RAISING ACHIEVEMENT OF SPECIAL EDUCATION STUDENTS THROUGH VOCABULARY INSTRUCTION

Except where reference is made to the work of others, the work described in this project is my own or was done in collaboration with my Advisor. This project does not include proprietary or classified information.

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RAISING ACHIEVEMENT OF SPECIAL EDUCATION STUDENTS THROUGH VOCABULARY INSTRUCTION

A project submitted

By

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to

LaGrange College

in partial fulfillment of

the requirement for the

degree of

SPECIALIST IN EDUCATION

in

Curriculum and Instruction

LaGrange, Georgia

27 June 2011

Abstract

The vocabulary of a content area was found to be a hindrance for students in mastering the curriculum, especially special education students with reading comprehension deficits. The Frayer model was one method used to help students assimilate technical vocabulary. Seventh grade life science students learned the vocabulary of the cells unit through the Frayer model. The students were given a pre- and post-test, participated in a survey, and an administrator was interviewed regarding the use of the Frayer model. Students showed gains in achievement from the pre- to the post-test, the students preferred the Frayer model, and the administrator was in favor of the model. The Frayer model should be varied with other methods and used across disciplines to raise student achievement.

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CHAPTER ONE: INTRODUCTION

Statement of the Problem

Federal guidelines under the No Child Left Behind Act (Gleibermann, 2007) mandate that all children must meet state education standards by the year 2014. This mandate is not exclusive of special education students, who due to their various disabilities, struggle to demonstrate mastery of state standards. This demonstration of mastery is through performance on state standardized tests, specifically the Criterion Referenced Competency Test (CRCT) for middle school students in the state of Georgia. Students with disabilities struggle learning science often due to a lack of literacy skills necessary for learning effectively from science textbooks. "Although science can be an interesting and enriching area of study, students with disabilities may encounter some learning difficulties regardless of how the content is presented" (Scruggs, Mastropieri, & Okolo, 2008, p.3).

Science textbooks are laden with complex vocabulary and it is the understanding and ultimately the application of such vocabulary that produces mastery in the content. Science learning involves very substantial amounts of vocabulary learning and memory of verbally based facts. In today's era of standards based learning and high-stakes testing text-based approaches to education have seen rise in their importance and focus in classrooms (Scruggs et al., 2008). Bozen and Honnert (2004) learned that "students need instruction in establishing and building vocabulary, note taking, and summarization before any in-depth discussions, or applications can take place that would make science a more meaningful topic and experience for all students" (p.19). This study explored the

educational implications of implementing the Frayer model in the science classroom and the influence the Frayer model had on the achievement of special education students.

Significance of the Problem

Traditionally, special education students came to the classroom without the same background knowledge as general education students. Due to special education regulations under the Individuals with Disabilities Education Act (IDEA), students with mild disabilities were placed in the general education classroom. While special education students learned alongside their general education peers, some struggled to keep the same pace. As Steele (2007) points out, "These students are required to pass the same standardized tests as children without disabilities; however, many of their characteristics such as deficits in memory, low-level reading and writing skills, and language difficulties interfere with their classroom success" (p.48). Special education students often did not possess the literacy skills necessary for learning effectively from science textbooks (Scruggs et al., 2008).

Lovitt and Horton (1994) wrote that "key vocabulary serves as a foundation on which facts, concepts, and relationships are built. Even the most cursory inspection of secondary science textbooks revealed that they are brimming with idiosyncratic vocabulary. Students who have command of a subject's vocabulary will undoubtedly stand a greater chance of mastering that subject than will pupils who lack familiarity with the key terms" (¶ 31). Scruggs and Mastropieri (1994) explained that mastery of the language of science enhances a student's ability to participate in class. Vocabulary was, therefore, essential to academic performance. As Spencer and Guillaume (2006) argued,

"In science and other content areas, vocabulary words are of primary importance because they are often labels for major concepts" (p. 209). Students with broader vocabularies have had greater school achievement. Nelson and Stage (2007) stated, "explicit vocabulary instruction methods improve vocabulary knowledge and reading comprehension, and the effects are greatest for students with low initial vocabulary knowledge levels" (p.2). Vocabulary instruction programs have been particularly beneficial to special education students by facilitating a deeper understanding of the content, producing higher standardized test scores.

Theoretical and Conceptual Frameworks

The LaGrange College Education Department [LCED] (2008) used the *Conceptual Framework* to guide the development and instruction of the professional education courses. The foundation of the *Conceptual Framework* was one of social constructivism, a theoretical base from which teacher education candidates learn how to be critical educators who can create learning environments in which learning is both enjoyable and rigorous (LCED, p. 3). Social constructivism, a theory in which teachers are facilitators, rather than lecturers or dispensers of information, requires teachers to organize, manage, and create learning environments in which students can be actively involved in the teaching and learning process (Tomlinson, 2001). Because students required the opportunity to first demonstrate their prior knowledge of a topic and then build upon that knowledge base, "the social constructivist method is based upon the premise that students act first on what they can do on their own and then with assistance from the teacher, they learn the new concept based on what they were doing individually" (Powell & Kalina, 2009, p.244). Vygotsky argued that students learn best through

cooperative learning, which is an integral factor in creating a social constructivist classroom. It is important for students to have the opportunity to work collaboratively with their peers and not to only interact with the teacher (Powell & Kalina, 2009). Through the employment of a social constructivist viewpoint, this research project explored how the implementation of the Frayer model in a seventh grade life science classroom has raised achievement of students, specifically special education students.

In order to acquire new vocabulary, students should have linked these new words to their past experiences and personal beliefs, "…knowledge is constructed in a context of social relations which affirm that, because no one person has the same experiences, there are multiple ways to view the world. Moreover, while all knowledge begins with experience, not all knowledge can be adequately constructed without understanding the central concepts, tools of inquiry, and structures of various disciplines" (LCED, p.3).

This research project was aligned with LaGrange College Education Department's *Conceptual Framework* Tenet 1.3, knowledge of learners. For Tenet 1.3, knowledge of learners addressed that educators understand how to provide diverse learning opportunities that support students' intellectual, social, and personal development based on students' stages of development, multiple intelligences, learning styles, and areas of exceptionality. Educators must also understand how factors inside and outside schools influenced students' lives and learning. The cognitive, social, emotional, and physical experiences of individual children all have had an effect on a student's vocabulary.

Domain 2 of the *Georgia Framework for Teaching* supported this research study and stated, Knowledge of Students and Their Learning: Teachers support the intellectual, social, physical, and personal development of all students. The research aligned itself with element 1C of the National Council for Accreditation of Teacher Education (NCATE) Standards: Professional and Pedagogical Knowledge and Skills for Teacher Candidates. The Interstate New Teachers Assessment and Support Consortium (INTASC) Principles that upheld this research are Principles 2 and 3. INTASC Principle 2 stated, the teacher understood how children learn and develop, and provided learning opportunities that support their intellectual, social, and personal development. INTASC Principle 3 stated, the teacher understood how students differ in their approaches to learning and creates instructional opportunities that are adaptive to diverse learners. National Board for Professional Teaching Standards (NBPTS) Core Proposition 1 matched with this research study: Teachers were committed to students and learning.

The second tenet of the LaGrange College Education Department's (2008) *Conceptual Framework* that this research project was aligned with was Tenet 3.3, Action. Tenet 3.3, action addressed that candidates have advocated for curriculum changes, instructional design modifications, and improved learning environments that support the diverse needs of and high expectations for all students. Domains 5 and 6 of the *Georgia Framework for Teaching* adhered to the action tenet of the *Conceptual Framework*. Domain 5 addressed planning and instruction: teachers design and create instructional experiences based on their knowledge of content and curriculum, students, learning environments, and assessments. Domain 6 addressed professionalism: teachers recognize, participate in, and contribute to teaching as a profession. The research project

aligned with element 1G of the NCATE Standards: Professional Dispositions for All Candidates. Principle 9 of the INTASC Standards was supported through the research: the teacher is a reflective practitioner who continually evaluates the effects of his/her choices and actions on others (students, parents, and other professionals in the learning community) and who actively seeks out opportunities to grow professionally. NBPTS Core Proposition 4 was aligned with the research; teachers think systematically about their practice and learn from experience.

Focus Questions

This study examined the impact of direct vocabulary instruction on the achievement of special education students in the life science classroom. The research also examined the efficacy of the Frayer model on student achievement. Through the implementation of this research study the change process was also be examined as to how best implement change in the school setting. The following focus questions drove and provided meaning to the research of how the implementation of the Frayer model in a seventh grade life science classroom can raise the achievement of students, specifically special education students.

1. How special education students' achievement was affected by direct vocabulary instruction through the Frayer model?
2. What were the student's perceptions of the Frayer model when used to teach direct vocabulary?

3. How successful was the new change process is getting an administrator to encourage the use of the Frayer model in classrooms during vocabulary instruction?

Overview of Methodology

This research study was approached through action research and evaluative research methods. Focus question one was addressed through action research as the effectiveness of the Frayer model was examined. Focus questions two and three were of an evaluative nature as they both addressed the perceptions of the Frayer model by students and an administrator. The setting for the study was a south metro-Atlanta middle school. The subjects were a group of seventh grade life science students. The Instructional Lead Teacher (ILT) from the study site was the participant in the study. The data collection methods included assessments, a survey, and an interview. Both content and construct validity were assessed throughout the study. Reliability was given to the study through a test- retest correlation from the pre and post test and a Cronbach's alpha performed on the survey results. The interview was recorded in order to lend dependability to the data collected from the interview. The study strived to minimize bias and create equity in achievement for all students. Assessment data were analyzed using a dependent- t test and an independent-t test, the survey was analyzed using a chi square, and the interview was analyzed and coded for themes.

Human as Researcher

I have taught seventh grade life science to gifted, general education, and special education students, all in the same classroom. I have often wondered how to best

increase the achievement of the special education students in the science classroom. Holding a degree in biology myself, I realized the vast amount of technical vocabulary in any branch of science and how mastery of the content requires an understanding of such vocabulary.

I have always questioned to what extent and how best to teach vocabulary. Should vocabulary be taught as a preview to the unit or during the unit? How should vocabulary be assessed? How much time was appropriate to devote to vocabulary acquisition? Reading and therefore vocabulary in the content areas has become more crucial in that high stakes standardized testing questions involve more reading. In the past I have not wanted to spend a great amount of class time devoted specifically to vocabulary instruction. Through this research project I hoped to visit the idea of vocabulary instruction to determine an appropriate amount of time spent on the instruction of content based terms. I hoped to find methods of linking scientific terminology to students' past experiences to help them better construct their own understanding.

CHAPTER TWO: REVIEW OF THE LITERATURE

Due to the frantic pace in which teachers have covered the curriculum in order to feel that their students are prepared for standardized tests, teachers are faced with the dilemma as to whether or not to teach direct vocabulary and if so how and to what extent. Literature supported the practice of direct vocabulary instruction as well as argued against such practice. Regardless of a teacher's position on direct vocabulary instruction, all teachers are faced with the challenging task of meeting the literacy needs of the diverse learners they teach. As preservice teachers prepare to meet these literacy needs, they discover that vocabulary teaching and learning is necessary for conceptual learning to occur in a specific content area (Hedrick, Harmon, & Wood, 2008). Recently there has been an effort by "local school districts to emphasize the teaching of literacy strategies within content area classrooms" (Hedrick et al., 2008, p. 444).

Special Education Students' Achievement and Direct Vocabulary Instruction

In order for students to be considered literate, they must have an extensive working vocabulary. Content specific vocabulary must be included in this working vocabulary. Vocabulary terms that are essential for mastery are present throughout a science curriculum. In fact, "In science and other content areas, vocabulary words are of primary importance because they are often labels for major concepts" (Spencer & Guillaume, 2006, p. 209). Wood, Vintinner, Hill-Miller, Harmon, and Hedrick (2009) also understood the importance of vocabulary instruction in the content areas, "…in reading expository texts, it is necessary to have a more in depth and thorough understanding of vocabulary words, because content vocabulary words can represent

critical concepts" (p. 321). Without knowledge of the vocabulary terms present in a textbook, meaning and understanding cannot be gained from the reading of a textbook. Textbooks are filled with content rich vocabulary and science textbooks are no exception.

Lovitt and Horton (1994) have observed that, "students who have a command of a subject's vocabulary will undoubtedly stand a greater chance of mastering that subject than will pupils who lack familiarity with the key terms" (¶ 31). Recent education legislation, including NCLB, emphasized student mastery of content, thereby making vocabulary instruction all the more important. Students are required to speak the language of science in order to master the content. While now recognized as important, vocabulary instruction in the science classroom can be a difficult task. The terminology required of students in science courses can be rather challenging as these terms are often low frequency words in which the student rarely comes in contact. This leads to less exposure to the terms and therefore, fewer opportunities for the student to master the meaning (Hedrick et al., 2008). The earlier students have mastered the vocabulary, the earlier the content can be mastered as was noted by Scruggs et al. (2008), "Any approach to science requires learning unfamiliar and sometimes abstract vocabulary. The sooner the most important vocabulary is assimilated, the more time can be devoted to deepening conceptual understandings" (p. 4).

Having mastered content based vocabulary can be a daunting task for the most talented of students, but it is truly a struggle for special education students. Special education students have strived to learn in spite of their particular disability, which often times includes a reading comprehension deficit. The difficulty and unfamiliarity of terminology located in science texts only compound the frustration many special

education students have faced while trying to cope with reading comprehension deficits. Understanding the text students have read builds confidence in that subject area, "content literacy is beneficial for a diverse range of students… Content literacy helps students to read and write effectively, understand and reason about content area concept and become more engaged in literacy and content subjects" (Klein, 2008, p. 1).

Graves (1985), a proponent of direct vocabulary instruction, contended that, "long term vocabulary instruction has been effective in improving students' ability to comprehend what they read" (p. 4). Speaking the language of science allowed students to be active participants in the classroom. Scruggs and Mastropieri (1994) found that, "students who do not master the essential language of science may find their ability to share experiences, and participate in class discussions impeded" (p. 318). Class participation was vital to a student's movement towards content mastery. Direct vocabulary instruction gave all students the knowledge needed to speak the language of science and therefore the ability to participate in classroom discussions. Those students who have low initial vocabulary levels are the students who benefit the most from explicit vocabulary as their vocabulary knowledge and reading comprehension both increase (Nelson & Stage, 2007). Baker, Simmons, and Kameenui (1995) also supported the assertion that special education students stand to make large achievement gains through direct vocabulary instruction, "students with poor vocabularies, including diverse learners, need strong and systematic educational support to become successful independent word learners" (p. 7). Special education students had the potential to make great academic gains through the explicit teaching of vocabulary. These students have needed support and guidance as they learn new words; they have needed techniques that

can generalize into other content areas and serve them in their academic careers. Hedrick et al. (2008) wrote, "students who lag behind in reading need assistance in both learning new words and in developing independent word learning strategies that can readily transfer to content area vocabulary" (pp. 446-447). Many vocabulary instruction strategies have been identified, all with their own individual merits. Different strategies have met with success more with some students than with others. Once an explicit vocabulary instruction method has been implemented in the classroom, its success must be evaluated. The success of an instruction method can be determined by, "…the extent that the method meaningfully reduces the gap between students with poor versus rich vocabularies" (Baker et al., 1995, p. 3).

The Frayer Model

The Frayer model, one such instruction method was employed to teach vocabulary. The Frayer model, essentially a type of graphic organizer allowed the students to separate the various aspects of a word or concept. In the center of a sheet paper the word or concept was listed with the remaining paper divided into four equal sized boxes. Separate information was then placed in each of these boxes. The Frayer model included the definition of the new concept, including any necessary attributes; listing some facts about the concept that make the concept unique; giving examples of the new concept; and finally listing non examples that do not illustrate the concept (Graves, 1985). This model worked well in teaching new concepts and ideas particularly because it was a type of graphic organizer which allowed the multiple pieces of information about a concept or word to be viewed in one glance. Through the employment of the Frayer

model students learned new vocabulary or concepts that gave way to greater reading comprehension and therefore greater academic achievement.

Strengths and Weaknesses of the Frayer Model

Students responded with different levels of success to various instruction methods and vocabulary instruction methods are no exception. Each method possessed a series of strengths and weaknesses that had to be weighed in order to determine which method was the most beneficial for a particular set of students. The Frayer model was judged to be an effective instructional model for teaching content area vocabulary. The Frayer model came with its own set of strengths and weaknesses.

In order to determine the strengths and weaknesses of an instruction method, several ideas should have been considered ranging from ease of use, student and teacher perception, to shear effectiveness. All of these aspects have been part of a teacher's determination to use or not use a particular instructional method. Some of the inherent strengths of the Frayer model were that it incorporated the linguistic and the nonlinguistic representations of words or concepts, it was in itself a graphic organizer to aid in the organization of material, and the model had the potential to improve the affective learning of vocabulary.

The Frayer model incorporated a definition with an illustration, a series of facts, examples, and non-examples of a term or concept. This model unlike several others employed multiple aspects of a term or concept so a more complete understanding was gained rather than just a definition. Marzano (2004) contended, "For information [vocabulary] to be anchored in permanent memory, it must have linguistic (language

based) and nonlinguistic (imagery based) representations" (pp. 71-72). The Frayer model adhered to Marzano's recommendations in that it incorporated both the linguistic and nonlinguistic representations. The definition, facts, examples, and non-examples all appealed to the linguistic representations and the illustrations that accompanied the definition appealed to the nonlinguistic representation of the term or concept. Through the incorporation of both linguistic and nonlinguistic representations of terms and concepts more learning styles were used and both hemispheres of the brain were then activated.

Another strength of the Frayer model was that it functions as a graphic organizer. Graphic organizers allowed information to be arranged into different compartments to facilitate the brain as the given information was processed and stored more efficiently. As a graphic organizer, the Frayer model followed the schema theory of linking new information to existing information in the brain (Monroe & Pendergrass, 1997). In order for information to be processed and stored in the brains of students, teachers were encouraged to use the Frayer model.

When compared to other direct vocabulary instruction methods, especially definition only, the Frayer model had the potential to improve the affective learning of vocabulary. Monroe and Pendergrass (1997) cited a study conducted in a western state in the United States students where students were taught content specific vocabulary through only definitions and through the use of the Frayer model. The researchers of this study found that the students learned and assimilated the terms into their own vocabularies more efficiently with the Frayer model than with only learning definitions, but also that the students taught using the Frayer model appeared to welcome vocabulary

instruction. These students actively participated in discussing attributes, examples, and non-examples for key vocabulary terms (Monroe & Pendergrass, 1997).

While the Frayer model possessed several strengths in facilitating vocabulary development for students, there were also some inherent weaknesses to the model. The primary weaknesses of the model included the time required to implement, the model required some level of practice, and some teachers did not feel the need to teach direct vocabulary.

For teachers, time was a precious commodity. Teachers were continually feeling a sense of urgency as more responsibilities were placed upon them. One of the strongest arguments for those who oppose the teaching of direct vocabulary was time (Graves, 1985; Marzano, 2004). Many teachers did not want to take the time to teach direct vocabulary. Even for those teachers who supported direct vocabulary, many of these teachers found fault with the Frayer model due to the time it required. The Frayer model involved the completion of a graphic organizer which was incredibly time consuming, especially for some students. In classrooms that already experienced strict time constraints, some teachers may not feel as if the Frayer model warranted the time it required (Graves, 1985). This was a decision each teacher had to make on an individual basis.

The completion of graphic organizers required skill and practice. Some students are more adept than others at completing graphic organizers and, therefore, the teacher had to scaffold support based on individual student need (Graves, 1985). As with any skill, the more it is practiced, the greater ease in which it was used. With time, practice,

and teacher support, students were successful at making their own Frayer model and other graphic organizers.

Lastly, some teachers did not feel that direct vocabulary instruction was necessary and that students could learn key vocabulary through other daily interactions with the curriculum (Marzano, 2004). Those teachers who did not support direct vocabulary instruction cited as their reasons that the great volume of words that students needed to learn far exceed the maximum number a student was capable of learning in one academic year, vocabulary sizes placed constraints on other instruction, and that students could learn vocabulary through wide reading (Marzano, 2004). All of these reasons discounted the use of the Frayer model.

Teachers would have had to judge the use of the Frayer model based on their own perceived merits and downfalls of the model. Once a teacher decided to use the Frayer model, he would have had determined how to best employ the model in his classroom based on the needs of students. Due to differences from classroom to classroom, the Frayer model was successful in some classrooms more than in others.

School Change

Attracting others to a new process, method, or idea was a difficult task. This world could not remain stagnant and therefore change was inevitable. The field of education was one realm of society that experienced frequent change that was sometimes for the better and other times not. Change was a process from which to learn and was an ongoing endeavor. One of the greatest weaknesses of the Frayer model was that the model was too costly in terms of classroom time required (Graves, 1985). In order to

attract more teachers to using the Frayer model to teach direct vocabulary, the time issue needed elimination. There were several different theories as to how to achieve change and then, once a change process was selected, how to monitor the change that was occurring.

The field of education experienced frequent and sometimes radical changes that left educators wondering about the basis behind the change. Several theories existed as to how to achieve change in education and each presented somewhat contradictory views on this process. Sieber (1972) wrote, "Probably no other institution [education] in our society is subjected to such a barrage of forces, planned and unplanned, and probably no other area of institutional change exhibits less consensus on the best means of going about the job" (p. 362). In deciding how to achieve change, the initiator appealed to the participants and recognized that there may not be one particular change theory or view that would be successful in appealing to all people, but rather theories or views would need to be blended.

Sieber (1972) identified three contrasting personalities embraced by a change leader: Rational Man, Cooperator, and the Powerless Functionary. Each of these personalities attempted the change process from different perspectives. The Rational Man approach to change was simply to disseminate information to the change participants. It was a series of one way communication from the change initiator to the change participants. If given convincing enough information, the participants would have eagerly joined the change effort. The change leader needed to provide information regarding the best techniques for teaching to the change participants.

The role of the Cooperator was characterized by the change facilitator recognizing and appealing to the cooperative spirit within each individual. The Cooperator relied on the change participants to want have been cooperative with the change efforts; "Without development of this cooperative spirit, innovation cannot occur" (Sieber, 1972, p. 368). This was characterized by a two-way communication path that achieved greater understanding and, therefore, greater change potential. In order for the Cooperator role of change to be successful, there had to be a climate conducive to change within the particular educational institution.

The goal of the Powerless Functionary was to "create legal mandates and sanctions that will induce specific changes" (Sieber, 1972, p. 375). Unlike the Rational Man or Cooperator, the Powerless Functionary did not attempt to rally cooperation or to increase knowledge on a particular technique. This role employed the use of a top-down approach that used rules and regulations that mandated the implementation of change. Often times teachers were then required to produce evidence of compliance with such rules and regulations. The Powerless Functionary approach made use of an external structure of power and control.

In order to achieve change, convincing data was presented to change participants, the change facilitator appealed to the cooperative nature of the change participants, or change participants were mandated to comply with the change. In most cases, none of these change theories would be successful alone, but rather a combination of the theories that were merged would be successful. Sieber (1972) identified the main components that were necessary to bring about change, "rational information, two- way interpersonal communication and expertise in group processes, consensus on new norms and sanctions

associated with a proposed change, legitimate authority of the person responsible for the innovation and the power to carry it through" (p. 380).

Once a decision had been made that initiated a change and a change process selected to bring about this change, there had to be a change monitoring system in place that gave feedback as to the effectiveness of the change. To borrow from the field of aviation, there must be a monitoring system put into place during the change process similar to that of the computer monitoring system on aircraft that monitors pressure, altitude, and other environmental factors (Hanson & Ortiz, 1975). This monitoring system provided pilots with the necessary feedback so decisions could be made to ensure a successful flight. Change initiators needed to have their own monitoring system that produced feedback so that decisions could be made so that classroom learning was successful. Hanson and Ortiz (1975) wrote that, "…internal feedback provides information on the effectiveness of the teaching learning process as derived from comparing test scores with predetermined objectives" (p. 261). Feedback provided the change initiator with the proper information so that it could be determined if the change was successful.

There was a debate over whether to teach direct vocabulary due to the time it consumed, however, based on the research, student achievement gained significantly from the teaching of direct vocabulary, especially special education students (Graves, 1985; Marzano, 2004; Monroe & Pendergrass, 1997). Vocabulary allowed for greater reading comprehension with which many special education students struggled. Knowledge of content related vocabulary provided for greater content literacy and allowed students to speak the language of the subject matter with one another. The

Frayer model was one direct vocabulary instruction method that successfully taught vocabulary. The Frayer model had inherent strengths and weaknesses as did any instruction model. The greatest strength of the Frayer model was that it combined the linguistic and nonlinguistic representations of the term or concept. The amount of time the model required was the greatest weakness of the Frayer model. In attempting to persuade other teachers to use teach direct vocabulary through the use of the Frayer model there were different approaches that were be taken: the factual presentation that the Frayer model was effective, asking other teachers for their cooperation in teaching using the Frayer model, and an administrative mandate for using the Frayer model. Once teachers were using the Frayer model, it was monitored for possible improvements.

CHAPTER THREE: METHODOLOGY

Research Design

In conducting this research study, a combination of applied action research and evaluation research were employed. Action research is defined as "a systematic approach to an investigation that enables people to find effective solutions to problems they confront in his everyday lives" (Stringer, 2007, p. 1). Action research allowed researchers the opportunity to work through some of the most confounding aspects of the problems that stood in the way of their goals. In the instance of this research study, action research was used to determine how effective the Frayer model was at raising the achievement of special education students.

The second lens in which to view this study was evaluation research. Evaluation research is, "a social science activity directed at collecting, analyzing, interpreting, and communicating information about the workings and effectiveness of social programs" (Ross, Lipsey, & Freeman, 2004, p. 1). Questions such as, "Is a particular intervention reaching its target population?, "Is the intervention effective in attaining the desired goals or benefits?", and "Is the program cost reasonable in relation to its effectiveness and benefits? were just some of the questions that evaluation research attempted to answer (Ross et al., p. 3). This study possessed an evaluative nature through the student surveys and the interview with an administrator that was conducted. Action research sought to determine methods for solving common problems, while evaluation research worked to constantly monitor the implemented methods for strengths and weaknesses. When

conducting this research, it was important to include both an action research and evaluation research aspect.

Setting

The setting of this research study was a suburban, south metro Atlanta middle school. The school population was approximately 1,074 students in grades 6-8 and 7% of these students were identified as special education students through the holding of an Individualized Education Plan (IEP). The setting was selected because it is my place of employment. Permission to conduct the study was first secured through an assistant principal that serves as the building Instructional Lead Teacher (ILT). All consent forms, surveys, and interview questions were attached to an application that went before an institutional review board (IRB) for approval before any data were collected.

Subjects and Participants

The subjects in this action research study included 86 students in the 7th grade. Of these 88 students, 15 of them were identified as special education students. Their disabilities included specific learning disabilities (SLD), emotionally and behaviorally disabled (EBD), and autism (AUT). There were 49 males and 39 females. Of the special education students, 12 were males and 3 were females. The students were 12-13 years of age. This particular school drew from a highly affluent area with high parental involvement.

The participant in this study was an assistant principal who serves as the Instructional Lead Teacher (ILT) and was interviewed. She was selected because she was a former science teacher and because of her status as ILT. Due to the fact that this

study directly impacted instructional methods, the ILT was a likely choice to participate in the study.

Procedures and Data Collection Methods

Throughout this research study, a variety of data collection methods were used to collect both qualitative and quantitative data: pre- and post- tests, student surveys, and a semi-structured interview. A data shell in Table 3.1 was included to outline the alignment of methods with focus questions for the research study.

Table 3.1. Data Shell

Focus Question	Literature Sources	Type: Method, Data, Validity	How these data are analyzed	Rationale
How special education students' achievement was affected by the implementation of the Frayer model in teaching vocabulary?	Hedrick, Harmon, & Wood (2008) Scruggs, Mastropieri & Okolo (2008) Wood, Vintinner, Hill-Miller, Harmon, Hedrick (2009)	Method: *Teacher made pre and post tests* Data: *Interval* Validity: *Content*	Quantitative: *Dependent T Test* *Independent T Test*	Quantitative: determine if there are significant differences
What were the student's perceptions of the Frayer model when used for direct vocabulary instruction?	Graves (1985) Monroe & Pendergrass (1997) Marzano (2004)	Method: *Survey* Data: *Ordinal* Validity: *Construct*	Quantitative: *Chi Square,* *Cronbach's Alpha*	Quantitative: determine if there are significant differences
How successful was the change process in getting an administrator to encourage the use of the Frayer model in classrooms?	Graves (1985) Hanson & Ortiz (1975) Sieber (1972)	Method: *Interview* Data: *Qualitative* Validity: *Construct*	Qualitative: *Coded for themes*	Qualitative: look for categorical data

The first focus question addressed how the use of direct vocabulary instruction through the Frayer model would affect student achievement, especially the achievement of special education students. The Frayer model was implemented during the cell unit. This unit was taught over a period of approximately three weeks. The first day of the unit began with a pre- test on cells. As the unit was taught, students created a cell book in which they folded three pieces of computer paper in half and stapled them together. The vocabulary words deemed necessary for mastery of the material were diagrammed using the Frayer model in the cell book. The ten words deemed necessary were cell membrane, lysosome, vacuole, mitochondria, endoplasmic reticulum, ribosome, Golgi body, cytoplasm, organelle, and nucleus. Each day a new page in the cell book was completed. At the completion of the unit a post- test was given. A copy of the pre- and post- test can be found in the appendix (see Appendix A).

The second focus question addressed student perception of the Frayer model. This was ascertained through a student survey given to all students. The survey was given after the students completed their post-test. A copy of the survey can be found in the appendix (see Appendix B). The survey was taken in part from a survey conducted by Bush (2009). The survey used Likert scale responses that ranged from strongly disagree, disagree, agree, and strongly agree to the various statements.

Based on the results of the action research study, the third focus question attempted to investigate the willingness of the Instructional Lead Teacher to encourage the use of the Frayer model in other classrooms. A qualitative approach was taken to gather these data through the use of an interview. A list of interview questions can be found in the appendix (see Appendix C). The ILT was asked about her feelings in

regards to direct vocabulary instruction, the use of the Frayer model, how receptive she believed the school's teachers were in the implementation of the model in their own classrooms, and her feelings from an administrative view on school-wide use of the Frayer model.

Validity, Reliability, Dependability, Bias, and Equity

Validity, reliability, dependability, bias, and equity all were addressed for each focus question. Focus question one sought to determine the affect of the Frayer model on student achievement through the use of a teacher made pre- and post- test. The pre- and post- test produced interval data. Interval data is "based on some underlying continuum such that we can talk about how much more a higher performance is than a lesser one" (Salkind, 2010, p. 140). The data were analyzed to determine if the post- test scores were significantly higher than the pre- test scores on the cells unit. As the pre- and post- tests were assessments of student knowledge, the validity of the tests was evaluated through content validity. Content validity was described as, "the adequacy with which the content of a test represents the content of the assessment domain about which inferences are to be made" (Popham, 2002, p. 53). The reliability of the pre- and post- test was examined. Reliability is a measure of a test's consistency with which it measures the data (Popham, 2002). A test- restest correlation was used to measure the stability of the assessment's results over time (Popham, 2002). The pre- and post- test had the potential of unfair bias to special education students if accommodations were not provided. Special education students could potentially be unfairly penalized on the pre- and post- test due to their disability. According to Popham (2002), "Unfair penalization arises when a student's test performance is distorted because of content that disadvantages the

student because of the student's group membership" (p. 75). In order to minimize the bias the special education students may have experienced, the collaborative teacher followed the students' IEP testing accommodations (ie. small group testing, extended time, and oral administration) during the pre- and post- test. In an effort to strive for equity for all students, the idea of achievement equity was aligned with this research study. Equity in student achievement attempted to close the achievement gap among groups of students on various types of assessments (Skrla, McKenzie, & Scheurich, 2009). Closing the achievement gap between special education and general education students was the intent of this research study.

The second focus question attempted to measure student perception of the Frayer model. These perceptions were ascertained through a student survey using a Likert scale. The various responses produced ordinal data due to the responses being ordered strongly disagree (1), disagree (2), agree (3), and strongly agree (4) (Salkind, 2010). The evidence of validity for this set of ordinal data was seen through construct related validity. Construct validity is a measure of a student's feelings or dispositions on a given topic (Popham, 2002). In order to determine the reliability or consistency with which students answered survey questions a Cronbach's alpha was performed. A Cronbach's alpha was used to determine the "internal consistency for tests [surveys] containing items on which students can be given different numbers of points" (Popham, 2002, p. 35). Again, an unfair bias was present in the survey against special educations students. Those students with reading deficits may have not understood the questions and therefore were put at an unfair disadvantage than their general education counterparts due to their disability (Popham, 2002). To minimize this bias, the collaborative teacher read aloud the survey

questions to the special education students. The data produced from the student survey attempted to improve teacher quality so that equity was provided for all students (Skrla et al., 2009). The survey assessed student perceptions of the Frayer model and their impressions of the effect of the Frayer model on their achievement.

The third focus question examined how receptive an administrator was to the data and her willingness to encourage the use of the Frayer model. These data were collected through an interview with the school's Instructional Lead Teacher. The data from the interview were qualitative. Perspective was gained on the potential of the Frayer model being more widely implemented, "the qualitative research interview attempts to understand the world from the subjects' point of view, to unfold the meaning of their experiences, to uncover their lived world prior to scientific explanations" (Kvale & Brinkmann, 2009, p. 1). Construct related validity was useful in supporting the data gathered from the interview because the data was based upon the ILT's feelings and disposition regarding the Frayer model (Popham, 2002). Dependability was ensured with which the interview data were reported, the interview was audiotaped, which, according to Kvale and Brinkman (2009) "frees the interviewer to concentrate on the topic and the dynamics of the interview. The words and their tone, pauses, and the like are recorded in a permanent form that is possible to return to again and again for relistening" (p. 179). The bias present in this interview was a personal bias that the Frayer model would help close the achievement gap if endorsed by the administration and subsequently adopted in classrooms school-wide. It was hoped that the data gathered from this interview would cause the administration to encourage the use of the Frayer model in order to increase the

achievement of special education students to be more comparable to that of their general education peers (Skrla et al., 2009).

Skrla et al. (2009) identified several areas of education in which inequities exist. The authors grouped the inequalities into three categories: teacher quality equity, programmatic equity, and achievement equity. The purpose of this study was to address achievement equity through implementing the Frayer model to teach direct vocabulary so that student achievement was raised. Skrla et al. (2009) identified special education students as a group that received inequitable experiences and could benefit from content rich direct vocabulary instruction. Through teaching direct vocabulary it was hoped that the achievement gap between general education and special education students would decrease.

Analysis of Data

The quantitative data collected to answer focus question one was analyzed using a series of dependent-t tests. The dependent-t tests showed if there were significant differences between means of one group tested twice. The test results of the pre- and post- test produced interval data that was examined for significant differences between the administration of the pre- test and the administration of the post- test, thereby indicating the Frayer model as an effective method in which to teach direct vocabulary. The data were examined to determine significant differences in the achievement levels of the special education students from the time of the pre- test to the time of the post- test after direct vocabulary instruction was received using the Frayer model. For comparative purposes, the pre- and post- tests of the regular education students were analyzed using a

dependent-t test as well. Lastly, an independent-t test was used to compare both the pre- and post- tests for the regular and special education students. The decision to reject the null hypothesis for all t-tests had been set at $p < .05$. The effect size was computed in order to determine the "magnitude of the treatment," (Salkind, 2010, p. 231) which, in this case, was the Frayer model. Effect size r was used to describe the magnitude of treatment for paired data as in the case of the dependent –t tests. Cohen's d measured the effect size for independent groups as in the case of the independent-t tests.

The survey collected ordinal data that was used to determine strengths and weakness of the Frayer model and the student's perception of the model. In order to analyze the data collected from the survey, a chi square analysis was conducted to determine the distribution of answers. The chi square determined which questions were significant towards supporting the use of the Frayer model and which questions were not significant in their support of the Frayer model. The significance level was reported at the $p < .05$, $p < .01$ and the $p < .001$ levels.

The interview data collected for the third focus question was qualitative. In reviewing the interview transcript, categorical or emerging themes about school change and improvement were coded.

The study was not only analyzed by focus question, but an overall holistic analysis was also performed. To give validity to the research, the study was first proposed to the supervising faculty for approval, which gave consensual validity. Eisner (1991) referred to this faculty review process as an agreement among competent others that the description, interpretation, evaluation, and thematic were correct.

Epistemological validation was produced when the results were compared to the literature that evaluated the use of the Frayer model (Denzin & Lincoln, 1998). Each of these measures of validity gave meaning to the study.

Structural corroboration, fairness, and rightness of fit all lent credibility to the research study. Structural corroboration brought a confluence of evidence together to form a compelling whole (Eisner, 1991). This study was designed using multiple sources of measures that assessed the effectiveness of the Frayer model. In the review of the literature, opposing points of view were presented as weaknesses of the Frayer model were exposed in order to add fairness to the study. The presentation of alternative viewpoints on the use of the Frayer model added strength to the study. Precision was important in order to make judgments and assertions about the results (Eisner, 1991). Throughout the design and analysis of the study, great care was taken to ensure detail and accuracy so that strong evidence from which to assert the value of the Frayer model was produced. By doing so, the rightness of fit credibility for this study increased.

Any research study could have been repeated, a measure of the study's transferability. Other teachers found this information useful as they may have wished to duplicate these findings as they make a decision to use or not use the Frayer model in their own classroom. Eisner (1991) referred to transferability as any study that was useful for others to apply to different situations and where perception and understanding by others increased because of the study findings.

The transformational power of this study was exhibited through its catalytic validity. Catalytic validity is the idea that the research will be convincing enough as to

act as a catalyst for change. It was hoped that through the data collected from the pre and post tests, the survey, and the interview that there was enough convincing evidence that served as a catalyst for other teachers to adopt the Frayer model (Lather as cited by Kinchloe & McLaren, 1998).

CHAPTER FOUR: RESULTS

The results for chapter four were organized by focus question. Quantitative and qualitative data are presented. Embedded tables were used to present data from t-tests of dependent and independent means as well as the survey data provided by the chi-square analysis. The qualitative data collected through interviewing the Instructional Lead Teacher (ILT) were discussed.

Focus question one sought to determine if the Frayer model increased student achievement, especially the achievement of special education students. To answer this question, the students were each given a pre- and post-test covering the cells unit. Two dependent- t tests were performed comparing the pre- and post- tests for the general education students as well as for the special education students. The results of the tests were analyzed to determine if there was any significance in the scores from the pre- test to the post- test for the two groups. Table 4.1 below shows the results of the dependent-t test for the general education students on the cells pre- and post-test and Table 4.2 shows the results for the special education students.

Table 4.1 Dependent-t Test Results for General Education Students

t-Test: Paired Two Sample for Means		
	Pre-Test	*Post-Test*
Mean	11.42466	22.56164
Variance	24.83105	20.99962
Observations	73	73
Pearson Correlation	0.531947	
Hypothesized Mean Difference	0	
df	72	
t Stat	-20.5041	
P(T<=t) one-tail	4.41E-32	
t Critical one-tail	1.666294	
P(T<=t) two-tail	8.81E-32	
t Critical two-tail	1.993464	

$t_{(72)}= -20.50, p < .05$

The mean from the pre- test to the post- test doubled showing a large increase in student achievement. The variance decreased showing more consistency among the scores on the post-test from those of the pre-test. Pearson's Coefficient of r = 0.53 showed a large test-retest reliability. The results of the dependent- t test for the general education students showed that $t_{(72)}= -20.50, p < .05$. In this case, the obtained value of 20.50 was larger than the critical value of 1.67; therefore, the null hypothesis was rejected meaning that there was a significant difference between the scores on the cells pre- and post-test for the general education students. The effect size r was -0.76.

Table 4.2 Dependent- t Test Results for Special Education Students

t-Test: Paired Two Sample for Means		
	Pre-Test	*Post-Test*
Mean	9.066667	18.6
Variance	20.78095	19.68571
Observations	15	15
Pearson Correlation	0.520548	
Hypothesized Mean Difference	0	
Df	14	
t Stat	-8.38075	
P(T<=t) one-tail	3.97E-07	
t Critical one-tail	1.76131	
P(T<=t) two-tail	7.94E-07	
t Critical two-tail	2.144787	

$t_{(14)} = -8.38$, $p < .05$

The mean from the pre- test to the post- test for special education students doubled showing a large increase in student scores on the post- test from their pre-test scores. The variance decreased slightly showing a small increase in the consistency of the post-test scores from the pre-test scores. Pearson's Coefficient of $r = 0.52$ showed a large test-retest reliability measure. The results of the special education dependent-t test were $t_{(14)} = -8.38$, $p < .05$. The obtained value of 8.38 was larger than the critical value of 1.76, therefore, the null hypothesis was rejected because there was a difference between the scores on the cells pre-test to the post-test for the special education students. The effect size r was -0.73.

Two independent- t tests were also performed comparing the pre-tests of the general education students to the special education students as well as the post-tests for both groups. The independent-t tests were analyzed for significance at the .05 level. Table 4.3 below show the results of the independent-t test of the pre-test and Table 4.4

show the results of the post-test between the general education and special education students.

Table 4.3 Independent-t Results Pre-Test General and Special Education Students

t-Test: Two-Sample Assuming Unequal Variances		
	Pre GEN	*Pre SPED*
Mean	11.42466	9.066667
Variance	24.83105	20.78095
Observations	73	15
Hypothesized Mean Difference	0	
df	21	
t Stat	1.795058	
P(T<=t) one-tail	0.043526	
t Critical one-tail	1.720743	
P(T<=t) two-tail	0.087052	
t Critical two-tail	2.079614	

$t_{(21)} = 1.79$, $p < .05$

The mean for the scores of the pre-test were lower for the special education students than for the general education students. The results of the independent-t test for pre-tests were as follows, $t_{(21)} = 1.79$, $p < .05$. The obtained value of 1.79 was greater than the critical value of 1.72, therefore the null hypothesis was rejected. There was a difference between the pre-test scores of the general education students and the special education students. Cohen's d yielded a large effect size of 0.72.

Table 4.4 Independent-t Test Results Post-Test General and Special Education Students

t-Test: Two-Sample Assuming Unequal Variances		
	Post GEN	*Post SPED*
Mean	22.5616438	18.6
Variance	20.9996195	19.68571429
Observations	73	15
Hypothesized Mean Difference	0	
Df	21	
t Stat	3.13190848	
P(T<=t) one-tail	0.00251911	
t Critical one-tail	1.72074287	
P(T<=t) two-tail	0.00503823	
t Critical two-tail	2.07961384	

$t_{(21)} = 3.13, p < .05$

The mean for the scores of the post-test were lower for the special education students than for the general education students. The results for this independent-t test for post-tests were $t_{(21)} = 3.13, p < .05$. The obtained valued of 3.13 was greater than the critical value of 1.72, therefore the null hypothesis was rejected because there was a difference in the post-test scores between the general education students and the special education students. Cohen's d yielded a large effect size of 0.64.

Focus question two aimed to determine student perception of the Frayer model. Student perception was measured using a survey administered to all students at the conclusion of the cells unit. The survey employed a Likert response scale and consisted of fifteen questions that asked students how they felt about reading in Science, the vocabulary in their textbook, and the use of the Frayer model. A chi square analysis was performed on the student survey responses that compared what was observed on the

survey to what would be expected by chance (Salkind, 2010). Table 4.5 displays the results of the student survey.

Table 4.5 Student Survey Results

Survey Items n = 15	Survey Questions	χ^2
Item 1	I am a good reader in all of my classes.	41.54***
Item 2	I like when we read in Science class.	42.45***
Item 3	Reading in Science class is not important.	48.36***
Item 4	The textbook we read in Science class is easy to understand.	31.72***
Item 5	Sometimes we have to read in science and I don't understand the words.	18.81***
Item 6	The vocabulary words we use in science class are easy to remember.	34.36***
Item 7	Reading guides help me to understand what I read.	32.81***
Item 8	Learning new words before I read is helpful.	56.90***
Item 9	My science book is too hard to read.	39.36***
Item 10	It is helpful when my teacher takes the time to teach vocabulary words.	59.81***
Item 11	Graphic organizers help me to learn information.	52.00***
Item 12	The Frayer model helped me understand the vocabulary terms in this unit.	39.54***
Item 13	The vocabulary words in the cells unit are easy to understand.	37.45***
Item 14	The Frayer model is a good method to use to learn vocabulary.	38.81***
Item 15	I like to use the Frayer model when learning new vocabulary.	11.09**

* $p < .05$, ** $p < .01$, *** $p < .001$

The chi-square statistic revealed that all questions on this survey were significant at either the $p < .01$ or $p < .001$ levels, meaning that all of the questions were answered in a similar manner. This means that there was a difference in how the students answered and what would have been expected by chance. In order to determine the internal consistency reliability of the student survey, a Cronbach's alpha test was performed using

the data from the survey responses. The purpose of the Cronbach's alpha was to determine if the survey items were consistent with one another. For the student survey regarding student perception of the Frayer model, the Cronbach's alpha was $\alpha = 0.56$. This survey showed a medium reliability.

The students indicated that they felt as if reading in the content areas was important and perceived themselves as generally good readers, able to comprehend the text as reported on questions 1, 2, 4, and 9. Most students answered that they felt as if the science vocabulary was easy to remember and they often understood the words that they read in science from the answers to questions 5 and 6. Questions 7 and 11 both indicated that students felt as if graphic organizers helped them to learn new information. Questions 12, 14, and 15 all showed a student preference towards the Frayer model.

The third focus question centered on the discovery of the opinions of a building administrator on teaching direct vocabulary, particularly the Frayer model and how open she was to encourage its use in other classrooms. Her opinions were highly regarded in that she serves as the building Instructional Lead Teacher (ILT) in charge of academics and she was herself a former 7th grade Life Science teacher. Her teaching experience made her familiar with the curriculum and its challenges. The interview took place in her office once all data were collected and analyzed so that the results were presented to her at that time.

The ILT conveyed that she did feel that students tend to struggle when reading science textbooks mainly because of the vocabulary. This vocabulary was often encountered in isolation for many of these students because it is not common terminology

used in other contexts. The cell unit had a large amount of unfamiliar terminology because the terms were low frequency words only encountered in the context. The structures of the cell were too small to be seen and therefore the students had little prior knowledge about the terms. In the ILT's experience the students typically had a high interest in the cell unit, but the test scores were lower due to the high volume of specific vocabulary and abstract concepts. Due to the difficulty students experienced with this unit, she felt that teaching direct vocabulary was well worth the time it required. The addition of graphic organizers to the teaching of direct vocabulary, she said, was a vital component to successfully teaching vocabulary. Graphic organizers are widely encouraged in the school and considered a "best practice" for teachers use. The ILT administrator felt that the Frayer model, as a type of graphic organizer, made it a great method to use when teaching direct vocabulary especially because it incorporated both linguistic and nonlinguistic aspects. However, she cautioned that whatever method was employed, it must be kept fresh and that one method should not be used repeatedly. The linguistic and nonlinguistic aspects of the Frayer model were the greatest asset of the Frayer model in the ILT's opinion and because it was a visual representation for students, she believed it had great potential to raise student achievement. In regards to encouraging other teachers to adopt the use of the Frayer model, she was open to doing so because she had seen the Frayer model employed in many classrooms throughout the building and felt many other teachers were willing to use it. While she recognized that many teachers were willing to use the Frayer model in their classrooms, the ILT also recognized that some teachers would be hesitant to adopt the practice because of the time requirement and it was difficult to change old habits for some teachers who have used a

different method or who do not teach vocabulary at all. From an administrative standpoint, she liked to see direct vocabulary instruction especially with difficult units such as the cell unit, but cautioned that the method should be varied throughout units.

Throughout the interview the ILT administrator stressed several factors in regards to the teaching of direct vocabulary. The first factor was the addition of a graphic organizer to the teaching of direct vocabulary. She commented that, "graphic organizers help students to organize information for retention in their memories." Secondly, the greatest strength of the Frayer model, in her opinion, was that it incorporated both linguistic and nonlinguistic properties. She stated that, "the incorporation of both of these properties for a vocabulary term appealed to both the visual and verbal learners." Lastly, the ILT stressed that it was important for vocabulary instructional methods to be varied as she commented, "I do not like to see only one instructional method used when teaching vocabulary as the students will become bored with it in time." While the Frayer model was an excellent method of teaching vocabulary, it too should be taught with other methods.

Chapter Four presented the results collected and found that student achievement increased for both general education and special education students from the beginning of the cell unit to the conclusion of the unit. Students reported that they liked the Frayer model and felt that it was a good method to use when learning new vocabulary. During the interview, the ILT expressed her support of the Frayer model from an administrative standpoint. The results from Chapter Four were further analyzed and discussed in Chapter Five along with recommendations for future research.

CHAPTER FIVE: ANALYSIS AND DISCUSSION OF RESULTS

Analysis of Results

A pre- and post-test was administered to general education and special education students to determine the effectiveness of the Frayer model. The achievement of all students was of interest, but particularly the achievement of special education students. Student achievement was ascertained through the administration of a pre- and post-test covering the cells unit. A dependent- t test was conducted comparing the pre- and post-test results of the general education students and another dependent- t test was conducted comparing the pre- and post-test results of the special education students. Independent- t tests were also performed comparing the pre-test scores of the general education students to the special education students' scores as well as comparing the post-test scores for both groups.

The null hypothesis was rejected for each dependent-t and independent-t test which consistently indicated differences between the pre- and post-test for general and special education students and when the pre-tests and post-tests of both groups were compared. The means of the dependent-t tests of the general education and special education students doubled showing a large increase in achievement through the teaching of the cells unit. This increase in achievement was at least due in part to the fact that the pre-test was administered prior to instruction and the post-test was administered after the instruction of the cells unit. The students' achievement should have increased without regard to the instructional method used. The increase in the test means on the pre- and post-test exhibited that students became more content literate. Content literacy led to

increased student achievement, “Content literacy helps students to read and write effectively, understand and reason about content area concepts and become more engaged in literacy and content subjects” (Klein, 2008, p. 1).

The pre- and post-test was shown to be reliable over time in that the reliability coefficient for each dependent and independent t test was direct and measured to be medium to large. Effect size was used to determine the “magnitude of treatment” (Salkind, 2010, p. 231) and in this case the treatment was the Frayer model. Validity sought to determine if a test measured the factors it was intended to measure. The pre- and post-test were considered valid because they were aligned to the Georgia Performance Standards (GPS), measuring the state standards for the cells unit. The data were significant because both the general and special education students increased their achievement in their learning of cells.

A survey was administered to all students regarding their attitudes towards the Frayer model. The survey responses were calculated and analyzed with a chi square and a Cronbach’s alpha was calculated to determine the consistency with which the questions were answered. When surveyed about their attitudes towards the Frayer model, students overwhelmingly indicated that they preferred the Frayer model and felt that it increased their learning of the content in the cells unit.

All survey questions were found to be significant at the .01 and .001 levels. The significance revealed that the questions were answered in a similar manner. Questions 12, 14, and 15 were of particular interest because they asked specifically how the students felt about the Frayer model and they overwhelmingly were in favor of the model.

Question 12 inquired if the students felt that the Frayer model helped them to understand the vocabulary terms in this [cells] unit. This particular question was significant at the .001 level as most of the students agreed or strongly agreed with this statement. Of the fifteen special education students surveyed, one student disagreed, seven agreed, and seven strongly agreed that the Frayer model helped them to understand the vocabulary terms. Question 14 asked if the students felt as if the Frayer model was a good method to use to learn vocabulary and was significant at the .001 level. Examining the special education students' responses particularly, two reported that they disagreed, four reported they agreed, and nine reported that they strongly agreed with this statement. Question 15 explored if the students liked using the Frayer model when learning new vocabulary. Eight special education students indicated that they agreed and seven indicated that they strongly agreed that they liked using the Frayer model when learning new vocabulary. These results were similar to the results of a study conducted in the western United States where researchers found that students learned and assimilated new vocabulary terms into their own vocabularies more efficiently with the Frayer model…students taught using the Frayer model appeared to welcome vocabulary instruction (Monroe & Pendergrass, 1997).

Survey question 11 inquired if students perceived graphic organizers to be helpful in learning new information. The students consistently answered this question at the .001 significance level. Graphic organizers provided structure and support that special education students needed when learning new information, "Students with poor vocabularies, including diverse learners, need strong and systematic educational support to become successful independent word learners" (Baker et al., 1995, p. 7). The Frayer

model as a type of graphic organizer provided the support these types of students needed to learn the technical vocabulary they encountered during a science class.

An interview was conducted to determine how open the ILT administrator was to change and to adopt the use of the Frayer model as a common practice in the school. Once the data were collected, this administrator was presented with the data and interviewed in regards to her feelings about teaching direct vocabulary and the use of the Frayer model to do so.

One theme that emerged from the interview regarding the teaching of direct vocabulary was the use of a graphic organizer should always be incorporated. Graphic organizers helped students organize and process new information. The Frayer model was considered a type of graphic organizer, but an added incentive to the use of the Frayer model is that it incorporated the linguistic and nonlinguistic representations of the words. The ILT pointed out how important it was to use linguistic and nonlinguistic representations that appealed to various types of learners. Marzano (2004) agreed with the importance of linguistic and nonlinguistic representations when learning new vocabulary, “For information to be anchored in permanent memory, it must have linguistic (language based) and nonlinguistic (imagery based) representations” (pp. 71-72). She also cautioned against the sole use of the Frayer model as students become tired of any instructional method when it was over used. It was important to keep instructional methods fresh and varied.

While the ILT does not encourage the isolated use of the Frayer model, she does support the using the Frayer model with some units to teach vocabulary. The graphic

organizer design of the Frayer model makes it considered a “best practice” within the school to use when teaching vocabulary. In her own classroom observations, the ILT has noted several teachers within the school using the Frayer model at various times. She also feels that many teachers within the school would be willing to adopt the practice of the Frayer model, but there are some teachers who may need more encouraging.

The interview exhibited construct validity as it measured the ILT’s feelings and disposition regarding the use of the Frayer model. The interview was significant in that it revealed the ILT’s feelings regarding the Frayer model and her willingness to support to widespread use of the model.

Through the interview it was discovered that the ILT administrator supported the use of the Frayer model in classrooms throughout the school. As the Frayer model was a type of graphic organizer, it was considered a “best practice” within the school and all teachers were encouraged to use “best practices” within their classrooms. The ILT administrator preferred to serve as the Rational Man in the dissemination of information to other teachers and allowed the teachers to decide to try the new change initiative (Sieber, 1972). Because the administration so highly encouraged and even mandated the use of “best practices” within the classrooms, sometimes the ILT administrator served as a Powerless Functionary in requiring top-down approaches to the implementation of change (Sieber, 1972). Change initiatives were monitored and the Frayer model was monitored by student achievement inside the classroom as well as on standardized tests (Hanson & Ortiz, 1975).

Discussion

While the study showed significant increases in student achievement that involved the cells unit, the introduction of the Frayer model was not necessarily the only contributing factor for the increase in student achievement. The students covered the same material in elementary school, but not in as much detail as was covered during this study. Student achievement was assessed through a pre- and post-test given before the start of the unit and at the completion of the unit. Through the course of instruction from the beginning to end of this unit student achievement should have increased regardless of the instructional method used. However, it was asserted that the Frayer model contributed to this increase in achievement.

The students indicated their preference for the Frayer model on the survey administered. For question 12 the chi-square statistic showed that $\chi^2_{(3)} = 39.55$, $p < .001$. The chi-square statistic for question 14 showed that $\chi^2_{(3)} = 38.82$, $p < .001$. The chi-square statistic for question 15 showed that $\chi^2_{(3)} = 11.09$, $p < .001$. This was attributed to the various aspects of the Frayer model. Many students enjoyed the nonlinguistic facet or illustration of the Frayer model. It was commented that the students preferred the Frayer model over more traditional methods of teaching vocabulary such as simply defining the terms. Also, the students enjoyed making their cell book as it was a student generated product.

The administration was supportive of the use of the Frayer model to teach direct vocabulary. The current administration was open to change and encouraged faculty to try

new techniques as long as the techniques were research based. It was cautioned that instructional methods needed varied, including the new ones that were implemented.

This study added to the body of knowledge that concerned the teaching of direct vocabulary and the use of the Frayer model. Many teachers feared teaching direct vocabulary due to the time commitment it required. The study illustrated the effectiveness of teaching direct vocabulary especially in vocabulary rich units. While teaching direct vocabulary required a greater time commitment up front, it may reduce the amount of time spent re-teaching the material because of student misconceptions. The survey results supported the use of the Frayer model as the students indicated their preference for the Frayer model and that they felt as if the Frayer model helped them to understand the vocabulary better.

The study revealed that teaching direct vocabulary was worth the time that it required, which was one of the major reasons teachers were hesitant to teach vocabulary. The Frayer model was shown to increase student achievement with all academic levels of students because it was a type of graphic organizer as well as it employed the linguistic and nonlinguistic aspects of vocabulary terms. The students were found to prefer the Frayer model when learning new vocabulary. Administrators found the Frayer model appealing because it was a type of graphic organizer, a highly encouraged practice in classrooms.

Structural corroboration was achieved through the use of multiple sources that included both quantitative and qualitative data. The pre- and post- test results supported the use of the Frayer model as scores increased as well as student attitudes towards the

Frayer model were in favor of using the Frayer model. From an administrative point of view the Frayer model was a good choice to teach vocabulary due to how the model organized information.

To address the fairness of the study opposing points of view were presented in the review of the literature. The three arguments cited as to not teach direct vocabulary using the Frayer model were the time it required, students needed practice using the Frayer model before becoming proficient with it, and some teachers simply did not feel the need to teach direct vocabulary (Graves, 1985; Marzano, 2004). The evidence was strong enough to support the teaching of direct vocabulary in spite of the time commitment. From the mean test scores that doubled for both the general and special education students from the unit's pre- test to post- test, the results of this study supported the teaching of direct vocabulary using the Frayer model to raise student achievement. Special education students, who often struggle with reading, needed the extra support that the Frayer model provided. The evidence was strong enough to determine that the Frayer model was a worthwhile instructional method.

Implications

The quantitative findings of this study can be generalized to a larger population because student achievement increased for all students represented in this study. While the study focused on special education students; gifted, general, and special education students were represented. Due to the diversity of students represented, the findings could be generalized to larger populations.

The major themes uncovered during the interview were the importance of using graphic organizers, using linguistic and nonlinguistic representations of terms, and varying instructional methods. Graphic organizers helped students organize information for retention and the Frayer model is a graphic organizer. Graphic organizers assisted in the organization of information for retention and the Frayer model was a type of graphic organizer. The Frayer model employed the linguistic and nonlinguistic representations of terms. The incorporation of the verbal and pictorial versions of a term appealed to a greater variety of learner. Lastly, all instructional methods should be varied as to not become too commonplace for the students.

Referential adequacy referred to how well a study could be replicated. All teachers, content and special education teachers alike, found the study of importance as direct vocabulary instruction was shown to benefit all students. Achievement increased for all populations of students present in the classroom. The study could be easily replicated because the Frayer model and study procedures can be used across content disciplines and with any unit.

Catalytic validity is the degree to which a study changed or transformed those involved with the study. This study transformed the students by showing them a new, more inviting method to learning vocabulary. Students also realized how learning vocabulary can increase their achievement. Other teachers were interested in how I was teaching vocabulary and have considered using the Frayer model in the future. Personally, the study transformed me as I learned that teaching direct vocabulary is well worth the time it required. I have seen the benefit of teaching direct vocabulary and have planned to continue this practice in the future. I have seen that the Frayer model is an

effective method to teach vocabulary, but do not think that it should be used exclusively. Agreeing with the ILT administrator, I also believe that the instructional methods must be varied to avoid becoming commonplace.

Impact on School Improvement

Through the course of conducting this study it was hoped that other teachers would have seen the merit in teaching direct vocabulary through the use of the Frayer model and adopt its practice in their classrooms. While I taught the unit other teachers were interested in the methods I used to teach the cells unit and particularly the vocabulary in the unit. Some of these teachers were considering using the Frayer model in the future. The ILT administrator also commented that during the regularly scheduled professional learning times she had encouraged the use of the Frayer model when discussing graphic organizers.

Recommendations for Future Research

The study could have been improved through spending more time at the beginning of the year training the students as to how to the Frayer model should have been properly completed. Instead, a great deal of time was taken at the beginning of the unit to teach the Frayer model instead of the content. The beginning of the year would be an excellent time for students to be trained in all procedures and forms of graphic organizers that are used throughout the course of the year. This would have allowed more time to be spent on the instruction of the content rather than the use of the Frayer model. In order to corroborate the findings from this study the Frayer model should be used with other units. The Frayer model could be implemented by other teachers and the

effects of the model in their classrooms examined. This could be easily achieved because the Frayer model could be extended across content area disciplines.

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Appendix A

Cells Test

Identify the choice that best completes the statement or answers the question.

1. During DNA replication, adenine (A) always pairs with
    a. Guanine (G).
    b. Cytosine (C).
    c. Thymine (T).
    d. Adenine (A).

2. Specialized cells are found only in
    a. animals.
    b. single-celled organisms.
    c. bacteria.
    d. many-celled organisms.

3. Each rung of the DNA ladder is made of
    a. a single nitrogen base.
    b. a pair of nitrogen bases.
    c. three nitrogen bases.
    d. four nitrogen bases.

4. The sides of a DNA molecule are made of
    a. sugar and phosphates.
    b. sugar and lipids.
    c. protein and phosphates.
    d. protein and carbohydrates.

5. What is the basic unit of structure and function in living things?
    a. Organ
    b. Tissue
    c. System
    d. Cell

6. Which of the following statements in NOT part of the cell theory?
    a. Cells are the basic unit of structure and function as living things.
    b. All cells are produced from other cells.
    c. Only animals are composed of cells.
    d. All living things are composed of cells.

7. The invention of the microscope made it possible for people to discover
    a. plants.
    b. skin.
    c. animals.
    d. cells.

8. What organelle captures the energy of sunlight and uses it to make food for the cell?
    a. Cell wall
    b. Cytoplasm
    c. Chloroplast
    d. Cell membrane

9. Which of the following statements is part of the cell theory?
    a. Only plants are composed of cells.
    b. All cells are produced from other cells.
    c. Cells can be produced from nonliving matter.
    d. Cells are one of several basic units of structure and function in living things.

10. Which organelles store food and other materials needed by the cell?
    a. mitochondria
    b. chloroplasts
    c. ribosomes
    d. vacuoles

11. The tiny cell structures located inside of a cell are called _____.
    a. Cell membrane
    b. Cytoplasm
    c. Organelle
    d. Nucleolus

12. What is the function of the cell wall?
    a. to protect and support the cell
    b. to perform different functions in each cell
    c. to prevent water from passing through it
    d. to prevent oxygen from entering the cell

13. What is the genetic material that parents pass along to their offspring?
    a. Golgi body
    b. allele
    c. cytoplasm
    d. DNA

14. A DNA molecule is shaped like a
    a. long, thin rod.
    b. spiral staircase.
    c. straight ladder.
    d. triple helix.

15. What happens during respiration?
    a. Oxygen is released into the air.
    b. Glucose is broke down, releasing energy.
    c. Carbohydrates are released into the bloodstream.
    d. Water and carbon dioxide are converted into energy.

16. During DNA replication, which nitrogen base pairs with cytosine (C)?
    a. Guanine (G)
    b. Cytosine (C)
    c. Adenine (A)
    d. Thymine (T)

17. The stage of respiration that releases most of the energy in glucose occurs in the
    a. nucleus.
    b. chloroplast.
    c. cytoplasm.
    d. mitochondria.

18. Where in the cell is DNA located?
    a. nucleus
    b. lysosome
    c. ribosome
    d. vacuole

19. Which term refers to the movement of molecules from an area of higher concentration to an area of lower concentration?
    a. collision
    b. diffusion
    c. active transport
    d. concentration

20. Cells in many-celled organisms
    a. all look the same.
    b. all have the same structure.
    c. are often quite different from each other.
    d. are the same size in every part of the organism.

21. What is the function of a cell membrane?
    a. to support the cell
    b. to perform different functions in each cell
    c. to control what enters and leaves the cell
    d. to form a hard outer covering for the cell

22. Homeostasis refer to an organism's ability to
    a. maintain stable internal conditions.
    b. compete for living space.
    c. dissolve chemicals.
    d. obtain energy.

23. Which organelle serves as a relay station sending materials from the endoplasmic reticulum to other parts of the cell?
    a. Vacuole
    b. Golgi body
    c. Lysosome
    d. Mitochondria

24. This cell structure carries proteins from one part of the cell to another.
    a. Mitochondria
    b. Nucleus
    c. Lysosomes
    d. Endoplasmic Reticulum

25. Which organelles release chemicals that break down large food particles into smaller ones?
    a. endoplasmic reticulum
    b. Golgi body
    c. lysosomes
    d. vacuoles

26. Why is water important for a cell?
    a. Water is the main ingredient in DNA.
    b. All proteins are made of water.
    c. Most chemical reactions in cells require water.
    d. Water is an essential organic compound for the body.

27. Ribosomes produce _____.
    a. lipids
    b. proteins
    c. carbohydrates
    d. sugar

28. Which organelle is the control center of a cell?
    a. mitochondrion
    b. ribosome
    c. nucleus
    d. chloroplast

29. Which of the following do all living things need to survive?
    a. water
    b. oxygen
    c. sunlight
    d. carbon dioxide

30. A clear, gel-like fluid located between the cell membrane and the nucleus that contains most organelles is
    a. lysosome.
    b. vacuole.
    c. cytoplasm.
    d. cell wall.

Appendix B

Student Survey

Please circle the choice that best describes your feelings about the question or statement.

1. I am a good reader in all of my classes.

   Strongly Disagree Disagree Agree Strongly Agree

2. I like when we read in Science class.

   Strongly Disagree Disagree Agree Strongly Agree

3. Reading in science class is not important.

   Strongly Disagree Disagree Agree Strongly Agree

4. The textbook we read in Science class is easy to understand.

   Strongly Disagree Disagree Agree Strongly Agree

5. Sometimes we have to read in science and I don't understand the words.

   Strongly Disagree Disagree Agree Strongly Agree

6. The vocabulary words we use in science class are easy to remember.

   Strongly Disagree Disagree Agree Strongly Agree

7. Reading guides help me to understand what I read.

   Strongly Disagree Disagree Agree Strongly Agree

8. Learning new words before I read is helpful.

Strongly Disagree Disagree Agree Strongly Agree

9. My science book is too hard to read.

Strongly Disagree Disagree Agree Strongly Agree

10. It is helpful when my teacher takes the time to teach vocabulary words.

Strongly Disagree Disagree Agree Strongly Agree

11. Graphic organizers help me to learn information.

Strongly Disagree Disagree Agree Strongly Agree

12. The Frayer model helped me understand the vocabulary terms in this unit.

Strongly Disagree Disagree Agree Strongly Agree

13. The vocabulary words in the cells unit are easy to understand.

Strongly Disagree Disagree Agree Strongly Agree

14. The Frayer model is a good method to use to learn vocabulary.

Strongly Disagree Disagree Agree Strongly Agree

15. I like to use the Frayer model when learning new vocabulary.

Strongly Disagree Disagree Agree Strongly Agree

Appendix C

Interview Questions

1. Why do you feel that students struggle to read science textbooks?
2. Why do you feel that students tend to struggle more with the cells unit than any other unit?
3. Do you feel that the time required to teach direct vocabulary is worth the benefit?
4. Which vocabulary instruction method do you prefer?
5. How do you feel about the Frayer model?
6. Do you feel that the Frayer model has the potential to raise student achievement?
7. Do you feel that other teachers would be willing to incorporate the Frayer model into their teaching practices? Why?
8. Why do you think that teachers would be reluctant to use the Frayer model?
9. From an administrative standpoint do you feel that teaching direct vocabulary using the Frayer model is a good practice?