reading anchor points, $F(2, 14) = 16.2, p < .05$, accounting for 70% of the variance in score. However, upon closer analysis the scores were influenced by two scores in anchor one. The students in anchor one were part of different groups, which showed differences in mean (see Table 10). The mean differences, in this case, could not be generalized because they were the means of only two individual students. Because the scores of these two students were outlier scores, they were omitted and the Repeated Measures was conducted again (see Table 10 and Table 11).

Table 10: Group Means for CELLA—Two Students in Anchor One

Measure	Treatment group		Comparison group	
	n = 1	<u>M (SD)</u>	n = 1	<u>M (SD)</u>
Sound waves pre-test		4		5
Sound waves post-test		6		6
Sound waves delayed post-test		4		5

Table 11: Mean Differences for ELs by Groups

Group	Content learning over time	Mean	SE	<u>95% Confidence interval</u>	
				Lower bound	Upper bound
Treatment Group	Pre-test	2.5	.375	1.7	3.3
	Post-test	3.6	.322	2.9	4.3
	Delayed post-test	3.8	.334	3.1	4.5
Comparison Group	Pre-test	2.4	.672	1.0	3.8
	Post-test	3.0	.576	1.8	4.2
	Delayed post-test	2.6	.598	1.3	3.9

Although there was no significant difference in Reading scales, there was a significant difference between groups $F(1, 14) = 5, p < .05$, accounting for 26% of the variance in score. The results suggested that ELs in reading anchor three benefited from most explicit instruction of macrostructures plus microstructures as their scores continued to increase even from post-test to delayed post-test. It also suggested that ELs in reading anchor four were able to retain content knowledge over time similar to their non-EL counterparts. When analyzing the means, the treatment group performed better than the comparison group (See Table 10). In addition to a

significant difference between groups, there was an interaction between reading scales and group $F(1, 14) = 24.8, p < .05$, accounting for 64% of the variance in score. These results suggested that the groups are changing differently over time (See Figure 4). Figure 5 depicts the differences in score for pre-, post-, and delayed post-test for ELs according to their CELLA Reading Anchor scores.

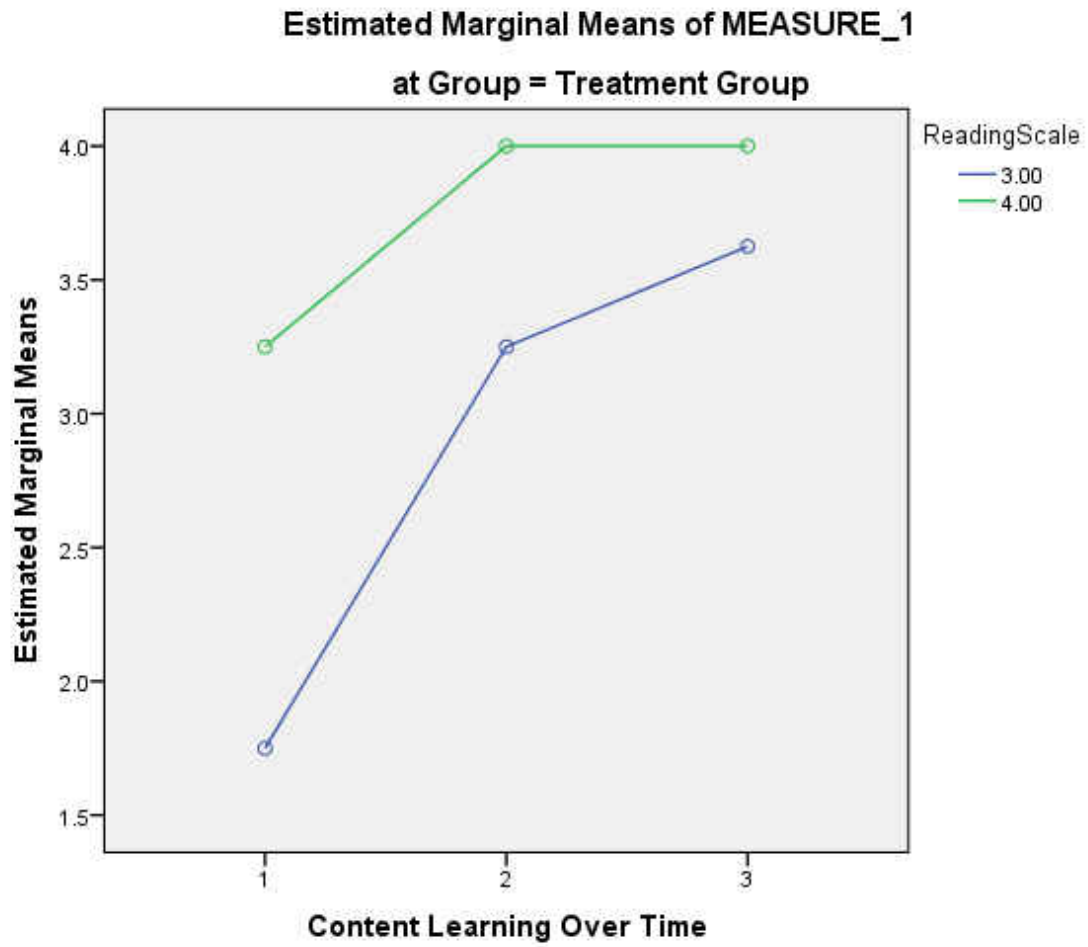


Figure 4: Student Performance on Science Content Learning in Treatment Group Based on Language Proficiency

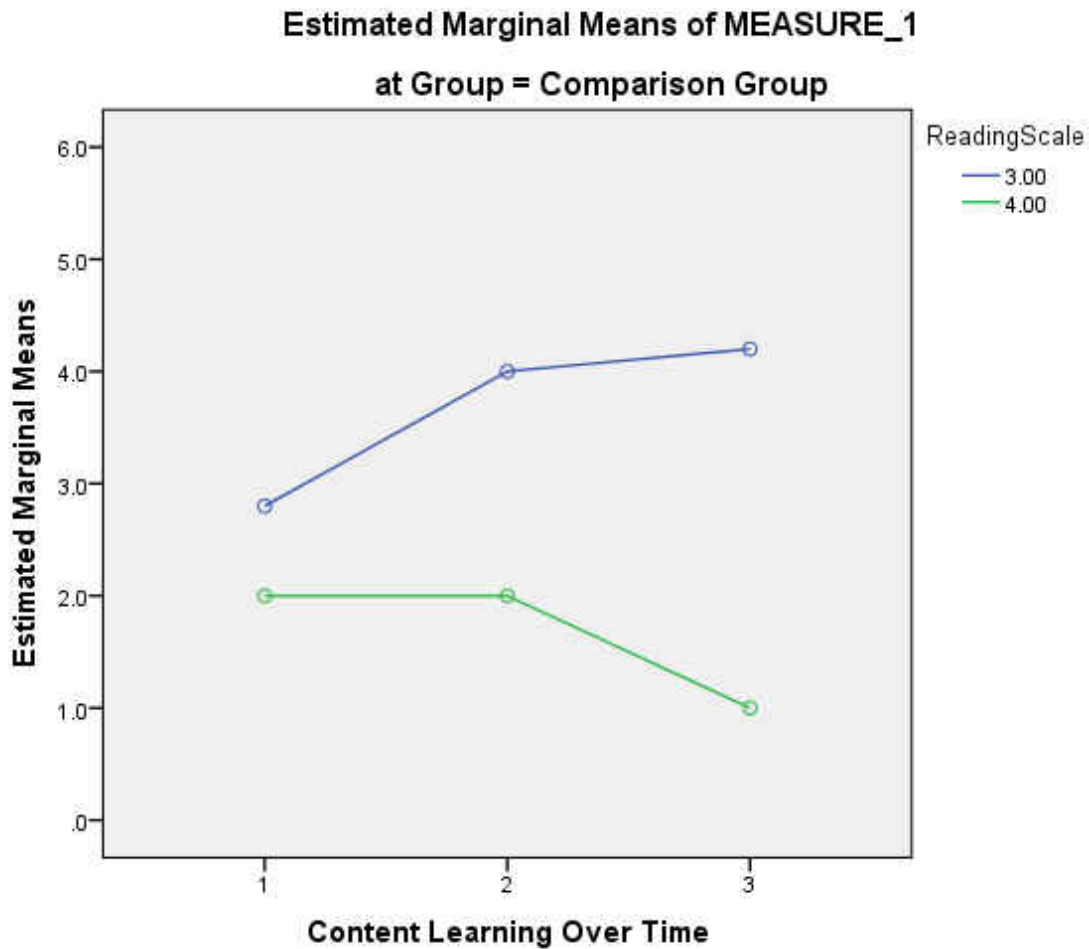


Figure 5: Student Performance on Science Content Learning in Comparison Group Based on Language Proficiency

Question 6: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' reading comprehension as measured by the English Language Arts eighth-grade REGENTS in three inclusive science classrooms based on language proficiency CELLA writing anchor scores?

Since the REGENTS reading comprehension measure required students to demonstrate comprehension in writing, the researcher used the CELLA writing anchor scores to identify the impact of the intervention. The researcher analyzed the scores of the ELs with CELLA writing

scores and separated them by groups to conduct an ANOVA Repeated Measures analysis. There was no statistical difference between groups $F(1, 14) = 2.8, p > .05$. Although there was no difference between groups, the researcher found that the gains for REGENTS were significant for writing scales $F(2, 14) = 6.4, p < .05$, accounting for 48% of the variance in score.

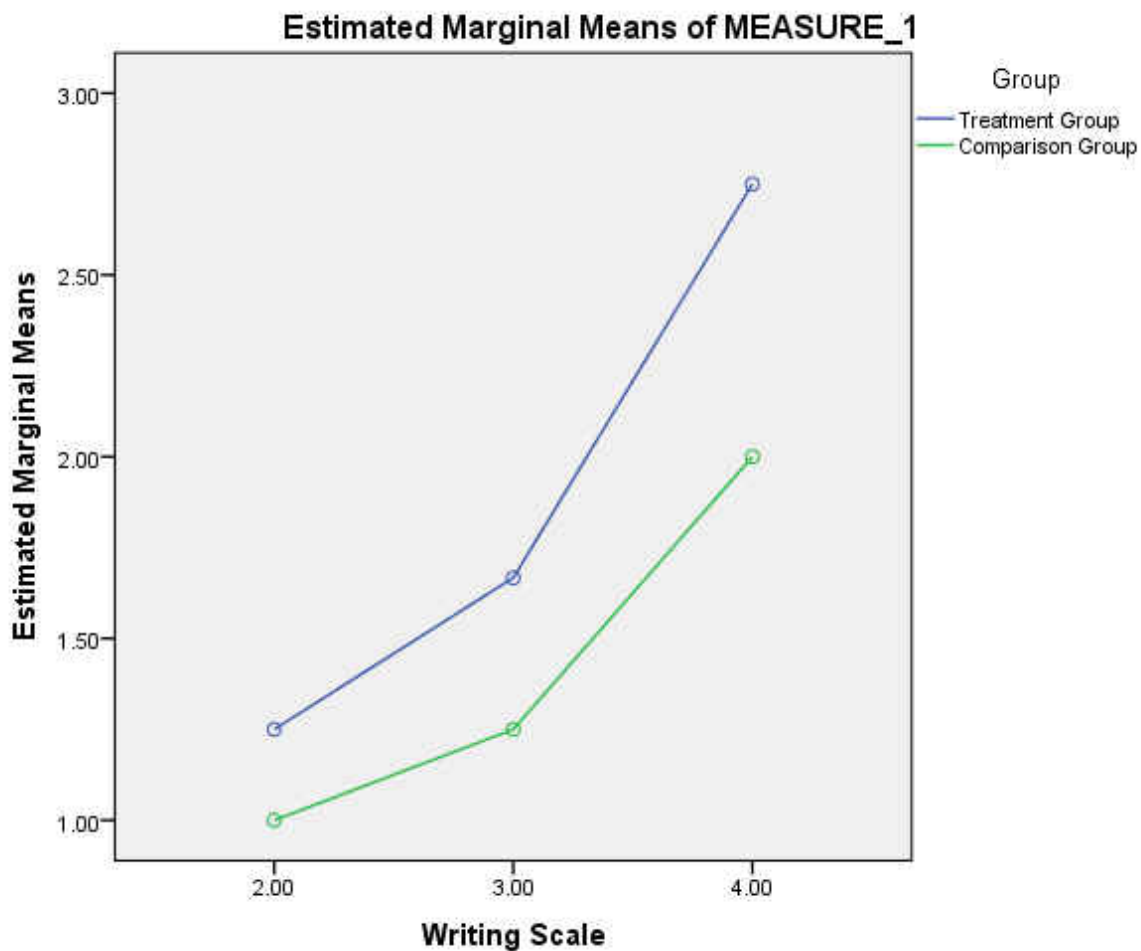


Figure 6: Writing Scale Group Comparison

Figure 6 shows ELs' performance on reading comprehension post-test separated by group and CELLA writing anchors. Table 12 provides the descriptive statistics for student performance on reading comprehension post-test separated by group and CELLA writing

anchors. Initially, the participants in the treatment group began higher than the participants in the comparison, and the treatment group maintained a higher score, with students in anchor two and anchor four improving in the post-test while most students in the comparison group maintained the same mean score, with the two students in writing anchor four having a lower post-test mean score.

Table 12: Reading Comprehension Scores Segregated by Group and Writing Anchor Score

	Anchor scores	n	Pre-test M (SD)	Post-test M (SD)
Treatment	2	2	1 (.0)	1.5 (.7)
	3	9	1.7 (.7)	1.7 (.7)
	4	2	2.5 (.7)	3 (.0)
Comparison	2	1	1 ()	1 ()
	3	4	1.3 (.5)	1.3 (.5)
	4	2	2.5 (.7)	1.5 (.7)

Question 7: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' sentence comprehension as measured by the TOAL-4 in three inclusive science classrooms based on language proficiency CELLA writing anchor scores?

The researcher sought to explore the effects of explicit instruction of macro-text structures plus micro-text structures on eighth-grade ELs' sentence comprehension scores based on their language proficiency CELLA writing anchor scores. The researcher analyzed the scores of the students with CELLA writing scores and separated them by groups to conduct an ANOVA Repeated Measures analysis. The result of the analysis was interesting for several reasons. There was no statistical significant difference between groups $F(1, 14) = 2.8, p > .05$. However,

the results showed that students in CELLA writing anchors two and three of the treatment group performed better on the pre-test than on the post-test, with the exception of students in CELLA writing anchor four (See Figure 7). Interestingly, the students in the comparison group showed similar trajectory, with the students in anchor three performing better on the pre-test than on the post-test (See Figure 8). The results for this analysis may be a result of the task at hand.

Although the researcher paired up the sentences by (1) the number of words provided for students to combine, and (2) the number of sentences provided for students to combine, the complexity of relationship between ideas may have hindered the students with lower writing proficiency.

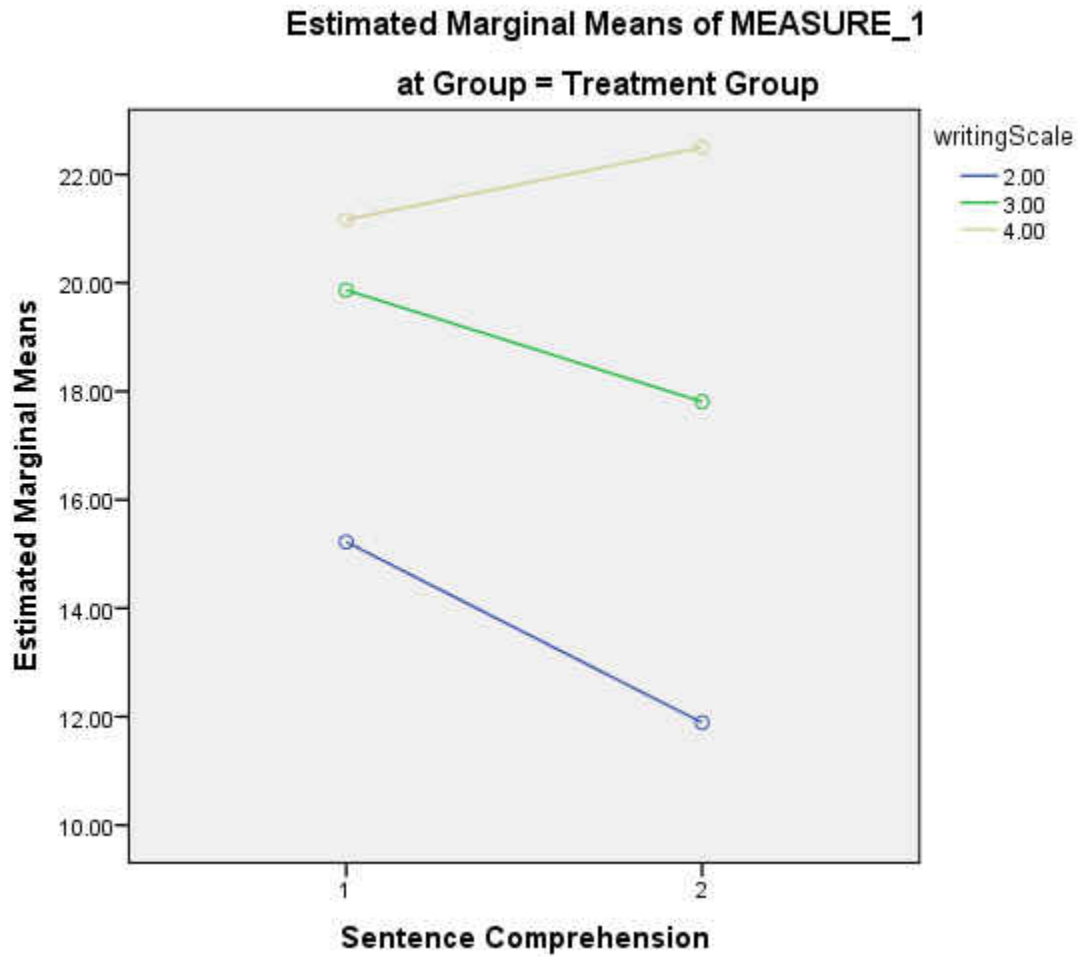


Figure 7: Sentence Comprehension Scores for Pre- and Post-tests for Treatment Group With CELLA Writing Anchors

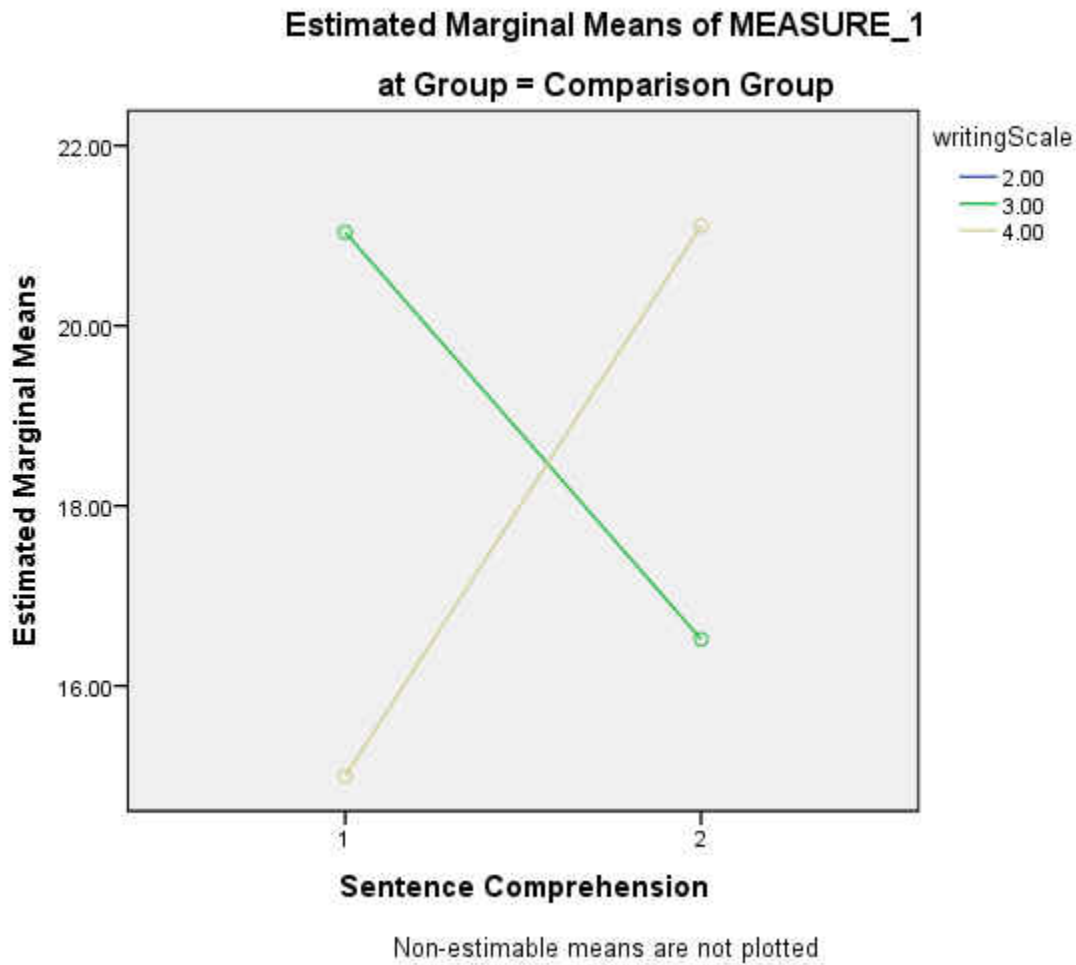


Figure 8: Sentence Comprehension Scores for Pre- and Post-tests for Comparison Group With CELLA Writing Anchors

Discussion

The results of this study are interesting for several reasons. Although this study did not show significant difference between groups overall in any of the measures, it did show significance in several aspects as it pertained to ELs in this study. These results were separated into two sections: (1) the results overall (including all students in three inclusive classrooms), and (2) the results for ELs in the three inclusive classrooms.

Results Overall

There are several reasons that may have affected the results of this research. First, the treatment group and the comparison were not equal in numbers of students classified as Limited English Proficient students. The treatment group had more ELs with a 17 students in the treatment group who had a Limited English Proficiency (LEP) classification status of “yes” versus only six students in the comparison group (see Figure 10). In addition, there were five students with disabilities (SD) in the treatment group, three of whom had both and LEP and SD classification, whereas in the comparison group eight students were SD but only one was both LED and SD.

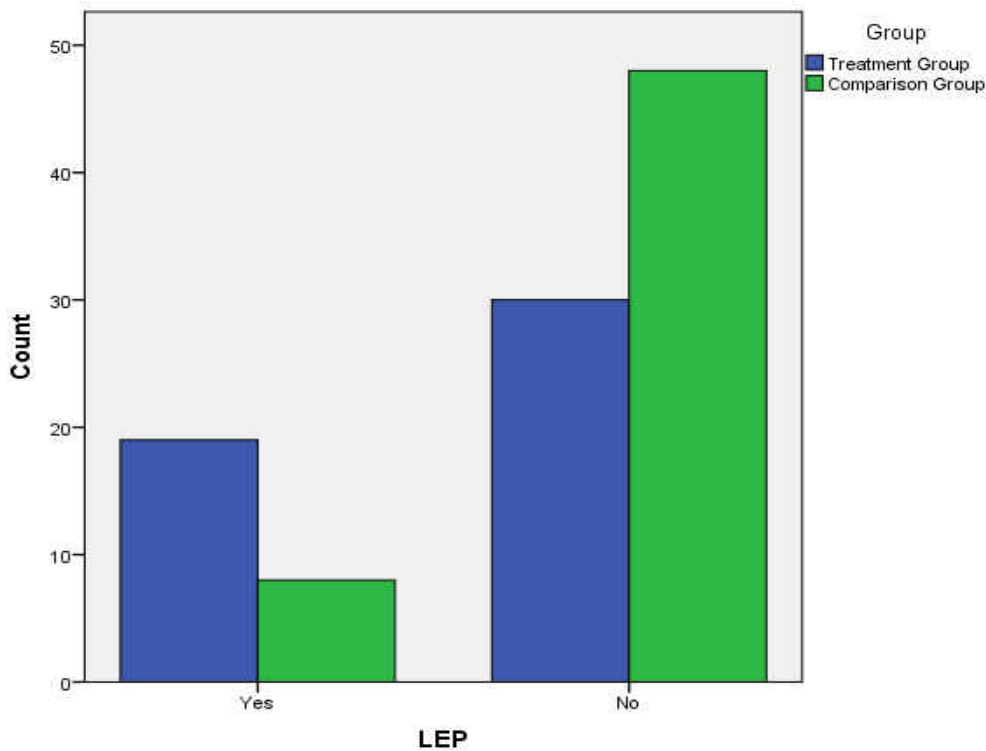


Figure 9: Disparities of LEP Students by Groups

The disparity between the groups may account for the lack of significant difference in some of the comparison measures. While the students with little to no English language proficiency were able to guess answers in the science test correctly, they were not able to guess in the reading comprehension measure or the sentence combination measure, as those required the students to produce language and answer in written form. In addition to the disparity in groups, cognitive strategic instruction needs ample time for learners to be able to internalize and utilize (Ehren, 2008). However, due to changes and demands of a traditional school environment, in the current study the intervention length was short, which may have accounted for the lack of significant difference between groups. On the other hand, despite the limited amount of time spent on intervention, there was a noticeable difference, though not statistically significant, on student performance in the delayed post-test for science content learning where students in the treatment group performed similarly to how they performed in the post-test, whereas the scores of students in the comparison group for the delayed post-test declined close to their performance in the pre-test, and there was statistical difference between groups for content learning when analyzing only ELs. This finding suggests that the instructional approach worked to improve content learning for ELs.

Another interesting finding of the study was the inverse effect in sentence comprehension scores. The average score of the treatment group declined from the pre-test to the post-test while the average for the comparison group increased slightly from pre-test to post-test, and the standard deviations for the treatment groups increased while those for the comparison group decreased. This finding may be due to three possible reasons: (1) Many students in the treatment group did not complete all sentences due to time constraints in the class; (2) Students in the treatment group used more simple sentence structure without a phrase and compound sentence

structure without a phrase; and (3) The researcher paired the sentence combination task by number of words and number of ideas provided to combine. Although the sentences were matched by number that does not take into account the level of complexity within the ideas to combine, so it may be possible that students found the ideas in this task too complex and reverted to either not answering or creating simpler sentences, which resulted in lower scores.

In the reading comprehension measures, the lack of significance between the groups may have to do with the length of intervention and the differences in text assigned as a basis for comparison. In the REGENTS pre-test, students had to read two narratives and answer four open-ended questions while the post-test had two expository texts and four questions. While the questions in the assessment were parallel, the text difficulty may have hindered the comprehension required to produce a response for the open-ended questions. Researchers have argued that narratives are easier to process (Berman & Katzenberger, 2004; Longacre, 1996) while expository text are more complex and require more from the reader (Goldman & Rakestraw, 2000).

ELs in Three Inclusive Classrooms

The results of the sentence combination TOAL sub-test scores for ELs corroborated the research in the field that explained that ELs with low language proficiency have difficulty in processing complex sentences and ideas. Researchers have found that ELs with low language proficiency have difficulty processing and recovering from misanalysis of sentences, especially with more complex input (Jackson, 2008; L. Roberts, 2012; Roberts & Felser, 2011). In other words, if students found the sentence ideas complex and difficult to combine, they may not have been able to recover from the misanalysis in order to formulate an effective and comprehensible sentence. Low proficiency ELs have difficulty finding links between elements across clause

boundaries and consolidating ideas with grammatical information (Jackson & van Hell, 2011; Roberts, Gullberg, & Indefrey, 2008). Other researchers have found that ELs with low language proficiency have limited processing of information (Hopp, 2006). The sentence combination task may be too challenging for ELs with low language proficiency, and as a result, they may not benefit from it until they increase their language proficiency. According to Laufer (1998), reading strategies are inaccessible to ELs until they have gained an adequate language threshold. Although students may conceptually understand the strategy, the language deficit may interfere with their ability to use the strategy. In this case, students with a CELLA writing anchor score of 4 were able show subtle improvements in their sentence comprehension scores, supporting Laufer (1998).

The results of the reading comprehension were interesting because they supported research on explicit instruction of text structures. The ELs in CELLA writing anchors two and four in the treatment group showed improvements from pre-test to post-test, yet the ELs in CELLA writing anchors two and three in the comparison group did not improve or regress from pre-test to post-test, and the ELs in anchor four performed better in the pre-test than in the post-test. This may be in part due to the differences in text used to answer parallel comprehension questions. The pre-test used two narrative texts for comparison, but the post-test used two expository texts. According to research, narratives are considered easier to follow since they are organized sequentially (Berman & Katzenberger, 2004; Longacre, 1996). Expository texts are considered more challenging, requiring readers to process textual features (Goldman & Rakestraw, 2000).

The results of the science test for the sound waves unit provided insight to the effect of teaching macro-structures plus micro-structures to ELs. The results showed that there was a

difference between the ELs in the intervention group and the ELs in the comparison group, where the ELs in the treatment group improved their scores on the post-test and the delayed post-test. The ELs in the treatment group in the CELLA Reading anchor three improved their scores from pre-test to post-test to delayed post-test, and the ELs in anchor four improved from pre-test to post-test and retained the same average for the delayed post-test. Unlike the treatment group, the comparison group did not have such gains. In fact, the results showed that groups are moving in different directions over time. One possible reason for these results is that the students in the treatment group received ongoing instruction, and the students received instruction on how to combine concepts from the two units (i.e., sound waves and electromagnetic waves) to create a comparison and contrast essay. These results need to be considered with care since the total number of ELs was low. These results may not be used to make general assertion about the EL population as a whole.

CHAPTER 5: DISCUSSION

In this chapter, the researcher discusses the conclusions extrapolated from the findings, fidelity of the implementation, limitations, practical implications, and recommendations for future research.

The purpose of this study was to explore the impact of explicit teaching of macrostructures plus microstructures on eighth-grade ELs' and non-ELs' science content learning, reading comprehension, and sentence comprehension in three inclusive classrooms. The results of the repeated measures ANOVA for all students and only ELs in the study are described below.

Research Questions

Question 1: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' and non-ELs' science content learning as measured by unit test in three inclusive science classrooms?

To assess the impact of explicit instruction of macrostructures plus microstructures on science content learning, the researcher used three publisher-created unit tests (pre-test, post-test, and delayed post-test) for the unit on sound waves (McDougal, 2012a) and two publisher-created unit tests (pre-test and post-test) for the unit on electromagnetic waves. The results for the electromagnetic waves unit tests also showed a significant difference between pre-test and post-test. However, no statistically significant difference was found between groups. Further, the sound waves unit test showed a significant difference between pre-test, post-test, and delayed

post-test; thus, both groups performed significantly better in the post-test, but there was not a significant difference between groups. Although there was not a statistical difference between groups, the means for the treatment group stayed the same between post-test and delayed post-test, while the means for the comparison group declined over the same period. This is critical because it may be possible that the scores of the students in the treatment group remained the same because of the combination of explicit science content instruction plus explicit instruction of the text structure of science, specifically comparison and contrast. Knowledge of macrostructures in content-area aids content-area learning and recall of information. Cook and Mayer (1988) found that when readers were aware of the text structure they were able to improve their comprehension of scientific text. Vaughn et al. (2013) found that students who were allowed to interact with social studies text through independent reading and small group discussion increased content acquisition.

Question 2: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' and non-ELs' reading comprehension as measured by the English Language Arts eighth-grade REGENTS in three inclusive science classrooms?

The researcher used the English Language Arts eighth-grade REGENTS exam in order to be able to control for the macrostructure the students were asked to employ during their comprehensive responses. The results for this question did not corroborate with the findings on various research studies on the positive impact of teaching text structures on reading comprehension scores (Chambliss, 1995; Mautone & Mayer, 2001; White, 2012). Although the data show that there was a significant difference between pre-test and post-test, the difference was not significant between groups. A possible reason for the lack of significant difference between groups may be the task itself, the difference in genre, or the amount of time allotted to

complete the task. While there are several advantages to an extended response assessment, such as measuring complex learning outcomes and integrating and applying thinking and problem-solving skills (Linn & Miller, 2005), there are several limitations, such as time required for response and the requirement of productive language. In this study, the requirement of productive language (writing) may have been a hardship for some students who had low language proficiency skills.

Another possible reason for the lack of significance may have been the genre in the REGENTS exam. While the questions for text analysis were comparable from pre-test to post-test, the genre of the text was different. In the pre-test, the students were given two narrative texts to compare and contrast, while for the post-test, the students were given two expository texts to compare and contrast. According to Hay and Moran (2005), the genre of text accounted for differences in sentence length, word count, and sentence complexity in comprehension responses. In their study, Hay and Moran (2005) sought to find how individuals processed syntax, and found that individuals produced more words and clauses, and demonstrated increased syntactic complexity for the narrative discourse than the expository discourse passage. Last, the students with low language proficiency typically need more time to formulate a response, and the students were limited to only 50 minutes for the REGENTS exam; thus, many of them did not finish answering all of the questions on the REGENTS. Those scores were included in the analysis, so if a student was present during the REGENTS exam, took an exam, and answered only the first question; he or she received a score for each question even if unanswered. All scores were factored into the analysis.

Question 3: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' and non-ELs' sentence comprehension as measured by the TOAL-4 in three inclusive science classrooms?

The researcher used the sentence combination subtest of the TOAL-4 to measure sentence comprehension. The sentence combination subtest was scaled to increase difficulty, so the researcher paired the sentences by word count (how many words were given initially to combine) and number of ideas (how many sentences/ideas were given initially to combine) to have repeated measure. The researcher conducted a repeated measure ANOVA and found that there was a significant interaction between all four scales scored (sentence type, grammar, comprehensibility, and logical order), but there was no significant difference between the groups. In fact, the scores for the treatment group declined from pre-test to post-test while the scores of the comparison group increased. The results for this question to corroborate the syntactic complexity hinder text processing (Gennari& MacDonald, 2008; Guthrie, 1973). For this task, students were asked to combine sentences into one cohesive thought, so the task itself may have been difficult for students to process. According to Nation and Snowling (2000), sentence comprehension is sensitive to syntactic complexity and semantics, so students may have had difficulty producing an appropriate syntactic relationship if they did not understand the syntactic complexity the sentences required, or if they did not possess the semantics to convey such relationships. During the analysis of the sentences, the researcher noticed that some students arranged the ideas in a logical pattern but failed to establish the relationship with proper syntax or semantics. This finding may be due to the differences in language proficiency, sentence complexity, and time constraints.

Question 4: Can reading comprehension scores be predicted by the relationship between sentence comprehension scores and reading comprehension scores in three inclusive science classrooms?

The researcher used a linear regression to determine whether reading comprehension scores can be predicted by the relationship between sentence comprehension and reading comprehension scores. The data showed that reading comprehension scores can be predicted by the relationship between sentence comprehension scores and reading comprehension scores. Students with high sentence comprehension also had high reading comprehension scores while students with low sentence comprehension scores had low reading comprehension scores.

The researcher also sought to determine whether one factor of the sentence comprehension task could predict reading comprehension scores by itself. The data showed that no one predictor could predict reading comprehension scores and that it was the combination of all four scores that served as a predictor. Because the scores for sentence type, grammar, comprehensibility, or logical order did not serve as predictors in isolation, these findings agreed with Nation and Snowling (2000) and Mokhtari and Thompson (2006), suggesting that the combination of syntactic complexity and semantics impacts reading comprehension. In other words, reading comprehension requires both semantics and knowledge of syntactic structures.

Question 5: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' science content learning as measured by unit test in three inclusive science classrooms based on language proficiency CELLA Reading anchor scores?

The results suggested that ELs with CELLA reading anchor three benefited from most explicit instruction of macrostructures plus microstructures. It also suggested that students in reading anchor four benefited from explicit instruction of macro-text structures plus micro-text

structures because they were able to retain content knowledge over time similar to their non-EL counterparts. The results also suggested that groups moved further apart over time, suggesting that ELs in the treatment group improved while the ELs in the comparison group remained the same or declined over time. These results need to be considered with care, since the total number of ELs was low. These results may not be used to make general assertions about the EL population as a whole.

Question 6: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' reading comprehension as measured by the English Language Arts eighth-grade REGENTS in three inclusive science classrooms based on language proficiency CELLA Writing anchor scores?

The results of the ANOVA Repeated Measure for this question were interesting because they show growth from ELs with low CELLA anchor scores and ELs with high CELLA anchor scores, but ELs with an anchor score three remained the same from pre-test to post-test. This may be due to the low number of participants in anchors two and four compared to anchor three, which had nine ELs. These results need to be considered with care, since the total number of ELs was low. These results may not be used to make general assertions about the EL population as a whole.

Question 7: Does explicit instruction of macro-text structures plus micro-text structures have an impact on eighth-grade ELs' sentence comprehension as measured by the TOAL-4 in three inclusive science classrooms based on language proficiency CELLA Writing anchor scores?

The results of the ANOVA Repeated Measures showed that ELs' scores in sentence comprehension declined between pre-test and post-test. The results for this analysis may be a

result of the task at hand. Although the researcher paired up the sentences by (1) the number of words provided for students to combine, and (2) the number of sentences provided for students to combine, it may have been possible for the complexity of relationships between ideas to have hindered the students with lower writing proficiency. These results need to be considered with care, since the total number of ELs was low. These results may not be used to make general assertions about the EL population as a whole.

Theoretical Implications

According to Goodman's socio-psycholinguistic view of reading, the reader's knowledge, experience, and background knowledge impact the interpretation of text. The background knowledge that affects reading can be either content based (e.g., knowledge of the scientific method) or linguistic and text based (e.g., knowledge of syntactic structures, knowledge of organizational patterns) (Goodman, 1994). During the implementation of the intervention, students were introduced to various content-, linguistic-, and text-based strategies. The results of this study were affected by the short time spent on intervention, selection bias, and low population, so the results cannot be generalized. The results of the reading comprehension and sentence comprehension tests varied when looking at only ELs and when looking at the entire participant group. On one hand, the results for ELs-only seemed to support Goodman's socio-psycholinguistic view of reading, where the ELs interacted more efficiently with the text after receiving explicit instruction of text structures. On the other hand, the results for all participants did not depict the same results as the ELs-only analysis. The results cannot be used to support or negate Goodman's view of reading, because the time spent on intervention was too short to make notable changes in the reading approach of students in the treatment group.

The result of the science tests (sound waves pre-, post-, and delayed post-test) do, however, seem to support Goodman's reading view, because it sheds light on the effect of teaching text structures. Although there was no statistical difference between groups, the fact that the students in the treatment group retained more of the information than the students in the comparison group suggested that when concepts were presented in relation to other concepts and students learned to identify the relationship between concepts, students retained information longer.

According to the Gradual Release of Responsibility Model, instruction needs to be scaffolded to support students in becoming independent learners and assume more responsibility over time, with less support from the teacher (Pearson & Gallagher, 1983). The present study used the Gradual Release of Responsibility Model during every session, but because of the short time spent on intervention and the linguistic limitation of several students in the treatment group, the results of the study cannot be generalized. The results for the ELs-only analysis supported the Gradual Release of Responsibility because students did perform significantly differently between pre- and post-test and between groups. However, the results of the analysis including all students did not follow the same pattern. Although the results did not show a significant difference between groups when all participants were considered, the results were affected negatively because of the short time spent on intervention. The Gradual Release Model requires time to ensure that students become independent learners.

Methodological Implications

The researcher used a non-equivalent group pre-test–post-test quasi-experimental design (Campbell & Stanley, 1963; Cook & Campbell, 1979). The research methods proved to be effective in establishing a baseline with the pre-test, allowing for comparison between pre- and

post-test. The researcher, however, was unable to determine with certainty that the differences in scores between pre- and post-test were due to the intervention as opposed to maturation, because the score differences between pre-, post-, and delayed post-test hinted that there was a difference, though not significant, between groups in the content retained over time when all participants were considered. Although the results of the intervention did not yield significant difference between the groups when all participants were considered, it did yield significant differences and interactions when considering only ELs.

The lack of significant difference when considering all participants may be due to the short amount of time spent on intervention while the significance in difference when considering only ELs may be due to the number of participants or to the notion that students were exposed to more language and strategies during the intervention. The research methods implemented were appropriate for establishing differences in score before and after intervention, and adequate for establishing differences between groups.

Practical Implications

There are several practical implications of the study. The results of the study suggested that students who received explicit instruction of macrostructures plus microstructures were able to retain content information over time, and ELs who received the intervention performed better in content learning. This result could be due to the amount of guided practice on text structures the researcher provided ELs and the amount of language support the researcher provided to the ELs.

Content-area teachers could use explicit instruction of content-area text structures to help students learn and retain content over time. Content-area teachers should also be aware that teaching content-area text structures as an effective reading strategy for content learning and

reading comprehension takes time, so content-area teachers should prepare to teach the strategy and review it constantly.

Since typical content-area teacher professional development does not include text structure pedagogy, content-area teachers need specific professional development. The results of this study suggested that explicit instruction of text structures can help students acquire and retain content knowledge over time. Research on the impact of teaching text structures showed significant growth when content-area teachers received professional development on the strategy (Ehren, 2008; Vaughn et al., 2013), and the instruction of text structures came from the content-area teachers, not an outsider (i.e., a researcher).

Another practical implication of this study is the need for content-area teachers to collaborate with other teachers (reading and language arts teachers) as well as other professionals (ESL teacher, ESE teacher, etc.) to create lessons and approaches to content using similar strategies, so that students receive the necessary exposure and opportunities to practice using strategies (Ehren, 2013). Collaboration allows for content (in this case, science) and language to enhance one another. Cervetti and Pearson (2012) stated, “Position literacy vis- à-vis science as a set of tools that supports students in using the methods and lenses of science to make sense of the natural world” (p. 585).

This study had additional implications for the instruction of ELs. The results of this study suggested that even in a short intervention period explicit instruction of macro-text structures plus micro-text instruction aids ELs with high-intermediate language proficiency (i.e., CELLA reading and writing anchor score of four or higher) with content learning and retention and reading comprehension. This study provided science teachers with an insight into how much language support and guided practice low language proficiency level students need in order to be

successful in science learning. The findings of this study showed that when ELs were explicitly taught macrostructures plus microstructures and provided language support and guided practice, they started to improve their scores in science content learning, and they may maintain learning scores over time. This suggested that an effective approach to teaching ELs in science classes should include explicitly teaching content vocabulary plus functional vocabulary, such as vocabulary used for instructions and directions and explicitly teaching text structures (i.e., text features, macrostructures, microstructures, and discourse markers). Teaching macrostructures is particularly important if the EL population is diverse, meaning they are from various countries, because organization of macrostructures in other cultures may vary from that of the organizational patterns in the United States. Science teachers need to be aware that students may not have the same organizational macrostructure, so explicitly teaching the macrostructures of science will help ELs achieve greater understanding of text.

Text Structures and English Learners

This study had practical implications for instruction of text structures for ELs. Language proficiency plays a critical role in an EL's ability to access effective learner literacy strategies. English learners with low language proficiency have limited access to literacy strategies, so teachers must be cognizant of the text structures used in class. English learners may struggle with understanding macrostructures. Depending on the country of origin, ELs may not be familiar with the macrostructures or microstructures used in the U.S. For example, in Haiti most story patterns are oral and follow a chronological order, so when Haitian students are in American classes, academic macrostructures may be entirely new to them. Therefore, it is critical that macrostructures are explicitly taught in secondary classes. Much like macrostructures, ELs may also lack knowledge and awareness of microstructures. For example,

Mandarin has a different syntactic construct than English; the subject does not need to learn the sentence in Mandarin, yet in English it is the basic construct. Teachers should not assume that ELs possess knowledge of text structures, but rather ensure that they have it by teaching them such structures.

What Can Science Teachers Do to Help English Learners in Science Class?

The literacy demands for ELs are high. One of the biggest roadblocks for ELs is the lack of academic language (Nutta et al., 2014). Some ELs may have a high social English proficiency, meaning they sound good when they are talking to their friends, but when they are tasked with reading or writing academic text, their lack of language proficiency hinders them. Science teachers can do several things to support ELs in the classroom. First, science teachers must make sure that they explicitly teach science vocabulary but also teach additional vocabulary words that may cause comprehension problems for ELs, such as verbs used to provide instructions (e.g., analyze, synthesize). Second, science teachers can provide ELs with academic language support by asking them level questions, which are questions that focus on what ELs can do instead of the deficits in their language (Nutta et al., 2014). Third, science teachers must be prepared to provide ELs with more guided practice than other students, especially because their pacing may be slower than other students, not because of a lack of content knowledge but a lack of language proficiency. Other instructional approaches science teachers can implement to help ELs are peer-learning and non-verbal support.

A good monitoring routine for science teachers is to expand the ELs' understanding of content and language by diversifying the leveled questions. For example, a new arrival from Congo was able to answer only yes/no questions after a few weeks. The teacher can push the student's language and content knowledge by asking him or her questions that require a one

word response or a short phrase, depending on how much language he or she has developed over the weeks. In other words, science teachers can build ELs' confidence, content learning, and language proficiency by asking questions in a variety of forms. Science teachers can also monitor ELs by assigning nonverbal tasks (Nutta et al., 2014), such as constructing a model of surface waves, and assess ELs performance on the task rather than use of language for the task. If the EL can successfully construct a model, then he or she understands the content but may lack the language to share that with others. Monitoring performance on nonverbal tasks is a powerful tool because if ELs can perform complex tasks, they demonstrate content learning and comprehension of science.

To help ELs become independent learners, science teachers must provide ample nonverbal stimuli to aid ELs in content learning, guided practice, and scaffolded instruction. ELs still benefit from the Gradual Release of Responsibility model, but science teachers must understand that depending on the abstractness of topics it may take longer to become independent learners. To aid ELs, science teachers can form collaborative groups. Students learn more from peers, so putting ELs in collaborative groups will help make the ELs feel included and will help improve language proficiencies and content-area learning. Finally, science teachers must recognize that even if ELs have reading and learning strategies in their first language, they may not have access to those strategies until their language proficiency increases.

Limitations

The present study had inherent limitations and other limitations that arose during the intervention. The results of this study did not corroborate with the findings of intervention studies that suggest that explicit instruction of reading strategies help improve reading

comprehension when considering all students in the group. There were several factors that impacted the results of the study.

Research Design

A non-equivalent group pre-test–post-test quasi-experimental design was used for this study. While the research design had its advantages, it limited the study because of its inherent threats to external and internal validity. One of the inherent threats to internal validity was attrition. At the beginning of the study, there were 115 students enrolled in the class, but 10 students were excluded because they did not complete the study. In addition to the 10 students that were excluded from all analysis, students were excluded from other analyses because they were missing data. For example, a student who completed the pre-test and post-test for the REGENTS reading comprehension assessments but did not complete the post test for the sound waves unit test would be excluded from the science test analysis but included in the REGENTS reading comprehension analysis.

Another inherent threat to internal validity was selection bias. The researcher used a convenience sampling method and randomly assigned the classes to groups. However, within those groups, the researcher was unable to randomly assign students. As a result, the study was limited by the selection bias.

According to Edmonds and Kennedy (2013), the non-equivalent pre-test–post-test quasi-experimental design presents threats to external validity of stimulus characteristics and setting. A limitation on the study’s replicability is that the intervention for this study was implemented by a doctoral student with knowledge and experience in teaching reading comprehension, text structures, and linguistics. This presents a limitation because the researcher had more knowledge of language than a typical middle school science teacher, and the researcher was unfamiliar with

the students' abilities before beginning the study. This suggests that in order to implement this intervention, science teachers would have to receive extensive professional development on teaching text structures for them to develop their knowledge about the literacy demands of science text reading, comprehension, and science learning overall. According to Fang (2014), "Few content-area teacher educators (CTEs) or literacy teacher educators (LTEs) have been trained to be specialists in both domains" (p. 444).

Instrumentation

For this study, the researcher collected sentence comprehension scores using the TOAL sentence combination subtest. However, the sentences were analyzed using four categories: sentence type, grammatical error, sentence comprehensibility, and logical order of sentences. The reason for this was to obtain more information about the students' command of language, but this method took away the validity and reliability that are inherent with the TOAL exam.

Another limitation of instrumentation was the science tests. To assess content learning, the researcher used parallel forms of publisher's unit tests (Serway, Faughn, Holt, Rinehart, & Winston, 2006). The questions for the exams were selected to match the information the students covered during class with the science teacher and their textbook content. To assess reading comprehension, the researcher used the eighth-grade English language arts Regents (OSA) and had all raters use the accompanying grading rubric (see Appendix E).

Sample Selection and Size

The purpose of this study was to explore the impact of explicit instruction of macrostructures plus microstructures in reading comprehension, content learning, and sentence comprehension in eighth-grade ELs and non-ELs in three inclusive science classes. The

researcher used a non-probability sampling method—convenience sampling. The population in the eighth-grade classes was composed of only 26 students classified as ELs and 90 students classified as non-ELs. Part of the reason for the low numbers of ELs and some of the attrition is due to the school's transient population, which reached 33% in the academic school year 2014-2015.

In addition to the low number of ELs in the study, there were several new arrivals from different countries, who spoke little or no English. The new arrivals did not have CELLA scores, nor had been officially classified as ELs, so their scores were not included in some of the analyses. In the sample of the study, there were 15 students with no LEP or non-LEP designation. The study was also limited by the number of students who completed all measures. In addition to students who began the study, then left or arrived after the commencement of the study, there were four students who began the study, left for several weeks and came back in time for the post-test. Their scores were not included in some of the analyses. Although the sample was composed of 110 students, the number of students that completed each assessment varied, so any interpretation of these results must take into account that the sample size was small, so generalizations about the population of students could not be made.

Time Spent on Intervention

The current study was implemented over nine weeks, and the time spent on intervention was approximately 7.50 hours (450 minutes) with approximately 3.5 hours (215 minutes) spent on pre- and post-testing. Time spent on intervention was lower than initially projected due to school days off, benchmark testing, and end of the marking period final exam. Studies show that students need more time to internalize and use cognitive and metacognitive strategies to improve their scores on standardized tests (Ehren, 2008; Vaughn et al., 2013). In the Vaughn et al. (2013)

study, researchers implemented the intervention over a six-to-eight week period for 50 minutes to 54 minutes per session with a total of 30 sessions. The researchers found statistically significant difference between the treatment group and the comparison group in content acquisition, content reading comprehension, and standardized reading comprehension. Vaughn et al. (2013) provided professional development for social studies teachers at the beginning of the school year and created heterogeneous groups of eighth-graders for their study. The type of grouping and the instructor implementing the intervention may be the reasons the researchers found statistical differences between groups. Another reason for the difference may be the time spent on intervention (1,500–1,620 minutes).

Time spent on intervention is crucial. In Ehren (2008), participants in a two-year longitudinal study did not start showing significant reading comprehension gains on standardized tests until the second year in the study. The participants in Ehren’s study received 14 to 39 hours of intervention during the first year of the study, and they did not show significant gains in reading comprehension. Ehren (2008) explained the lack of significant gains after the year by stating, “Learning metacognitive behaviors such as self-questioning and strategy use take more time to generalize to standardized testing than the dosage (14–39 hours) facilitated” (p. 4). In addition, the 50-minute-long intervention that was delivered twice a week became a burden to the participating teachers who sacrificed content learning time. It may be more useful to consider integrating related interventions in a smaller amount of science instructional time (e.g., 20 minutes) over a period of three days per week for sustainability purposes.

The time limitation of this study also affected the learning outcomes of ELs. Because there were several ELs with low language proficiency, there was a higher need for guided practice. The instructional approach of this study focused on teaching text structures to ELs and

non-ELs. In order for learners to use text structure to aid in comprehension, learners must have knowledge of surface structures in order to gain access to knowledge of text-based constructs (i.e., the deeper meaning of text). However, in this study there were several ELs with low language proficiency, so the researcher needed more time for guided practice and for independent practice. In this study, the researcher provided ELs with extra time of guided practice, which meant reduced time for independent practice. Learners need time to practice what they learn.

Scope of the Study

The scope of this study was to examine instructional strategies that content-area teachers can use to improve content learning and reading comprehension. As such, the results of the study refer only to the effectiveness of the instructional strategies and not to the mental processes that may have developed in the children as reader tools. This study did not assess the students' mental processing of text, selection of reading comprehension strategies, or metacognitive activities taking place during reading.

Researcher and Collaboration

Another factor that may have impacted the results was the researcher as the person who administers the intervention. In the present study, the relationship between the researcher and the teachers was cooperative, but not ideal. According to Mattessich, Murray-Close, and Monsey (2001), a cooperative relationship is one that is between individuals but mediated by a third person, does not take into account organizational goals or missions, has interactions on an as need basis, does not include joint planning, conveys information only as needed, does not share authority, responsibilities, or resources. The relationship between the researcher and

teachers may have been due to the inherent challenges of collaborating in a environment (i.e., school structure and professional socialization) (Friend & Cook, 2012). Some teachers feel compelled to ‘fix’ the academic problems of their students alone (Friend & Cook, 2012), and as such each teacher focuses only on his or her academic content, and not on the bigger picture—how to improve the literacy and academic progress of students in general. The unintentional isolation that some teachers may feel is fostered by the school environment (i.e., lack of academic teams) where it is difficult to collaborate with other teachers because of break scheduling, work load, and physical isolation from one another.

Contributions

This study contributed to the body of literature of text structures, explicit instruction of text structures and content learning, the impact of L2 language proficiency on content learning and reading comprehension, and instructional strategies for content-area teachers with ELs.

This study contributed to the body of literature on text structures and content learning. Although the differences between the groups, when both non-ELs and ELs were compared to the comparison group, were not statistically significant, because of the interaction over time the study did add to the body of literature on text structure as an approach to aid in content learning by suggesting that explicit instruction of science text structures (both macrostructures and microstructures) aids in the retention of content over time. This study also contributed to the body of literature on the relationship between microstructures and reading comprehension by showing that it is both syntactic complexity and semantics that predict reading comprehension scores. One does not work independent of the other.

In addition to adding to the body of literature of text structures, this study also contributed to the body of literature on L2 language proficiency and its impact on reading

comprehension, content learning, and access to strategies. As it pertains to ELs, this study added to the body of literature on instructional approaches and language support for ELs in middle school science classes.

Future Research

This study has several implications for future research in the area of collaboration, teacher attitudes about content-area literacy, professional development of content-area teachers, language support, textbook publishers, and replication of this study.

Collaboration

This study was limited by the lack of collaboration between the researcher and the content-area teachers in the study. Collaboration is an instructional practice that supports adolescent reading comprehension in content areas (Ehren, 2008; Fisher & Frey, 2014; L. Roberts, 2012; Vaughn et al., 2013). Due to the increased demands on language, collaboration with SLP would serve as an effective instructional practice to promote literacy (L. Roberts, 2012). L. Roberts (2012) called for SLP collaboration to address the language demands of the CCSS because language, format, and structure are all parts of the SLP's expertise. "The expertise that SLPs offer will be crucial in supporting both classroom teachers and students as they teach and learn new skills and knowledge" (para 8). Like SLPs, ESL teachers possess knowledge of linguistics and language acquisition that can help classroom teachers with ELs in the content-area classes.

Collaborative approaches to education, such as co-teaching, are effective in improving student learning (Fenty et al., 2012). To conduct a successful co-teaching approach in a classroom, collaborating teachers should work together during planning, delivery, and post-

planning (Scruggs et al., 2007), especially when teaching students a complex strategy (Fenty et al., 2012). In Vaughn et al. (2013), five teachers received professional development at the beginning of the school year to be able to implement the intervention in their content-area classrooms. The teachers taught essential content vocabulary, text comprehension, and team-based learning approaches in the social studies classroom over three 10-day cycles (30 sessions in total). Using this approach, students in the treatment group showed gains that differentiated from the gains of the comparison group. In Ehren (2008), the teachers in the study co-taught the classes with one teacher being a general education teacher and the other a special education teacher. Under this approach, after two years the students showed statistical gains in standardized tests and in use of metacognitive strategies. In Fisher and Frey (2014), the researchers provided ongoing professional development to teachers in several middle schools where they taught low-performing students the close-reading strategy, and found that 18 out of 48 students made reading gains of more than one level. Because collaborations between teachers and literacy experts are beneficial, there is a need for future research studies to focus on the impact of collaboration between content-area teachers and literacy experts on student outcomes on standardized measures and teacher measures of reading comprehension and content learning, both immediate and delayed.

Teacher Attitudes

In the current study, the teacher attitudes toward teaching content-area literacy impacted the results of the study. The participating teachers in this study did not favor the instruction of content-area literacy administered by the researcher. The sentiment the teachers shared was that time was taken away from content-area teaching and learning. Most science teachers are

unaware of terms like scientific literacy, and they lack the understanding of what literacy in science looks like or its impact on content learning (Sarkar & Corrigan, 2014; Ulusoy & Dedeoglu, 2011). It is the lack of understanding of what science literacy is and how it impacts content learning that may account for teachers' negative attitudes and their resistance toward collaboration with literacy experts. Another possible reason for teacher resistance may be due to the fact that in states like Florida, teachers are paid based on student performance, so although teachers have a level of understanding about content-area literacy, they will be resistant toward literacy instruction because they view it as loss of instructional time. Future research needs to focus on raising science teachers' knowledge about the role of literacy in science reading, comprehension, shifts in teacher attitudes, and comparisons between the attitudes of teachers that work in states that incorporate merit pay and those states that do not on literacy in science classrooms and collaboration with literacy experts.

Professional Development

The findings and limitations of this study call for research on effective professional development for science teachers for the purpose of developing their knowledge about the role of text structures for reading comprehension and science learning. The demands of the CCSS call for content-area teachers to teach the literacy of their respective contents, but pre-service teacher programs focus primarily on content learning. Because of the current nature of teacher preparation, it is unclear how many teachers know how to teach the text structures of their content area or their content-area literacy (Fang, 2014). In a qualitative study of content-area teachers, Ulusoy and Dedeoglu (2011) found science teachers reported using reading comprehension strategies in the classroom. When asked to elaborate on how they used such

reading comprehension strategies, the teachers explained that they lectured the important points and asked the students questions about the content, and some teachers added that they provide students with writing assignments that entailed summarizing, experiment reports, and short answer responses. Content-area teachers do not have a specific definition for content-area literacy (Sarkar & Corrigan, 2014). The conclusions of Ulusoy and Dedeoglu (2011) and Sarkar and Corrigan (2014), along with the findings and limitations of this study, call for research on effective professional development to provide science teachers with knowledge and skills for teaching content-area literacy.

Language Support

This intervention study used several language support techniques for ELs (translation, leveled questions, and additional guided practice). There is a need for future studies on how much language support ELs of various language proficiencies need in order to make gains in content-area measures, reading measures, and writing measures.

Textbooks

One of the limitations of this study was that the text structures the students were exposed to through their content-area textbooks used an overall simplistic writing style, lacking variety of text structures. In order for instructional approaches such as the one described in this study to be more fruitful, students need to be exposed to an array of text structures. In addition to the lack of text structures, when the researcher was analyzing eighth-grade textbooks to use during the intervention, she found a lack of logical progression in text complexity between eighth-grade science text and ninth-grade science text. The text complexity for ninth-graders is much higher

than the text complexity for eighth-graders in science text. This study has implications for future research on science textbooks. Future research needs to focus on the progression of text complexity in textbooks between secondary grades (e.g., eighth-grade to ninth-grade).

Replication of This Study

Several variables limited the findings of this study. Future research should focus on replicating this study in several ways. First, future research should look at replication of this study with a larger sample size. Second, a replication of this study needs to be implemented in shorter dosages (i.e., 25 minutes a week) over a longer period of time (i.e., one academic year). In research studies, where dosage was lower in frequency but the duration of the intervention was longer in time (Gayo et al., 2014; Vaughn et al., 2011), the results showed positive results for reading comprehension. Studies showing significant improvement in reading comprehension after instruction of strategic reading were implemented over several months or years (Bos & Anders, 1992; Ehren, 2008, Vaughn et al., 2013), but intervention studies of text structures delineating specific dosing and time frames to have a significant impact on reading are scarce. Future research studies should focus on comparing the effects of teaching text structures to improve reading comprehension with different time intervals (a three-month group, a six-month group, a nine-month group, etc.). This type of study would shed light on how much time it takes to make teaching text structures a viable strategy for reading comprehension. Future research should also be conducted on dosing to determine how many times a week and for how long (i.e., dosage) content-area teachers need to teach content-area structures to yield a positive impact on reading comprehension and content learning.

APPENDIX A: INSTITUTIONAL REVIEW BOARD



University of Central Florida Institutional Review Board
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 Orlando, Florida 32826-3246
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www.research.ucf.edu/compliance/irb.html

Approval of Exempt Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Jelitza E. Rivera**

Date: **September 04, 2014**

Dear Researcher:

On 9/4/2014, the IRB approved the following activity as human participant research that is exempt from regulation:

Type of Review: Exempt Determination
 Project Title: A QUASI-EXPERIMENTAL STUDY ON THE IMPACT OF EXPLICIT INSTRUCTION ON SCIENCE TEXT STRUCTURES ON EIGHTH-GRADE STUDENTS' READING COMPREHENSION, SENTENCE COMPREHENSION, AND CONTENT LEARNING

Investigator: Jelitza E. Rivera
 IRB Number: SBE-14-10448
 Funding Agency:
 Grant Title:
 Research ID: n/a

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 09/04/2014 05:18:57 AM EDT

IRB Coordinator



EXPLANATION OF RESEARCH

Title of Project: A Quasi-experimental Study on the Impact of Explicit Instruction on Science Text Structures on Eighth-grade Students' Reading Comprehension, Sentence Comprehension, and Content Learning.

Principal Investigator: Jelitza Rivera

Faculty Supervisor: Dr. Vicky Zygouris-Coe

You are being invited to take part in a research study. Whether you take part is up to you. The purpose of this study is to examine the impact of explicit instruction of text structures on sentence comprehension, reading comprehension, and content learning. In other words, the purpose of the study is to investigate the effectiveness of an approach to teaching science. The study will take place in school during science class, so you will not have to travel to any other place than school to participate. If you decide to take part in the study, all you have to do is attend your science class regularly. This study is expected to take no more than 8-12 weeks. All data will be collected during the 8-12 weeks of the study.

Study contact for questions about the study or to report a problem: If you have questions, concerns, or complaints you may contact Jelitza Rivera, Doctoral Candidate, TESOL Program, School of Teaching, Learning, and Leadership, (407) 516-2441 or Jelitza.Rivera@ucf.edu, or contact Dr. Vicky Zygouris-Coe, Faculty Supervisor, College of Education, School of Teaching, Learning, and Leadership at 407-823-0386 or Vassiliki.Zygouris-Coe@ucf.edu

IRB contact about your rights in the study or to report a complaint: Research at the University of Central Florida involving human participants is carried out under the oversight of the Institutional Review Board (UCF IRB). This research has been reviewed and approved by the IRB. For information about the rights of people who take part in research, please contact: Institutional Review Board, University of Central Florida, Office of Research & Commercialization, 12201 Research Parkway, Suite 501, Orlando, FL 32826-3246 or by telephone at (407) 823-2901.

APPENDIX B: PHASES OF THE INTERVENTION

	Phase	Description
1.	Pre-test	Day 1: Provide students all period to complete the ELA eighth-grade REGENTS exam. Day 2: Provide students all period to complete science content on sound waves and sentence combination assessment.
2.	Introduction to strategic reading	Day 3: Introduce students to reading strategies used in science class. Introduce students to text feature strategy for analysis of text organization. Also, introduce students to comparative key words and microstructures (i.e., comparison statements: _____ is heavier/lighter than _____; _____ has greater gravitational pull than _____, but not _____).
3.	Introduction to text structures	Day 4: Review text feature strategy and microstructure analysis. Introduce students to text structure, organization patterns, and discourse markers.
4.	Analyzing text	Day 5: Practice using pre-reading strategies, macrostructure features, discourse markers, and micro-structures.
5.	Analyzing comparative statements	Day 6: Using strategies before and during reading and analyzing comparative statements
6.	Using reading strategies	Day 7: Using strategies before and during reading.
7.	Using reading strategies to write	Day 8: Using strategies to read and write about science.
8.	Analyzing text	Day 9: Analyzing text for evidence in macrostructure and microstructures
9.	Using strategies to read and write	Day 10 and Day 11: Using strategies reading comprehension and writing
10	Post-test	Day 12: REGENTS Day 13: TOAL and Science Unit Test

APPENDIX C: REGENTS PRE-TEST

TIPS FOR TAKING THE TEST

Here are some suggestions to help you do your best:

- Be sure to read carefully all the directions in the test book.
- Plan your time.
- Read each question carefully and think about the answer before writing your response.

This test asks you to write about what you have listened to or read.

Your writing will **NOT** be scored on your personal opinions. It **WILL** be scored on:

- how clearly you organize and express your ideas
- how accurately and completely you answer the questions
- how well you support your ideas with examples
- how interesting and enjoyable your writing is
- how correctly you use grammar, spelling, punctuation, and paragraphs



Whenever you see this symbol, be sure to plan and check your writing.

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Directions

In this part of the test, you are going to read a story called "The Man Who Could See Elephants" and a poem called "Purple Snake." You will answer questions and write about what you have read. You may look back at the story and the poem as often as you like.

Go On

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Book 3

Page 1



THE MAN WHO COULD SEE ELEPHANTS

by Yashanti Rahman

Deep in the mountains, near an out-of-the-way village, there was an abandoned stone quarry. And near that quarry lived an old man who could carve the most extraordinary elephants out of stone.

People from all over the world came to that out-of-the-way village deep in the mountains to buy the old man's elephants. Museums put his work on display for everyone to see.

Many sculptors tried to carve elephants as extraordinary as the ones made by the old man, but they could not. His elephants were too powerful and gentle and wise and solemn and joyous all at once. No one else could make elephants quite like his.

One winter a young sculptor came to see the old man. "Please," he said, "could you show me how to carve elephants?"

"My boy," said the old man, "I cannot show you how to carve elephants. I can only show you how to carve stone."

The young man was disappointed. He thought he already knew how to carve stone. But he had traveled far to learn from the old man, so he said, "Very well, teach me how to carve stone."

For many months, he went to the quarry early every morning with the old man. They spent the whole day there, hammering and chiseling away at the stone.

Slowly the days went by. The ice melted on the quarry ponds. The pussy willows bloomed. The birds came back from their winter homes. Children came to play hide-and-seek among the rocks and to hunt for tadpoles and limpets and dragonfly nymphs in the shallow pools.

And the young man learned that there was much he had not known about carving stone.

Finally, one evening, as bright autumn leaves danced in the breeze, the old man said, "You have learned well, my boy. You can cut and carve and polish as well as I. There is no more for me to teach you."

"But there is more for me to learn," said the young man, who still could not carve elephants. "Let me watch you for one more season."

- 31** Complete the chart below to describe the main problem the young man has and how his problem is resolved. Use details from the story "The Man Who Could See Elephants" to support your answer.

The young man's main problem	How the young man's problem is resolved

Purple Snake

by Pat Mora

"It's in there, sleeping,"
Don Luis says and winks.
He knows I want to feel
the animal asleep in a piece of wood,
like he does,
turning it this way and that,
listening.

Slowly he strokes the wood,
rough and wrinkled like his hands.

He begins to carve his way,
"Mira. Its head, its scales, its tail."

Don Luis rubs and strokes
the animal before he paints
its eyes open.

When the paint dries,
I place the purple snake
by the green bull and red frog
that Don Luis found asleep
in a piece of wood.

Mira = Look



Planning Page

You may PLAN your writing for question 34 here if you wish, but do NOT write your final answer on this page. Your writing on this Planning Page will NOT count toward your final score. Write your final answer on Pages 9 and 10.



Page 8

Book 3

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APPENDIX D: REGENTS POST-TEST

TIPS FOR TAKING THE TEST

Here are some suggestions to help you do your best:

- Be sure to read carefully all the directions in the test book.
- Plan your time.
- Read each question carefully and think about the answer before writing your response.

In this test, you will be writing about texts that you will be listening to or reading. Your writing will be scored on

- how clearly you organize your writing and express what you have learned
- how accurately and completely you answer the questions being asked
- how well you support your responses with examples or details from the texts
- how correctly you use grammar, spelling, punctuation, capitalization, and paragraphing



Whenever you see this symbol, be sure to plan and check your writing.

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Book 3

Reading and Writing

Directions

In this part of the test, you are going to read an article called "The Youngest of Them All" and an article called "Helping Hand." You will answer questions 31 through 34 and write about what you have read. You may look back at the articles as often as you like.

Go On

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Book 3

Page 1

The Youngest of Them All

by W. H. (Chip) Gross



Adam's winning work of art—a mottled duck

Federal Migratory Bird Hunting and Conservation Stamps are commonly called "Duck Stamps." These pictorial stamps are produced by the U.S. Postal Service for the U.S. Fish and Wildlife Service; however, they are not valid for use as postage. Each waterfowl hunter is required to purchase a stamp and carry it along with a hunting license.

Do you like to draw or paint pictures of wildlife? Adam Grimm does—and he's been doing it since he was your age. Adam is the youngest person to ever win the Federal Duck Stamp Art Contest.

Adam won this famous wildlife art competition when he was just 21 years old. No cash prize is given to the winner, but Adam will make hundreds of thousands of dollars from the sale of copies of his painting.

Duck stamps help wildlife. All waterfowl hunters 16 years old and older must buy a duck stamp before going hunting. The money

from the sale of duck stamps goes to the Migratory Bird Conservation Fund, used to purchase wetlands for the National Wildlife Refuge System.

Besides being a wildlife artist, Adam is an avid waterfowl hunter. He learned to hunt from his father. He says that hunting got him interested in painting wildlife. Adam lives in Elyria, Ohio, along the shores of Lake Erie. One of the five Great Lakes, Lake Erie provides Adam constant opportunities to observe waterfowl.

Adam has a natural art talent, but he has also had to work hard to achieve so much so early in life. "When our kids got into high school," Adam's father said, "we expected them to get summer jobs. Adam's two sisters found work outside the home; we told Adam he could stay home to paint and draw, but he'd have to work at it 40 hours a week, just like any other job."

Adam's choice to stay home and perfect his artwork paid off. In 1996, at age 18, he placed fourth in the federal Junior Duck Stamp Conservation and Design Contest.

Go On

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Book 3

Page 3

One year later he was a semi-finalist in the Ohio Wetlands Habitat Stamp design competition. He followed that with a third place finish in the Ohio contest the next year and a second place finish the year after that, before winning the national contest.

So what would Adam Grimm like to do in the future? Paint wildlife, of course. "Nothing

interests me like nature, the outdoors . . . every kind of wild animal intrigues me."

Adam believes that his detailed paintings increase people's awareness of wildlife. "It's odd how few people actually go outdoors to look at ducks and geese. But when you put those same ducks and geese in paintings—with all the details—people notice."

- 31** In the chart below, provide two examples of how Adam Grimm prepared himself to become a successful wildlife artist. Then describe how each example contributed to his success. Use details from the article to support your answer.

	How Adam Grimm prepared himself to become a successful wildlife artist	How it contributed to his success
1.		
2.		



Helping Hand

by James Daniels

Michael Schuman didn't know much about Parkinson's disease two years ago. Now, his invention could help people all across the country.

Michael Schuman saw one of his favorite actors, Michael J. Fox, on television one night in May 2000.

Michael [Schuman] was shocked, not entertained. Instead of delivering a one-liner on the sitcom *Spin City*, Fox was telling the world that he has Parkinson's disease. Michael Schuman, 13 at the time, wondered, "What's Parkinson's disease?"

He later found out that more than one million people suffer from the neurological¹ disorder, which is most common in people older than 50. He learned that symptoms can include muscle stiffness and tremors² in the shoulders, arms and hands.

¹neurological: having to do with the nervous system

²tremors: shaking

He learned that even the simplest task can be painful for people in the late stages of Parkinson's.

Michael Schuman wanted to help.

What Could He Do?

Michael's grandfather told him about a glove he'd tried to make once, to keep a bowler's wrist from twisting.

Michael gathered materials—elbow pads for skating, odd pieces of plastic and scraps of fabric—and invented what he called the Parkinson's Glove. His mom and grandmother sewed it together.

The Parkinson's Glove uses a top support bar and a wrist bar to reduce tremors in the arm. It supports the arm and wrist. But it's flexible, so the wearer can move his arm freely.

Go On

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Book 3

Page 5

The Test

When it was finished, Michael and his family had to see if it would work. They visited Parkinson's support groups at local hospitals.

Michael says the patients were happy to try anything if it meant help with daily tasks.

Michael handed a woman one spoonful of water. She tried to raise it. Her hand trembled. Measuring what was left, Michael found that she had spilled 10 milliliters of water. Then, they helped her put on the glove, and Michael handed her another spoonful of water.

She lifted it slowly to her lips, lowered it, and handed it back.

This time, only two and a half milliliters were gone. All the patients tried. They spilled, on average, 63 percent less by using the glove, Michael says.

Working With the Expert

Michael recently filed a patent application with the U.S. Patent and Trademark Office. Michael has been making prototypes³ of the glove and sending them to manufacturing companies, trying to make them available to more people.

"Seeing how well it worked, and how people reacted—how it can help people who are struggling with tremors in their everyday lives—made me determined to go on," Michael says.

Michael also has continued testing the glove for more than a year with Dr. Edward Davis, a neurologist from Fort Myers, Florida. Dr. Davis has studied Parkinson's and treated patients with the disorder.

"Michael shows humanity through his creativity," Dr. Davis says.

³prototypes: original models

32 Michael Schuman can be described as both determined and sympathetic. Circle the word you think best describes him in the article "Helping Hand."

determined

sympathetic

Explain your choice using details from the article.

33 Explain the purpose of the test Michael Schuman conducted at local hospitals with the Parkinson's Glove. Use details from the article "Helping Hand" to support your answer.

Go On

Planning Page

You may PLAN your writing for question 34 here if you wish, but do NOT write your final answer on this page. Your writing on this Planning Page will NOT count toward your final score. Write your final answer on Pages 9 and 10.



APPENDIX E: RUBRIC SAMPLE FOR READING/WRITING

Reading/Writing Specific Rubric Chart

Reading/Writing Task: “The Calculating Countess” and “John Wesley Powell”(Questions 31, 32, 33, 34)

Points	5 Responses at this level:	4 Responses at this level:	3 Responses at this level:	2 Responses at this level:	1 Responses at this level:
Overall	demonstrate a thorough understanding of the articles and support that understanding with text-based details. Responses reveal that the student understands the similarities and differences between the two scientists, Ada Byron Lovelace and John Wesley Powell.	are essentially logical and accurate, but may reflect a predominantly literal understanding of the articles. Responses may generalize or present facts without synthesizing them.	indicate only a partial understanding of the articles. Responses may draw some accurate conclusions about the lives of Lovelace and Powell, but may be sketchy, or reflect some misinterpretation of the texts.	are readable but indicate a limited understanding of the articles.	are often very brief or repetitive, indicating that the student has understood only sections of the articles.
Graphic Organizer (Question 31)	are accurate, complete, and thorough, citing two events in Lovelace’s life and how they influenced her, using text-based details.	are essentially accurate.	may be very brief or may contain some inaccuracies.	are incomplete or contain inaccuracies.	are incomplete or inaccurate.
Short Response (Question 32)	explain how the scientific method helped Powell and his crew survive their river voyages and support that explanation with text-based details.	may explain but not fully support how the scientific method helped Powell and his crew survive their river voyages.	may contain some accurate information, but may be incomplete or may include unrelated, unsustained ideas (e.g., may only briefly describe how the scientific method helped Powell and his crew).	may address only parts of the task, show a misinterpretation of the task, or display gaps in understanding of the articles. Responses may contain some accurate details, but may not make meaningful connections or draw conclusions (e.g., may describe the scientific method but fail to make the connection to how it helped Powell and his crew in their voyages).	show confusion and misunderstanding of the texts.
Short Response (Question 33)	explain why Powell was considered a daredevil explorer, using text-based details.	may be somewhat general or may not include much text-based support.	may contain some accurate information, but may be incomplete or may include unrelated, unsustained ideas (e.g., may generalize the reference to Powell as a daredevil explorer, without much detail).	may address only parts of the task, show a misinterpretation of the task, or display gaps in understanding of the articles. Responses may contain some accurate details, but may not make meaningful connections or draw conclusions (e.g., may show difficulty in supporting why Powell was referred to as a daredevil explorer).	show confusion and misunderstanding of the texts.
Extended Response (Question 34)	uses ample text-based details to describe the training Lovelace and Powell received and how it led them to successful careers. Responses are organized, focused, and address all parts of the task; writing is fluent and has a sense of engagement or voice.	may describe the training Lovelace and Powell received without fully explaining how it led to their successful careers. Responses show a clear attempt at organization, but may occasionally introduce extraneous information.	may contain some accurate information, but may be incomplete or may include unrelated, unsustained ideas (e.g., may attempt to address all parts of the task, but may be incomplete or weakly organized).	may address only parts of the task, show a misinterpretation of the task, or display gaps in understanding of the articles. Responses may contain some accurate details, but may not make meaningful connections or draw conclusions (e.g., may only explain in general terms the training Lovelace and Powell received, and may be very brief or not sustain focus).	are unfocused, or focus solely on minor details or extraneous information; the explanation of the training Lovelace and Powell received leading to their careers may not be based on details contained in the articles.

SCORE POINT 0 = The responses are completely incorrect, irrelevant, or incoherent.

**APPENDIX F: INNOVATION CONFIGURATION MAP AND
INTERVENTION FIDELITY**

Using Text Structures as for Analyzing Text and Learning Content			
A. Pre-Reading			
1. Students activate content-based background knowledge (KWHL)			
A	B	C	D
Most students were engaged in background knowledge activation, most of the time	Most students were engaged in background knowledge activation, part of the time	Few students were engaged in background knowledge activation, part of the time.	Few students were engaged in background knowledge activation any of the time.
2. Students activate text-based background knowledge			
A	B	C	D
Most students were engaged in background knowledge activation, most of the time	Most students were engaged in background knowledge activation, part of the time	Few students were engaged in background knowledge activation, part of the time.	Few students were engaged in background knowledge activation any of the time.
3. Students activate strategy-based background knowledge			
A	B	C	D
Most students were engaged in background knowledge activation, most of the time	Most students were engaged in background knowledge activation, part of the time	Few students were engaged in background knowledge activation, part of the time.	Few students were engaged in background knowledge activation any of the time.
B. During Reading			
1. Students use graphic organizers to analyze text			
A	B	C	D
Most students were engaged in graphic organizer use, most of the time	Most students were engaged in graphic organizer use, part of the time	Few students were engaged in graphic organizer use, part of the time.	Few students were engaged in graphic organizer use any of the time.
2. Students use text features to analyze text			
A	B	C	D
Most students were engaged in text feature use, most of the time	Most students were engaged in text feature use, part of the time	Few students were engaged in text feature use, part of the time.	Few students were engaged in text feature use any of the time.
3. Students use discourse markers to analyze text			
A	B	C	D
Most students were engaged in discourse marker use, most of the time	Most students were engaged in discourse marker use, part of the time	Few students were engaged in discourse marker use, part of the time.	Few students were engaged in discourse marker use any of the time.
C. Post Reading			
1. Students engage in independent practice			
Most students engaged in independent practice without any teacher assistance	Most students engaged in independent practice with some teacher assistance	Few students engaged in independent practice with a lot of teacher assistance	Few students engaged in independent practice any of the time.

Using Text Structures as for Analyzing Text and Learning Content			
A. Teacher Scaffolds Instruction for Students			
A	B	C	D
Teacher builds up complex concepts and questions through simpler concepts and questions all of the time	Teacher builds up complex concepts and questions through simpler concepts and questions most of the time	Teacher builds up complex concepts and questions through simpler concepts and questions some of the time	Teacher builds up complex concepts and questions through simpler concepts and questions almost none of the time
B. Teacher Presents Strategy through Modeling with Explanations			
A	B	C	D
Teacher introduces the strategy, explains why it is important and useful, and models how to use it through multiple examples.	Teacher introduces the strategy, explains why it is important and useful, and models how to use it through one example.	Teacher introduces the strategy, does not explain why it is important and useful, but models how to use it through at least one example.	Teacher tells the students about the strategy and then requires students to use it.
C. Teacher Provides Guided Practice			
A	B	C	D
Teacher provides students with ample guided practice before requiring students to practice independently.	Teacher provides students with some guided practice before requiring students to practice independently.	Teacher provides students with very little guided practice before requiring students to practice independently.	Teacher does not provide students with guided practice before requiring students to practice independently.
D. Teacher Monitors Students' Independent Progress and Provides Coaching Accordingly			
Teacher frequently monitors students during independent practice and provides students with coaching as needed.	Teacher sometimes monitors students during independent practice and provides students with coaching as needed.	Teacher rarely monitors students during independent practice and provides students with coaching as needed.	Teacher does not monitor students during independent practice and provides students with coaching as needed.

Researcher Fidelity Check Pre-Test – Phase I

Date: _____

Class: _____

Pre-test: Day 1: REGENTS Day 2: TOAL and Science Unit Test	Present	Absent
<p>Establishes reading comprehension, sentence comprehension, and content-area knowledge baseline.</p> <ol style="list-style-type: none"> 1. Explains to the students that the assessment will provide information of how well the students perform in reading comprehension and sentence combination tasks. 2. Explains to the students that the science test provides information about their current level of science content knowledge. 3. Emphasizes that the results of the assessments will have no impact on their grades, but stresses the importance of doing the best they can. 		
<p>Observes student behavior and assesses feedback to guide instruction: <i>This can be done in class or through the assessment of student work and verbal feedback.</i></p>		

Phase II: Introduction to strategic reading

Directions: Please mark if the following target teacher behaviors were present or absent from the lesson.

Key Elements	Present	Absent
<p>Introduces the idea of using strategies before reading, during reading, and after reading.</p> <p>Reviews some of the common strategies that students have been taught to use by asking students to share some of the strategies that they use or have been instructed to use.</p> <p>Uses graphic organizer to classify strategies and to highlight its use.</p> <p>Introduces text features as a pre-reading strategy</p> <p>Models how to use text features before reading by thinking aloud</p> <p>Employs gradual release during instruction: <i>I do (modeling), we do (guided practice), you do (independent practice)</i></p> <p>Provides students with an opportunity to implement using text feature strategy: <i>Individual Practice</i></p> <p>Provides English learners with additional guided practice and language support</p> <p>Other behavior:</p>		

Phase III: Using pre-reading strategies and introducing text structures

Directions: Please mark if the following target teacher behaviors were present or absent from the lesson.

Key Elements	Present	Absent
Reviews text features: <ol style="list-style-type: none"> 1. Briefly discusses text features 2. Allows students time for independent practice 		
Introduces text structures: <ol style="list-style-type: none"> 1. Defines text structures 2. Discusses how text structures can be useful during reading 3. Introduces the comparison and contrast genre (macrostructures—organizational pattern—point by point) 4. Introduces discourse markers 5. Models how to identify the relationship established by discourse markers. 		
Uses textbook chapter on sound waves to analyze text		
Uses graphic organizer to support concept: <i>KWHL and Comparison Graphic organizer</i>		
Employs gradual release during instruction: <i>I do (modeling), we do (guided practice), you do (independent practice)</i>		
Requires students to demonstrate understanding of using text features and discourse markers to analyze text.		
Provides English learners with additional guided practice and language support		
Other behaviors:		

Phase IV: Using pre-reading strategies, macrostructure features, discourse markers, and micro-structures.

Directions: Please mark if the following target teacher behaviors were present or absent from the lesson.

Key Elements	Present	Absent
<ol style="list-style-type: none"> 1. Reviews text features (macro) and discourse markers 2. Allows students time for independent practice using text features and text structures (macro) 3. Employs gradual release during instruction: <i>I do (modeling), we do (guided practice), you do (independent practice)</i> 4. Provides English learners with additional guided practice and language support. 5. Uses graphic organizer to support concept: <i>Comparison and Contrast</i> 		
Other behaviors:		

Phase V: Using strategies before and during reading and analyzing comparative statements
 Directions: Please mark if the following target teacher behaviors were present or absent from the lesson.

Key Elements	Present	Absent
Review of strategies—independent practice <ol style="list-style-type: none"> 1. Pre-reading (text features) 2. During reading (macrostructure) and (discourse markers) 		
Introduction of comparative statements: <ol style="list-style-type: none"> 1. Define conditional statements 2. Define comparative statements 3. Explain use of comparative statements in creating relationships in texts. 4. Model creating comparative statements (i.e., _____ is heavier/lighter than _____; _____ has greater gravitational pull than _____, but not _____) 		
Uses the comparison and contrast graphic organizer to extract information for comparative statements.		
Employs gradual release during instruction: <i>I do (modeling), we do (guided practice), you do (independent practice)</i>		
Provides English learners with additional guided practice and language support		

Other behaviors:

Phase VI: Using strategies before and during reading.

Directions: Please mark if the following target teacher behaviors were present or absent from the lesson.

Key Elements	Present	Absent
<p>Explains to students that they should do the best they can in the sound waves post-test.</p> <ol style="list-style-type: none"> 1. Allots students at least 15 minutes to complete the exam. <p>Reviews the use of text features for previewing the text, activating prior knowledge, and navigating the text.</p> <p>Reviews the use of text structures to answer comprehension questions.</p> <p>Reviews the use of text structures to construct comparison and contrast extended response.</p>		
<p>Uses think-aloud strategy when modeling how to analyze text structures and text features.</p>		
<p>Uses graphic organizer to support concept: <i>Comparison and Contrast</i></p>		
<p>Employs gradual release during instruction: <i>I do (modeling), we do (guided practice), you do (independent practice)</i></p>		
<p>Provides English learners with additional guided practice and language support</p>		
<p>Other behaviors:</p>		

Phase VII: Using strategies to read and write about science.

Directions: Please mark if the following target teacher behaviors were present or absent from the lesson.

Key Elements	Present	Absent
Reviews: 1. comparative statements 2. conditional statements 3. discourse markers		
Introduces: 1. Comparison and contrast (subject by subject organizational pattern) 2. Discusses the use of a subject-by-subject comparison 3. Complex sentence structures		
Use a graphic organizer to diagram complex sentences		
Uses think-aloud to analyze the relationship established by complex sentences		
Uses graphic organizer to support concept: <i>Comparison and Contrast</i>		
Employs gradual release during instruction: <i>I do (modeling), we do (guided practice), you do (independent practice)</i>		
Provides English learners with additional guided practice and language support		
Other behaviors:		

Phase VIII: Analyzing text for evidence in macrostructure and microstructures

Directions: Please mark if the following target teacher behaviors were present or absent from the lesson.

Key Elements	Present	Absent
<p>Provides a sample essay comparing and contrasting Sound waves and EM waves</p> <p>Reviews macrostructure, thesis, topic sentence, key words, and relationships between ideas.</p> <p>Reviews analysis of conditional statements and construction of compare and contrast responses.</p>		
<p>Uses graphic organizer to support concept: <i>Comparison and Contrast Essay: EM waves versus Sound waves</i></p>		
<p>Employs gradual release during instruction: <i>I do (modeling), we do (guided practice), you do (independent practice)</i></p>		
<p>Provides students with an opportunity to analyze text: <i>Individual practice in pairs</i></p>		
<p>Provides English learners with additional guided practice</p>		
<p>Other behavior:</p>		

Phase IX: Using strategies reading comprehension and writing

Directions: Please mark if the following target teacher behaviors were present or absent from the lesson.

Key Elements	Present	Absent
Allows students time to write a comparison and contrast essay on Electromagnetic waves and sound waves using several texts.		
Uses graphic organizer to support concept: <i>Comparison and Contrast Essay: EM waves versus Sound waves</i>		
Provides English learners with additional guided practice		
Other behavior:		

Researcher Fidelity Check Post-test – Phase X

Date: _____

Class: _____

Key Elements

Present

Absent

Post-test: Day 12: REGENTS Day 13: TOAL and Science Unit Test	Present	Absent
Establishes reading comprehension, sentence combination, and content-area baseline. <ol style="list-style-type: none"> 1. Explains to the students that the assessment will provide information of how well the students perform in reading comprehension and sentence combination tasks. 2. Explains to the students that the science test provides information about their current level of science content knowledge. 3. Emphasizes that the results of the assessments will have no impact on their grades, but stresses the importance of doing the best they can. 		
Observes student behavior and assesses feedback to guide instruction: <i>This can be done in class or through the assessment of student work and verbal feedback.</i>		

APPENDIX G: DESCRIPTION OF INTERVENTION

Fidelity Check

To conduct fidelity check, the researcher had a volunteer doctoral assistant to observe the delivery of the intervention. The researcher and the doctoral assistant met before the beginning of the intervention to review how to complete the intervention chart. The doctoral assistant observed to ensure that the objectives of the lesson were met during the lesson. During the lessons, the doctoral assistant sat in the classroom and completed the fidelity check form. After each lesson, the researcher wrote down notes on the lessons and student response to intervention.

Researcher Fidelity Check Pre-Test – Phase I

Date: _____

Class: _____

Pre-test: Day 1: REGENTS Day 2: TOAL and Science Unit Test	Present	Absent
<p>Establishes reading comprehension, sentence comprehension, and content-area knowledge baseline.</p> <p>Explains to the students that the assessment will provide information of how well the students perform in reading comprehension and sentence combination tasks.</p> <p>Explains to the students that the science test provides information about their current level of science content knowledge.</p> <p>Emphasizes that the results of the assessments will have no impact on their grades, but stresses the importance of doing the best they can.</p>		
<p>Observes student behavior and assesses feedback to guide instruction: This can be done in class or through the assessment of student work and verbal feedback.</p>		

Notes: Students were given the REGENTS pre-test and instructed to read the two texts provided and answer the subsequent questions. For students, who spoke little to no English, the instructions were delivered in Spanish. The researcher did not provide additional translations. Students were given 50 minutes to complete the REGENTS exam. When the REGENTS is administered as a standardized assessment, students are given 60 minutes to complete the test and an additional 10 minutes for preparation. Due to the time constraints of the classes, the students were given 50 minutes to complete the REGENTS exam.

On day two, the students were given the TOAL sentence combination subtest, which was composed of 15 sets of sentences for the students to combine. On the same day the students were given the sound waves pre-test, which was composed of ten science multiple format questions. The students were given 50 minutes to complete both exams. The TOAL was

administered first, so that the researcher can provide instructions in both English and Spanish. Then, the students were given the science test 25 minutes into the period. If students completed the TOAL sooner, they were given the science test earlier.

Several students asked the researcher if the exam was required and if they were going to be graded on it. When students were instructed to do the best that they can because the exam was going to be used as a baseline to determine their progress, some students took longer to start the exam, and consequently did not finish it. On the second day of pre-testing, the students were more willing to complete the exam.

Phase II: Introduction to strategic reading

Directions: Please mark if the following target teacher behaviors were present or absent from the lesson.

Key Elements	Present	Absent
Introduces the idea of using strategies before reading, during reading, and after reading.	X	
Reviews some of the common strategies that students have been taught to use by asking students to share some of the strategies that they use or have been instructed to use.	X	
Uses graphic organizer to classify strategies and to highlight its use.	X	
Introduces text features as a pre-reading strategy	X	
Models how to use text features before reading by thinking aloud	X	
Employs gradual release during instruction: <i>I do (modeling), we do (guided practice), you do (independent practice)</i>	X	
Provides students with an opportunity to implement using text feature strategy: <i>Individual Practice</i>	X	
Provides English learners with additional guided practice and language support	X	
Other behavior: Time for individual practice was limited to ten minutes. The researcher constructed a chart of reading strategies the students claimed they already use during reading. The researcher asked leveled questions to get participation from ELs. The ELs were allowed to use their Chrome books to translate words during independent practice.		

Notes: The researcher began building background knowledge by asking the students to think about the reading strategies they already use during reading. The researcher and the students constructed a chart of reading strategies. The researcher added the text feature, the macrostructure, and microstructure strategies. The first strategy used was the text features. The researcher used lesson one of unit 3 in the textbook (McDougal, 2012a) to model using text features as a pre-reading strategy to create a mental plan for reading. The researcher was able to model using the strategy, conduct guided practice with the students, and provide them with ten minutes of independent practice before the period finished.

Phase III: Using pre-reading strategies and introducing text structures

Directions: Please mark if the following target teacher behaviors were present or absent from the lesson.

Key Elements	Present	Absent
Reviews text features: 3. Briefly discusses text features 4. Allows students time for independent practice	X	
Introduces text structures: 6. Defines text structures 7. Discusses how text structures can be useful during reading 8. Introduces the comparison and contrast genre (macrostructures—organizational pattern—point by point) 9. Introduces discourse markers 10. Models how to identify the relationship established by discourse markers.	X	
Uses textbook chapter on sound waves to analyze text	X	
Uses graphic organizer to support concept: <i>KWHL and Graphic organizer</i>	X	
Employs gradual release during instruction: <i>I do (modeling), we do (guided practice), you do (independent practice)</i>	X	
Requires students to demonstrate understanding of using text features and discourse markers to analyze text.	X	
Provides English learners with additional guided practice and language support	X	
Other behaviors: The researcher had students preview pages 178 and 179 in their textbook, and complete the <i>KWHL</i> chart as a pre-reading strategy to get the students thinking about what they are going to read. The researcher introduced students to text structures by providing a definition. The researcher introduced the students to compare and contrast macrostructures and had students read pages 178 and 179 in the <i>Fusion</i> textbook. Once the students read it, the researcher used a comparison and contrast visual chart to establish similarities and differences between longitudinal waves and transverse waves. Once the graphic organizer was completed, the researcher introduced the students to discourse markers and modeled how discourse markers depict the relationships between ideas. The researcher helped students construct sentences that established the relationships between the two concepts. The students only had eight minutes for independent practice.		

Notes: The students had little time for independent practice of strategies. To modify for ELs, the researcher provided the students with a list of key vocabulary that was defined and translated to Spanish. The researcher also used leveled questions and nonverbal cues, such as graphic organizers, to help students understand the concepts. ELs were also allowed to use their Chrome books to use a translator if they chose to do so, only two students in period two, no students in period three, and three students in period five used it.

Phase IV: Using pre-reading strategies, macrostructure features, discourse markers, and micro-structures.

Directions: Please mark if the following target teacher behaviors were present or absent from the lesson.

Key Elements	Present	Absent
<p>6. Reviews text features (macro) and discourse markers</p> <p>7. Allows students time for independent practice using text features and text structures (macro)</p> <p>8. Employs gradual release during instruction: <i>I do (modeling), we do (guided practice), you do (independent practice)</i></p> <p>9. Provides English learners with additional guided practice and language support.</p> <p>10. Uses graphic organizer to support concept: <i>Comparison and Contrast</i></p>	X	
<p>Other behaviors: The researcher reviewed the use of text features and macrostructures to identify the organization of ideas, and the use of discourse marker to establish relationships between sentences. The researcher provided the students with the comparison and contrast graphic organizer and had the students use pages 186 and 187 to practice. Students worked in pairs. The researcher used leveled questions and translation of key vocabulary.</p>		

Notes: Because students had not had much time for independent practice on previous intervention days, the researcher ensured that they had most of the period to practice in pairs and independently.

Phase V: Using strategies before and during reading and analyzing comparative statements

Directions: Please mark if the following target teacher behaviors were present or absent from the lesson.

Key Elements	Present	Absent
Review of strategies—independent practice 1. Pre-reading (text features) 2. During reading (macrostructure) and (discourse markers).	X	
Introduction of conditional and comparative statements: 1. Define conditional statements 2. Define comparative statements 3. Explain use of comparative statements in creating relationships in texts. 4. Model creating comparative statements (i.e., _____ is heavier/lighter than _____; _____ has greater force than _____, but not _____)	X	
Uses the comparison and contrast graphic organizer to extract information for comparative statements.	X	
Employs gradual release during instruction: <i>I do (modeling), we do (guided practice), you do (independent practice)</i>	X	
Provides English learners with additional guided practice and language support	X	

Other behaviors: The researcher used the textbook to identify the conditional statements on page 179, and then provided additional examples. The researcher introduced conditional statements and how to analyze the information they provide. After, the students used page 190 to complete the compare and contrast graphic organizer. The researcher used a sample question: How is wave speed affected by different mediums? The researcher used the Gradual Release of Responsibility model to walk the students through the entire process. The researcher used information in the comparison and contrast graphic organizer to model how to extract information to construct a comparison and contrast response. The students were then asked, “What is the difference between longitudinal waves and transverse waves?” the students were allowed to work in pair to answer the question. The researcher used leveled questions, graphic organizers, and translations for ELs.

Phase VI: Using strategies before and during reading.

Directions: Please mark if the following target teacher behaviors were present or absent from the lesson.

Key Elements	Present	Absent
<p>Explains to students that they should do the best they can in the sound waves post-test and EM pre-test.</p> <p>2. Allots students at least 15 minutes to complete the exam post-test, and 15 minutes to complete the EM waves pre-test.</p> <p>Reviews the use of text features for previewing the text, activating prior knowledge, and navigating the text.</p> <p>Reviews the use of text structures to answer comprehension questions.</p> <p>Reviews the use of text structures to construct comparison and contrast extended response.</p>	X	
<p>Uses think-aloud strategy when modeling how to analyze text structures and text features.</p>	X	
<p>Uses graphic organizer to support concept: <i>Comparison and Contrast</i></p>	X	
<p>Employs gradual release during instruction: <i>I do (modeling), we do (guided practice), you do (independent practice)</i></p>	X	
<p>Provides English learners with additional guided practice and language support</p>	X	
<p>Other behaviors: The researcher administered the sound waves post-test. The students were allotted 15 minutes to complete ten questions. The researcher then administered the EM waves pre-test and allotted 15 minutes. The researcher then used the remainder of the period to review text features, text structures, discourse markers, conditional statements, and comparative statements. The researcher used leveled questions, graphic organizers, and translations for ELs. The teacher for period three requested that the students be allowed to finish a science project in class, so after the students were done taking the tests within 25 minutes, the researcher and the doctoral assistant left the class and no dose of intervention was administered that day for period three.</p>		

Phase VII: Using strategies to read and write about science.

Directions: Please mark if the following target teacher behaviors were present or absent from the lesson.

Key Elements	Present	Absent
Reviews: 4. comparative statements 5. conditional statements 6. discourse markers	X	
Introduces: 4. Comparison and contrast (subject by subject organizational pattern) 5. Discusses the use of a subject-by-subject comparison 6. Complex sentence structures	X	
Use a graphic organizer to diagram complex sentences		X
Uses think-aloud to analyze the relationship established by complex sentences	X	
Uses graphic organizer to support concept: <i>Comparison and Contrast</i>	X	
Employs gradual release during instruction: <i>I do (modeling), we do (guided practice), you do (independent practice)</i>	X	
Provides English learners with additional guided practice and language support	X	
Other behaviors: The researcher reviewed comparative statements, discourse markers, and conditional statements using page 198. The researcher introduced students to a different comparison and contrast organizational pattern, subject-by-subject. The researcher also introduced the students to complex sentences and modeled how to extract meaning from them. The students were asked to establish the differences between sound waves and EM wave by completing a compare and contrast graphic organizer. The researcher used leveled questions, graphic organizers, and translations for ELs.		

Phase VIII: Analyzing text for evidence in macrostructure and microstructures

Directions: Please mark if the following target teacher behaviors were present or absent from the lesson.

Key Elements	Present	Absent
<p>Provides a sample essay comparing and contrasting Sound waves and EM waves</p> <p>Reviews macrostructure, thesis, topic sentence, key words, and relationships between ideas.</p> <p>Reviews analysis of conditional statements and construction of compare and contrast responses.</p>	X	
<p>Uses graphic organizer to support concept: <i>Comparison and Contrast Essay: EM waves versus Sound waves</i></p>	X	
<p>Employs gradual release during instruction: <i>I do (modeling), we do (guided practice), you do (independent practice)</i></p>	X	
<p>Provides students with an opportunity to analyze text: <i>Individual practice in pairs</i></p>	X	
<p>Provides English learners with additional guided practice</p>	X	
<p>Other behavior: The researchers provided the students with a sample essay comparing sound waves and EM waves, with analysis. Then, she explained each point through think-aloud. After she modeled the essay, she had the students use the graphic organizer they completed the previous class to construct their own comparison of sound waves and EM waves. After modeling, the students had 20 minutes to plan and begin writing their response. The researcher walked around and provided students with assistance writing their comparison.</p>		

Note: Because class periods are only 50 minutes, students did not have ample time to work independently on their writing. To provide ample time, this approach took two sessions.

Phase IX: Using strategies reading comprehension and writing

Directions: Please mark if the following target teacher behaviors were present or absent from the lesson.

Key Elements	Present	Absent
Allows students time to write a comparison and contrast essay on Electromagnetic waves and sound waves using several texts.	X	
Uses graphic organizer to support concept: <i>Comparison and Contrast Essay: EM waves versus Sound waves</i>	X	
Provides English learners with additional guided practice	X	
Other behavior: The researcher reviewed the use of the graphic organizer to extract information for writing. The researcher provide the students with another session to complete their comparative writing. The researcher walked around and provided students with assistance writing their comparison. The researcher used leveled questions, graphic organizers, and translations for ELs.		

Researcher Fidelity Check Post-test – Phase X

Date: _____

Class: _____

Post-test: Day 12: REGENTS Day 13: TOAL and Science Unit Test	Present	Absent
<p>Establishes reading comprehension, sentence combination, and content-area baseline.</p> <p>Explains to the students that the assessment will provide information of how well the students perform in reading comprehension and sentence combination tasks.</p> <p>Explains to the students that the science test provides information about their current level of science content knowledge.</p> <p>Emphasizes that the results of the assessments will have no impact on their grades, but stresses the importance of doing the best they can.</p>	X	
<p><i>Observes student behavior and assesses feedback to guide instruction: This can be done in class or through the assessment of student work and verbal feedback.</i></p>		

Notes: Students were given the REGENTS post-test and instructed to read the two texts provided and answer the subsequent questions. For students, who spoke little to no English, the instructions were delivered in Spanish. The researcher did not provide additional translations. Students were given 50 minutes to complete the REGENTS exam. When the REGENTS is administered as a standardized assessment, students are given 60 minutes to complete the test and an additional 10 minutes for preparation. Due to the time constraints of the classes, the students were given 50 minutes to complete the REGENTS exam.

On day two of post-test, the students were given the TOAL sentence combination subtest, which was composed of 15 sets of sentences for the students to combine. On the same day the students were given the sound waves delayed post-test, which was composed of ten science multiple format questions, and the EM waves post-test, which was composed on six questions. The students were given 50 minutes to complete both exams. The questions for the sound waves delayed post-test and the EM waves post-test were combined in one sheet of paper, but questions were grouped by topic. The students were given both exams, but were instructed to start with the TOAL, so that the researcher can provide instructions in both English and Spanish. If students completed the TOAL sooner, they were given the science test earlier.

Several students complained that there were too many exams in one week. Students were instructed to do the best that they can because the exam was going to be used as a comparison to their pre-test to determine their progress. Some students did not finish the REGENTS, and some did not finish the TOAL. On the second day of post-testing, the students were more willing to complete the exam.

**APPENDIX H: SUPPLEMENTAL RESOURCES USED DURING
INTERVENTION**

Classification of Strategies: Graphic Organizer

Before Reading	During Reading	After Reading

Direction of Waves

Directions: Read the paragraph below and use the word bank at the end to fill-in the blanks.

If you throw a rock into calm water, the impact of the rock disturbs the water and begins a ripple effect. This is a mechanical wave, which needs a medium to initiate motion.

Mechanical waves move in two forms: parallel or perpendicular to the direction the wave is moving. The motion of the ripple is going away from the center perpendicular to the direction the wave is traveling. Waves that travel perpendicular to the direction the wave is traveling are transverse waves. _____ transverse waves, longitudinal waves travel parallel to the direction of the wave. Because transverse waves move perpendicular to the direction the wave is traveling, it has *crests*, the highest point in a wave, and *troughs*, the lowest point in a wave.

_____ longitudinal waves do not move perpendicular to the direction the wave is moving, _____ longitudinal waves do not have _____ and _____.

_____ longitudinal waves have compressions, crowded areas, and rarefactions, stretched-out areas.

Word Bank

crests

troughs

unlike

however

instead

so

The Effect of Electromagnetic Waves on Birds

Directions: Read this article by H. Mouritsen and answer the questions that follow the article.

Birds know where to go when it's time to migrate. They get some of that superb sense of direction from their ability to detect Earth's magnetic field. That magnetic sense acts a bit like a compass used by human hikers, but **the energy coming from some electronic devices can perturb a birds' internal compass, and that might confuse a bird's sense of direction**, according to a new study.

Most electronic devices send out **waves of energy called electromagnetic radiation**. The levels are too low to harm people. **Although any given device only sends out a small amount, some types of this radiation could pose a problem to birds**. **Even when held captive in a lab, birds know when it's time to migrate**. They fidget in their cages. They try to face in the direction they would fly away, if outdoors, but the birds can't always line up correctly, notes Henrik Mouritsen, a biologist at the University of Oldenburg in Germany.

He and his colleagues studied European robins (*Erithacus rubecula*). **They took some birds outside the city of Oldenburg to a rural area with low electromagnetic noise**. There, the birds had no problem figuring out which way to turn. But birds caged in the city were confused. They were likely to face in the correct direction only when they were shielded from **electromagnetic radiation**. Electronic equipment can sometimes interfere with a magnetic compass. Scientists have long argued about whether such devices might also interfere with the biology of animals, including a bird's magnetic sense. **Earlier studies have claimed to find such effects, but many scientists didn't accept those findings**.

Joseph Kirschvink has called for researchers to be more careful when studying the effects of electronic devices on birds' sense of direction. As a biomagnetist at the California Institute of Technology, in Pasadena, he studies animals' magnetic sense. He says Mouritsen's team has done better work than any previous team in probing how electronic noise might affect birds' magnetic compass.

As a result of this study, he told Science News, "I think it needs to be considered seriously." He also said he hopes to see other scientists try to confirm the new findings by running similar tests.

Mouritsen's experiments began back in 2004. He observed that caged robins did not face toward their migratory directions. For several years he could not figure out why. Then another researcher in his lab suggested that they set up a shield. Called a Faraday cage, it consisted of grounded aluminum screens that blocked incoming **electromagnetic radiation**. When protected by the screening, birds in the lab at last faced in the direction they should migrate.

Over the next few years, Mouritsen and his colleagues kept testing the idea that **electromagnetic noise upsets a robin's sense of direction**. They tried various ways to challenge it. Yet their data always showed the same thing. **The birds only faced the correct direction when the shield blocked out the electromagnetic radiation**.

Not all types of everyday radiation confused the birds' sense of direction. Although cell phones and power lines are often blamed for confusing birds, the researchers reported that they had no effect in their tests.

Mouritsen told Science News he was reluctant to start studying birds and **electromagnetic radiation**. After all, he knew that previous experiments that tested its effects on animals had been criticized as zany or sloppy. But he says he and his students worked hard to think of different ways to test their ideas.

"It's not the first time it's been claimed," he said of the link between compass confusion and electronics. "But I hope it's the first time it holds up."

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Questions about the article:

1. According to the Stephen Ornes, why were the birds in the cage confused?

2. Read the following sentence and write what you think it means in your own words:

They try to face in the direction they would fly away, if outdoors, but the birds can't always line up correctly...

What is electromagnetic radiation?

Electromagnetic energy is a term used to describe all the different kinds of energies released into space by stars such as the Sun. These kinds of energies include some that you will recognize and some that will sound strange. They include:

- Radio Waves
- TV waves
- Radar waves
- Heat (infrared radiation)
- Light
- Ultraviolet Light (This is what causes Sunburns)
- X-rays (Just like the kind you get at the doctor's office)
- Short waves
- Microwaves, like in a microwave oven
- Gamma Rays



All these waves do different things (for example, light waves make things visible to the human eye, while heat waves make molecules move and warm up, and x rays can pass through a person and land on film, allowing us to take a picture inside someone's body) but they have some things in common.

They all travel in waves, like the waves at a beach or like sound waves, and also are made of tiny particles. Scientists are unsure of exactly how the waves and the particles relate to each other. The fact that electromagnetic radiation travels in waves lets us measure the different kind by wavelength or how long the waves are. That is one way we can tell the kinds of radiation apart from each other.

Although all kinds of electromagnetic radiation are released from the Sun, our atmosphere stops some kinds from getting to us. For example, the ozone layer stops a lot of harmful ultraviolet radiation from getting to us, and that's why people are so concerned about the hole in it.

We humans have learned uses for a lot of different kinds of electromagnetic radiation and have learned how to make it using other kinds of energy when we need to. DS1 would not be able to communicate with Earth from space, for example, if it could not produce radio waves.

More Questions:

3. Based on the information about electromagnetic radiation, why do you think that birds are negatively affected by it?

4. Why isn't a bird's ability to find its migratory path affected by the electromagnetic radiation of the sun?

5. Why do some scientists disagree or not accept the findings of experiments that show that electromagnetic radiation has a negative effect on birds?

6. According to the author, "although cell phones and power lines are often blamed for confusing birds, researchers reported that they had no effect in their tests. " Do you agree with this result? Why or why not?

7. In the paragraph, "Over the next few years, Mouritsen and his colleagues kept testing the idea that **electromagnetic** noise upsets a robin's sense of direction. They tried various ways to challenge it. Yet their data always showed the same thing. The birds only faced the correct direction when the shield blocked out the **electromagnetic** radiation."
What is the author trying to tell you?

8. Electronic noise is another word for _____.
9. What do you think should be the next step for scientists to find out more about the disturbances electromagnetic radiation causes animals?

Electromagnetic Waves versus Sound Waves Text Analysis

Electromagnetic Waves versus Sound Waves ¶

Have you ever wondered why you see lighting before you hear the accompanying thunder? It is because light travels faster than sound. Light is a type of electromagnetic (EM) wave and thunder is an example of sound waves. [There are two main differences between sound waves and light waves.]

[The first difference is in velocity. Sound waves travel through air at the speed of approximately 1,100 feet per second; light waves travel through air and empty space at a speed of approximately 186,000 miles per second. Although both are forms of wave motion, sound requires a solid, liquid, or gaseous medium; whereas light travels through empty space. The denser the medium means the greater the speed of sound. The opposite is true of light. Light travels approximately one-third slower in water than in air. Sound travels through all substances, but light cannot pass through opaque materials. The best example to illustrate the differences in velocity between sound waves and EM waves is the difference in time from when lighting can be seen and its accompanying thunder is heard.]

[The second difference is the type of wave that composes EM waves and sound waves.] Sound is composed of longitudinal waves (alternate compressions and expansions of matter), but light is composed of transverse waves in an electromagnetic field. The type of wave and the velocity of the wave affect its frequency. Frequency affects both sound and light. A certain range of sound frequencies produces sensations that you can hear. A slow vibration (low frequency) in sound gives the sensation of a low note. A more rapid sound vibration (higher frequency) produces a higher note. Likewise, a certain range of light frequencies produces sensations that you can see. Violet light is produced at the high-frequency end of the light spectrum, while red light is produced at the low-frequency end of the light spectrum. A change in frequency of sound waves causes an audible sensation—a difference in pitch. A change in the frequency of a light wave causes a visual sensation—a difference in color.]

→ [Although EM waves and sound waves have two distinct differences, both types of waves can be found in everyday things in the environment, house, school, and office. Therefore, the next time you are outside with your friends, take a look around and see sound waves and EM waves affect everything you see and hear.]

Comment [D1001]: This is the main idea for the entire essay.

Comment [D1002]: This is the main idea for body paragraph 1.

Comment [D1003]: Key word meaning contrast.

Comment [D1004]: Key word meaning contrast.

Comment [D1005]: Key word meaning contrast.

Comment [D1006]: Key word meaning contrast.

Comment [D1007]: Key word meaning contrast difference.

Comment [D1008]: This is the main idea for body paragraph 2.

Comment [D1009]: Key word meaning contrast difference.

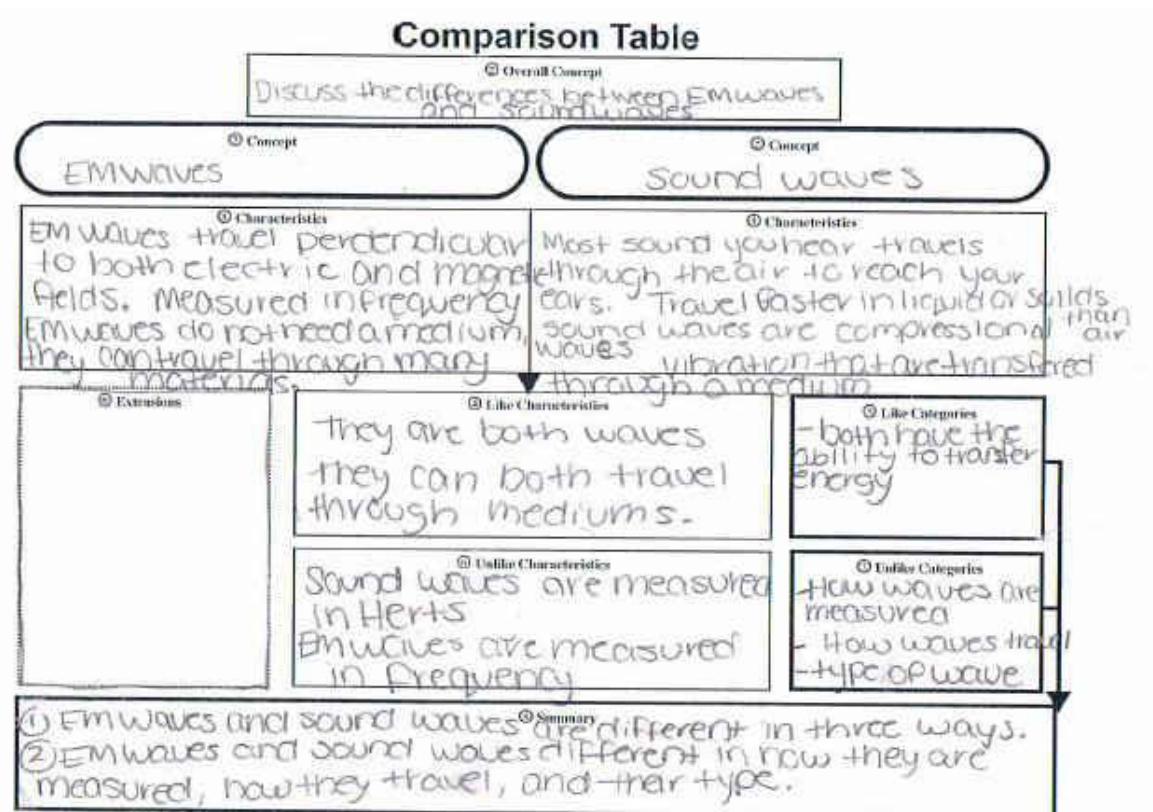
Comment [D1010]: Key word meaning similarity.

Comment [D1011]: Key word meaning contrast difference.

Comment [D1012]: Restatement of the main idea to wrap up.

Comment [D1013]: Key word for similarity.

Student Sample: Using the Graphic Organizer



EM WAVES VS SOUND WAVES

EM waves and sound waves are different in how they are measured, how they travel, and their type.

EM waves ^{are} electrically charged particles that vibrate. These waves don't need a medium to travel. EM waves can travel at the speed of light. Unlike ~~sound~~ waves, sound waves cannot travel without a medium. These waves are compressional waves. ^{only in the sound} Sound waves are vibrations that are transferred through mediums.

In addition,

sound waves and EM waves are measured differently. Sound waves are measured in hertz while EM waves are measured in frequency. More specifically, hertz are a pitch of sound unlike hertz. Frequency is how fast the wave moves.

Student Writing Sample II

• Did you know waves are found in everyday things. There are different waves and each one has their own type. Sound waves are fast but EM waves are faster than light. They are cause with all the racket of car and music and becoming loud speaker.

^{main idea}
Type of Electromagnetic waves than sound. Light is a type of sound waves. Electromagnetic waves and sound waves are different in several ways. Sound waves and EM waves are different in type, measurement and travel.

Student Writing Sample III

Do you ever think about Sound waves and Electromagnetic waves? Sound waves and Electromagnetic waves two different type of wave. Sound waves ~~are~~ ^{are} ~~different~~ ^{different} in type, measurement and travel.

~~First sound waves and EM waves are different in type but sound waves are longitudinal and EM waves are transverse.~~

3rd Para

However these two waves are different on travel. Sound waves need a medium to travel but in the other hand EM can travel with a medium but it doesn't need it. EM waves can travel to space and sound waves cannot travel to space. / 3rd Para.

2nd paragraph

First sound waves and EM waves are different in type. but how? Sound waves are longitudinal waves, what is that? A wave vibrating in the direction of propagation. Sound waves traveling through air or other mediums. In the other hand EM waves are transverse waves. Transverse waves are a wave vibrating at right angles to the direction of its propagation. Sound waves are faster in light but EM are faster on solids. They have a bit stuff on different.

Student Writing Sample IV

Transverse waves and longitudinal waves are similar in the way that they travel, but different in their speed. Longitudinal waves are faster than transverse waves. The book says that when there is an earthquake that longitudinal waves are faster than transverse waves. However, longitudinal waves move ~~parallel~~ parallel to the wave's direction of travel, but transverse waves move perpendicular to the direction of the wave. This is how transverse waves and longitudinal waves are similar and different.

In the story "The man who could see elephants" his attitude was positive & he was willing to teach the young man how to carve. For example "... you can cut curve and finish as well as I..." This is saying that he was not selfish to teach the young man to carve elephants because if no one was as good as the old man.

In the poem, "Purple Snake" the author's attitude is calm. He

Go On

states that "Mira. its head,
its hooves, its tail." "don - his
rubs and strokes the animal
before he paints"

The authors attitudes are
similar because they are both
determined and taking there
time to paint the snake / carve
the elephant. And they are both
focused on getting it done.

Student Sample: Response to Reading Comprehension Question 32

One year later he was a semi-finalist in the Ohio Wetlands Habitat Stamp design competition. He followed that with a third place finish in the Ohio contest the next year and a second place finish the year after that, before winning the national contest.

So what would Adam Grimm like to do in the future? Paint wildlife, of course. "Nothing

interests me like nature, the outdoors, ... every kind of wild animal intrigues me."

Adam believes that his detailed paintings increase people's awareness of wildlife. "It's odd how few people actually go outdoors to look at ducks and geese. But when you put those same ducks and geese in paintings—with all the details—people notice."

- 31** In the chart below, provide two examples of how Adam Grimm prepared himself to become a successful wildlife artist. Then describe how each example contributed to his success. Use details from the article to support your answer.

How Adam Grimm prepared himself to become a successful wildlife artist	How it contributed to his success
1. One of the ways Adam Grimm prepared himself was by hunting.	This contributed to his success because he got to see and observe what the wildlife looked like.
2. He prepared by staying home to paint and draw instead of doing a summer job.	By staying home instead of going to a job contributed to his success because he had time to practice his drawing skills.

Student Sample: Response to Reading Comprehension Questions 33 and 34

- 32 Michael Schuman can be described as both determined and sympathetic. Circle the word you think best describes him in the article "Helping Hand."

determined

sympathetic

Explain your choice using details from the article.

I think that Michael Schuman is sympathetic because of what he does to help so many people. He heard about his favorite actor and his disease, then he was very angry about it. Michael went and made a solution for this problem and still went to make for more people. He wanted to make sure as much people as possible could get help.

- 33 Explain the purpose of the test Michael Schuman conducted at local hospitals with the Parkinson's Glove. Use details from the article "Helping Hand" to support your answer.

The purpose of taking the glove to a local hospital was to see if the glove worked. He wanted to see if his experiment was a success. In the text it says "When it was finished, Michael and his family had to see if it worked." The purpose was to see if his job was successful.

Go On

Student Sample: Response to Reading Comprehension Question 34

34

Adam Grimm and Michael Schuman used their creative abilities for different purposes. Write an essay in which you explain the difference in the boys' motives for using their creative abilities. Then describe how each boy's creativity led to his success. Use details from both articles to support your answer.

In your answer, be sure to

- explain the difference in Adam's and Michael's motives for using their creative abilities
- describe how each boy's creativity led to his success
- use details from both articles to support your answer



Check your writing for correct spelling, grammar, and punctuation.

In the text "The Youngest Of Them All" and "Helping Hand" Both men use their creative abilities in different ways. Adam uses his creativity in painting. Michael uses his to help people with a disease. Adam was fascinated with animals and nature after his dad taught him how to hunt. Michael got his creativity after he saw and learned about Parkinson's Disease. These events in both men's life are the reason for their success. Once Adam realized how much he

Go On

Student Sample: Sentence Combination

1. We went to the party. It was on Sunday.

we went to the party ^{and it} was on Sunday.

2. Emily likes candy. Emily likes cake.

Emily likes candy and cake.

3. Bill was early for the game. Rob was early for the game.

Bill and Rob was early for the game.

4. He had dreamed. He dreamed of money. He dreamed of excitement. He dreamed of adventure.

he had a dream of money and excitement and adventure.

5. The girl looked frightened. She wasn't frightened.

The girl was frightened and then she was not.

6. Sam had a picnic. It was last Friday. It was after school.

Sam had a picnic last Friday and it was after school.

7. It is miles away. The number is 450. The miles are to Boston.

it is miles away and the number is 450 to go to Boston.

8. Ann wears rings. The rings are on her fingers. The rings are pretty.

Ann wears rings and the rings are on her fingers and the rings look pretty.

9. The snow melted. It was very hot outside.

The snow melted and it was very hot outside.

10. I thought Beth wanted a cat. No, she wanted a dog.

I thought beth wanted a cat but no she wants
A dog.

11. Sara typed a letter. The letter was to Steve. The letter was sent back.

Sara typed a letter to Steve and he sent the letter
back.

12. The girls loaded the gear into the car. They were going on the trip. It was a fishing trip.

The girls loaded the gear into the car and they were going
on a trip and it was a fishing trip.

13. The afternoon paper was scattered over the yard. The paper had become unfolded.

in the afternoon paper was scattered over the yard and
the paper had become unfolded.

14. We ran in the race. It rained. It was Thursday.

we ran in the race and it rained and it was on
thursday

15. We heard static on the radio. We feared a thunderstorm. We decided not to go out in the boat.

we heard static on the radio and we feared a thunderstorm
was coming so we decided not to go out on the boat.

APPENDIX I: TOAL SENTENCE COMBINATION PRE-TEST

Sentence Combination Pre-Test

Name: _____ Period: _____

Teacher's Name: _____

Example Item:

We ate lunch. It was an hour ago.

We ate lunch an hour ago.

1. We went to the party. It was on Sunday.

2. Emily likes candy. Emily likes cake.

3. Bill was early for the game. Rob was early for the game.

4. He had dreamed. He dreamed of money. He dreamed of excitement.
He dreamed of adventure.

5. The girl looked frightened. She wasn't frightened.

6. Same had a picnic. It was last Friday. It was after school.

7. It is miles away. The number is 450. The miles are to Boston.

8. Ann wears rings. The rings are on her fingers. The rings are pretty.

9. The snow melted. It was very hot outside.

10. I thought Beth wanted a cat. No, she wanted a dog.

11. Sara typed a letter. The letter was to Steve. The letter was sent back.

12. The girls loaded the gear into the car. They were going on the trip. It was a fishing trip.

13. The afternoon paper was scattered over the yard. The paper had become unfolded.

14. We ran the race. It rained. It was Thursday.

15. We heard static on the radio. We feared a thunderstorm. We decided not to go out in
the boat.

APPENDIX J: TOAL SENTENCE COMBINATION POST-TEST

Sentence Combination Post-Test

Name: _____ Period: _____

Teacher's Name: _____

Example Item:

We ate lunch. It was an hour ago.

We ate lunch an hour ago.

1. They should ask Ben. They will get many suggestions.

2. The driver roared away. The roaring was in dust. The dust was in a cloud.

3. The hamburgers were on the grill. They were sizzling. The smell made us hungry.

4. First, we descended to the edge of the river. Next, we boarded a small raft.
Then we launched the raft.

5. They would dance. Where they would dance the lights would be bright.
The light would flash.

6. The book had an exciting conclusion. I hated to see it end.

7. She has two dogs. One dog is a collie. One dog is a spaniel. They perform different duties on the farm.

8. David saw the new girl. He asked for her name. He wanted to date her.

9. Jennifer will swim in the summer. The pool opens in June. Her friends will be there too.

10. Jack went to work every day. He did not like to go. He needed the money.

11. Joan is annoyed. She doesn't like Richard. She has to be polite to him anyway. She doesn't want to embarrass her friend.

12. The bird spread its wings. The bird soared off the cliff. The cliff was craggy.
The bird hovered over the canyon. The bird surveyed the scene below.

13. The artist is drawing. He is skilled. He is sitting under a tree. He is watching the players.

14. We saw a movie. The one we saw was about a disaster. The earth was dying. It was the earth as we know it.

15. The dog's head was cocked. It was cocked to one side. There was a loud scratching noise. The dog listened to the sound. The dog leaped up. He leaped toward the door.

APPENDIX K: SENTENCE COMBINATION RUBRIC

Sentence Combination Score Rubric

	Sentence Type	Grammar	Comprehensibility	Logical Order
1	Simple Sentence	No error	Yes	Yes
2	Compound Sentence	Run-on error	No	No
3	Complex Sentence	Comma splice error		
4	Compound-Complex	Verb error		
5	Simple Sentence with Phrase	Pronoun agreement error		
6	Compound Sentence with Phrase	Modifier error		
7	Complex sentence with Phrase	Word usage error		
8	Compound-complex Sentence with Phrase	More than one error		
9	No Response	No response	No response	No response
10	Did not combine sentences	Did not combine	Did not combine	Did not combine

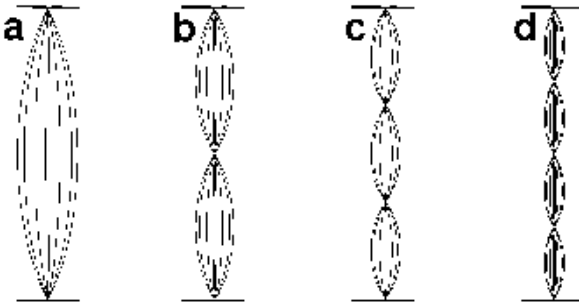
APPENDIX L: SOUND WAVES PRE-TEST

Name: _____ Class/Period _____
 Pre-test Sound Waves

Match the following terms with the correct definition. There is one extra term that will not match any of the definitions.

	Column A	Column B
___	1. Time for one cycle to occur	a. Cycle
___	2. Distance from one point on a wave to the same point on the next wave	b. Hertz
___	3. Unit of measurement for frequency (one cycle per second)	c. Amplitude
___	4. A single unit of periodic motion	d. Period
___	5. Happens when two or more waves interact	e. Wavelength
		f. Interference

The pictures below represent vibrating guitar strings. Which picture shows a guitar string of one and only one wavelength?



Which of the following usually occurs inside a material instead of at the surface?

- a. Reflection
- b. Refraction
- c. Diffraction
- d. Absorption

The frequency at which a system vibrates when disturbed is called its _____ frequency.

Destructive interference occurs because:

- a. multiple waves combine to make a wave of smaller amplitude.
- b. waves bend around or through holes in an obstacle.
- c. waves are absorbed and disappear.
- d. two waves add up to make a wave of larger amplitude.

Which of the following statements is NOT TRUE of the speed of sound waves?

- a. Sound waves travel faster in metal than in air.
- b. The speed of sound in air is about 343 meters per second.
- c. Sound waves are slower than light waves.
- d. Sound waves travel faster in outer space than in air.

APPENDIX M: SOUND WAVES POST-TEST

Name: _____ Class/Period _____
 Post-test Sound Waves

Match the following terms with the correct definition. There is one extra term that will not match any of the definitions.

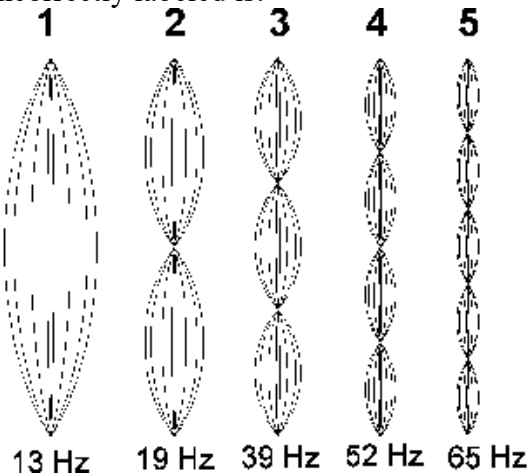
Column A

Column B

___	1. Multiples of the fundamental	a. Resonance
___	2. A group chosen to include all those things of interest to be studied	b. Decibel
___	3. A system that shows harmonic motion	c. System
___	4. The maximum response to an oscillating force occurring at a natural frequency	d. Frequency
___	5. Number of cycles that occur in one second	e. Oscillator
		f. Harmonics

6. Sound whose frequency is too high for human hearing to detect is called _____.

7. The picture below shows five harmonics of a vibrating string experiment. The vibrating string incorrectly labeled is:

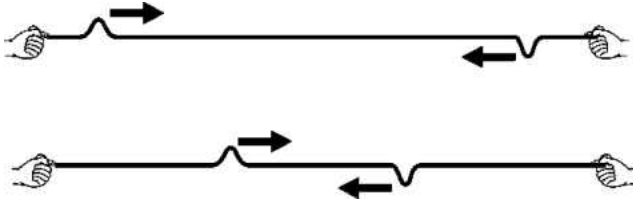


- a. 1
- b. 2
- c. 3
- d. 4

8. Although a door is only slightly opened, sound will pass from one room to another due mainly to:

- a. reflection.
- b. refraction.
- c. diffraction.
- d. absorption.

9. Two pulses are traveling on the same rope as shown in the diagram. As they meet, what type of interaction will occur at their meeting point? _____

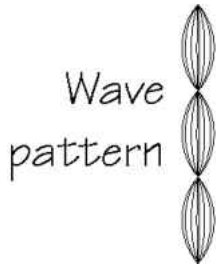


10. Natural frequency is:

- a. what happens when two waves combine to produce one wave of lower amplitude.
- b. the frequency at which a system oscillates when it is disturbed.
- c. the rate at which vibrations are naturally damped in an oscillator.
- d. an oscillator whose frequency is a multiple of another wave.

APPENDIX N: SOUND WAVES DELAYED POST-TEST

1. The graph that shows the volume (“loudness”) of a sound at different frequencies is called a _____.
2. How many anti-nodes does this standing wave have?



- a. One
 - b. Two
 - c. Three
 - d. Four
3. A decibel is a unit used to measure the:
 - a. pitch of sound.
 - b. color or complexity of sound.
 - c. loudness of sound.
 - d. frequency of a sound.
 4. The word *supersonic* describes:
 - a. motion faster than the speed of sound.
 - b. frequencies of sound too high for the human ear to hear.
 - c. decibels of sound too soft for the human ear to hear.
 - d. decibels of sound too loud for the human ear to hear.
 5. When a wave bends as it crosses a boundary, _____ occurs.
 - a. reflection.
 - b. refraction.
 - c. absorption.
 - d. diffraction.
 6. . A longitudinal wave travels:
 - a. only along the Earth’s longitudinal lines.
 - b. perpendicular to the direction of oscillations.
 - c. in the same direction as the oscillations.
 - d. perpendicular to a latitude wave.
 7. Sound waves are always:
 - a. transverse waves.
 - b. longitudinal waves.
 - c. electromagnetic waves.
 - d. seismic waves.
 8. A transverse wave:
 - a. lasts no longer than one minute.
 - b. oscillates perpendicular to the direction of wave travel.

- c. oscillates in the same direction as the direction of wave travel.
 - d. has enough energy to travel at least 5,000 kilometers.
9. Ultrasound is:
- a. the speed at which the latest, top-secret jet aircraft fly.
 - b. used to make internal images of the human body.
 - c. extremely painful to the human ear.
 - d. of lower frequency than the human ear can detect.
10. Which of the following usually occurs inside a material instead of at the surface?
- a. Reflection
 - b. Refraction
 - c. Diffraction
 - d. Absorption

APPENDIX O: ELECTROMAGNETIC WAVES PRE-TEST

Name: _____ Class/Period _____
Pre-test Electromagnetic Waves

1. Electromagnetic waves are made by _____.
 - A) vibrating electrical charges
 - B) strong compressions
 - C) vibrating water molecules
 - D) vibrating air molecules
2. What type of waves do not require matter to carry energy?
 - A) mechanical
 - B) electromagnetic
 - C) transverse
 - D) compressional
3. The entire range of electromagnetic wave frequencies is known as _____.
 - A) visible light
 - B) ultraviolet radiation
 - C) the electromagnetic spectrum
 - D) magnetism
4. _____ is the distance from the top of one crest of a transverse wave to the top of the next crest in that wave.
 - A) Wavelength
 - B) Amplitude
 - C) Frequency
 - D) Wave velocity
5. Which of the following has the shortest wavelength?
 - A) green light
 - B) X rays
 - C) radio waves
 - D) infrared radiation
6. As frequency increases, wavelength _____.
 - A) becomes faster
 - B) increases
 - C) decreases
 - D) remains constant

APPENDIX P: ELECTROMAGNETIC WAVES POST-TEST

Name: _____ Class/Period _____
Post-test Electromagnetic Waves

1. As frequency decreases, wavelength _____.
 - A) becomes faster
 - B) increases
 - C) decreases
 - D) remains constant
2. Which of the following has the longest wavelength?
 - A) green light
 - B) X rays
 - C) radio waves
 - D) infrared radiation
3. The energy carried by an electromagnetic wave is called _____ energy.
 - A) thermal
 - B) mechanical
 - C) radiant
 - D) potential
4. What type of waves uses matter to carry energy?
 - A) mechanical
 - B) electromagnetic
 - C) transverse
 - D) compressional
5. The electromagnetic spectrum is a range of electromagnetic wave frequencies.
 - A) True
 - B) False
6. Which of the following properties of a transverse wave is the distance from one trough to the next?
 - A) amplitude
 - B) frequency
 - C) intensity
 - D) wavelength

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