The D2 Cuing Method:
The Use of A Systematic Cuing Method in The Elementary Classroom

Dawn M. Callahan Dennis, M.S. CCC-SLP
B.S., Boston University, 1990
M.S., Boston University, 1991

Submitted to the Graduate Department and Faculty
of the School of Education of Baker University
in partial fulfillment of the requirements for the degree

Doctor of Education
in
Educational Leadership

April 12, 2012

Dissertation Committee

Major Advisor

Abstract

The D2 Cuing Method is a hierarchical cuing method designed to scaffold students to a correct answer during teacher-student question-answer interactions. Rooted in the treatment protocols traditionally used by speech and language pathologists in clinical settings, the D2 Cuing Method was developed using instructional strategies based on: scaffolding, cuing, feedback, praise, and wait time; theories of learning through interaction; hierarchical cuing; and neuroscience theories of learning and memory/recall. The D2 Cuing Method is the result of this researcher's twenty-one year career as a medical and school-based speech-language pathologist. Development of the D2 Cuing Method was intended to provide teachers with a systematic approach to supporting students in the teachable moment during large group, Tier I RTI instruction.

This researcher investigated the impact of the D2 Cuing Method on student achievement during large group instruction in fourth and fifth grade classrooms in the core curriculum subjects of reading, mathematics, science, and social studies. Sub-groups of interest included students who qualified for special education services, gifted and talented programming, and free and reduced lunch. The quantitative research suggested potential for positively impacting student achievement in reading, mathematics, science, and social studies. The qualitative research suggested a positive impact on student learning and teacher ability to successfully use scaffolding and cuing methods in the classroom during instruction.

The pilot study was intended to add to the body of literature supporting researched based instructional strategies for large group instruction. Future research suggestions included repetition of the study, specific investigation of sub-groups of

students, use of multiple methods to assess student achievement, assessment of changes in classroom culture, and increasing the duration of the study. This researcher intends to test, refine, and better understand the D2 Cuing Method so that it will evolve into a viable and effective method of instructional support for students in the classroom.

Dedication

This dissertation is dedicated to every child and adult with whom I had the privilege of working during my twenty-one years as a speech-language pathologist. You have taught me lessons more valuable than any book or research article could ever teach. I am a better therapist, educator, researcher, and person because of each of you. For that I am eternally grateful.

Never sadden the hearts of the young.

Jerome F. Callahan, Jr.

Acknowledgements

To think for even a moment that this dissertation was accomplished through the efforts of only one person would be remiss. I feel compelled to list under my name the names of several others who committed countless hours to the development, implementation, and editing required to complete this final product.

To my sons, Cole and Noah, who endured many evenings and weekends of an absent mom: I must say thank you. I am so grateful for your understanding, support, and quick hugs to remind me it was “all good.” Know that watching you grow and discover, struggle and achieve, laugh and cry, has fueled my passion to be a better educator, better researcher, and ultimately a better mother.

To my brothers, David, Daniel, and Damien: The DMC’s! Thank you for the phone calls, texts, and emails that offered reassurance, encouragement, and a good laugh when needed always helping me move forward and stay the course. You have forever been my guaranteed support system. I am the luckiest sister ever, and truly blessed.

To my mother Pauline: you endured numerous phone calls of panic and self-doubt. You always had the time to listen, calm in your voice, and just the right words to carry me through. For forty-two years you have been my teacher, my guide, and my friend. I am a strong woman because of you. We come from a long line of “tough old birds.” It is on their shoulders I stand. Thank you for passing on to me that courage and strength.

To the teachers, students, and administration at School District X: this study could not have been completed without your interest, support, and dedication to the process.

Thank you for being an integral part of my efforts and believing this work was not only important but valuable.

To Cohorts 6 and 7: you made those late Wednesday nights, Saturday group project meetings, and the portfolio and dissertation process bearable. Each of you shared unique perspectives, thoughts, and experiences that made my learning more rich and meaningful. Your excellence pushed me harder and farther. To those I relied on most: Becky, Jennifer, Denise, Jenni, Jasmine, Corey, Sandy, Rebecca, Kelly, and David. I respect you all tremendously and value the friendships made.

To my dissertation committee: Peg Waterman, Dr. Karen Exon, and Dr. Laura Nelson. Each of you contributed to my learning; pushing me hard, seeking only what was best, and encouraging me along the way. Peg: you made statistics fun. That is quite a talent. I appreciated all of the phone calls, Saturday meetings, and ability to make me appear mathematically smart! Thank you. Dr. Exon: you added an element of expertise and perspective that fine-tuned my writing, pushing me to the next level. Your time and energy was much appreciated. Dr. Nelson: you guided me through the IRB process and offered such clear guidance in the research design, steering me on a course to success. Thank you for the open door to "throw out an idea," supporting my efforts, and always believing I was smart enough to do this well.

Finally, there are two men who supported me from day one, whose knowledge, high expectations, experience, and willingness to call it like it is gave me the greatest support: Jerry Callahan and Dr. Dennis King.

To my father, Jerry: there are no words. For forty-two years you have always been my guiding-beam: my first Major Advisor. It has been a tremendous privilege to work so closely with you in this endeavor. As a district leader and educator, I have admired your skill, your knowledge, and your ability to meld the art and science of education so fluidly for years. To grow in that admiration as a peer, and not just as your daughter, has been enriching. Helping me stay the course, talking me through my jumble of ideas, and reading every word of this dissertation at least three times was such a gift. You were as invested in this project as I was, always at my back and on my side. Knowing you respect and take pride in my efforts is the greatest reward of this journey. When I look at my diploma, I will always see your name next to mine. Not bad for a tuna fish!

And to Dr. Dennis King, my Major Advisor: it has been a great honor and pleasure. From the very beginning, you took a serious interest in my work, my ideas, and respected my unique, non-traditional background. You taught me how to think as an administrator and researcher, how to reach levels of excellence higher than I thought possible, and always reminded me to breathe while finding my time. You let me own this, all the while supporting my efforts. Your advice was sound, your reassurance came when I most needed it, and your commitment to this endeavor was as great as mine. This accomplishment could not have been achieved without such collaboration. I respect you highly. For all of this, I am most grateful.

Table of Contents

List of Tables

List of Figures

Chapter One

Introduction

Speech and language pathologists have developed and integrated into their patients' treatment plans, effective therapeutic methods that are relevant to the fields of medicine and clinical practice as well as public education (German, 2009; Wiig & Semel, 1984). A review of literature reveals that the most successful and frequently used methods include cuing, scaffolding, and feedback as they relate to language development, language rehabilitation, memory, and word recall/retrieval skills (German, 2009; Linebaugh & Lehner, 1977; Love & Webb, 1977; Nickels, 2002, 2010; Wisenburn & Mahoney, 2009; Wiig & Semel, 1984).

These methods have been utilized to aid in the language rehabilitation of individuals who suffered stroke or head injury as well as to encourage the development of young children and adolescents who have been diagnosed with a language disorder. The literature detailing word-finding deficits (difficulty storing and recalling specific vocabulary words) and anomia (reduced ability to name items and use specific vocabulary following brain injury from a stroke or head trauma) has provided an abundance of language development and learning theories, as well as therapeutic protocols which assist children and adults to acquire skills that enhance the storage and recall of words (Bjork & Bjork, 1992; German, 2002, 2009, Linebaugh & Lehner, 1977; Love & Webb, 1977; McGregor, 1994; Nickels, 2002, 2010; Wiig & Semel, 1984; Wisenburn & Mahoney, 2009). Relevant to the field education, these theories and protocols provide information about how an individual's memory stores and recalls information. Understanding how information, storage, and recall function helps educators gain insight into how students access, synthesize, and use newly learned information (Jensen, 2005; Willis, 2006).

Linking language development theories and therapeutic protocols to the field of education requires an investigation of current teaching strategies utilized in the classroom and identifying treatment methods that can be shared between the clinical and classroom settings. The research conducted for this study suggested that cuing, scaffolding, and feedback which occur in the medical and clinical realm could be effectively applied to teaching and learning in a classroom setting. Recent meta-analyses suggest that the quality of instruction is the primary determinant of successful student learning in the classroom (Hattie, 2009; Marzano, 2003).

The term *effective quality teaching* encompasses a wide range of attributes and might be prone to generalization. However, an accepted characterization and the definition that will apply to this study is supplied by Hattie (2009). He explained:

> The act of teaching requires deliberate interventions to ensure that there is cognitive change in the student. Thus, the key ingredients are awareness of learning intentions, knowing when a student is successful in attaining those intentions, having sufficient understanding of the student's understanding as he or she comes to task, and knowing enough about the content to provide meaningful and challenging experiences in some sort of progressive development. It involves an experienced teacher who knows a range of learning strategies to provide the student when they seem not to understand, to provide direction and re-direction in terms of the content being understood and thus maximize the power

> of feedback, and having the skill to 'get out of the way' when learning is progressing towards the success criteria. (p. 23)

If the teacher is the most fundamental ingredient in student learning and achievement, and the ability of the teacher to utilize effective teaching strategies determines student success, then creating effective, new, and varied teaching strategies should result in improved student achievement in the classroom. The support provided by teachers should be timely and occur in a fashion that creates a classroom culture of safety and success. When a safe and successful culture exists in the classroom, students trust enough to take educational risks, challenge their thinking, and maximize the feedback provided to broaden their learning (Hattie, 2012). In essence, learning becomes an interactive partnership between teacher and student where safety and success breeds success.

Hattie's (2009) definition of effective teaching touches on three main elements. The elements of scaffolding, feedback, and cuing strategies are designed to enhance student learning in the classroom. The process of scaffolding aligns to Hattie's definition of using a variety of teaching strategies and "getting out of the way" once a child is supported to a new level of understanding. Feedback is defined as providing direction. Cuing strategies align to the student's acknowledgement and acceptance of re-direction. In order to significantly improve the quality of teaching and student achievement innovative, research-based teaching strategies, based on sound research should be applied to the academic environment (Hattie, 2012).

As the field of neuroscience develops and more is understood about the brain and the neuro-processes used in the act of learning, educators will benefit from these findings and become more effective in their ability to teach all children (Jensen, 2005, 2008; Sousa, 2010; Willis, 2006, 2007, 2008; Wolfe, 2010). Jensen (2005) urged educators to conduct more action-based research in the classroom that promotes evidence-based teaching and learning strategies. In response to Jensen's challenge this researcher developed the D2 Cuing Method which draws upon her twenty-one years of experience as a speech-language pathologist in the educational and medical settings. The D2 Cuing Method was created to bridge the field of medicine with the field of education by application of medically-based language-learning strategies in the elementary classroom.

The D2 Cuing Method, named for creator Dawn Dennis, is an instructional strategy based upon:

- the educational strategies of scaffolding, cuing, feedback, and wait time;
- the educational theory of learning through interaction;
- the language learning strategies of hierarchical cuing; and
- neuroscience theories of learning and memory/recall.

Because the D2 Cuing Method is systematic and differentiated, this method of learning can be applied to all students. The D2 Cuing Method qualifies as a high quality, evidenced-based classroom instructional tool (also known as a Tier I intervention, and will be explained later in this chapter) and fits with the Response to Intervention (RTI) model of instruction commonly utilized in general education. The D2 Cuing Method is based upon the systematically applied and hierarchically ordered cuing methods traditionally used by speech and language pathologists to treat stroke and head injured patients suffering from language deficits (see chapter three, Figure 2 for a detailed description of the implementation methods and hierarchy of cues).

This study was conducted to determine if the use of the specific instructional strategy, the D2 Cuing Method, would have a positive effect on test scores for students in the fourth and fifth grade regular education classrooms for the following core curriculum subjects: reading, mathematics, social studies, and science. Curriculum content aligned to the Missouri Show Me Standards and Missouri Grade Level Expectations (DESE, 2011). This study sought to determine if sub-groups of students (those qualifying for special education services, gifted and talented programming, and free and reduced lunch) benefited differently from general education students. Teacher perception of the effectiveness of the D2 Cuing Method for student achievement was examined and investigated. Overall, this study formally evaluated the D2 Cuing Method and its contribution to the body of literature that targets research-based instructional strategies.

This chapter provides the conceptual framework and background for the study, the statement of the problem, the significance and purpose of the research, the delimitations, assumptions, and research questions. Included is the overview of methodology and organization of the study.

Conceptual Framework and Background

Based upon the premise that a student should not be “passed over” when he/she does not correctly answer a question, the D2 Cuing Method was developed by utilizing research and protocols from the fields of education, speech-language pathology, and neuroscience. What follows, in brief, is the conceptual framework and components of the

D2 Cuing Method. The overall structure of the D2 Cuing Method as it relates to scaffolding is followed by discussion of the application of a five-tiered hierarchy of cues, feedback, use of wait time, repetition of the question to practice correct response, and verbal praise. Background research and literature will underscore and justify the components of the D2 Cuing Method. The relevance of Response to Intervention (RTI) and Tier I classroom setting to the D2 Cuing Method will be discussed. Finally, the shift from student responsibility for success to teacher responsibility for student success makes the D2 Cuing Method a valuable education tool for all students and teachers.

Teachers need innovative instructional strategies that are simple to learn, easy to implement, and may be applied in a variety of teaching situations so that teachers are better equipped to meet student needs and challenges. Incorporated in the D2 Cuing Method are evidence-based practices that are concise, easy to use, and help student learning for retrieval and storage of new information. The D2 Cuing Method aids the teacher to guide student learning through a real-time approach while utilizing a hierarchically established series of cues in order to elicit a correct answer. When performed effectively, the D2 Cuing Method sustains and enables the teachable moment allowing the student to experience success rather than failure. Only if the student does not possess direct imitation skills, (the ability to immediately imitate the answer provided by the teacher) that he/she may not be successful with this method, as direct imitation is the level of the D2 Cuing Method that provides the greatest amount of support. The D2 Cuing Method may be used in large group instructional settings and can differentiate instruction, enabling learning for all students.

The first aspect of the D2 Cuing Method is overall structure as it relates to scaffolding. Van de Pol, Volman, and Beishuizen (2010) define scaffolding as a teacher-student interaction in which the teacher applies strategies for learning that are contingent upon student responses, systematically reduce support over time (fading), and consequently, transfer the responsibility from teacher to student to complete a particular task. By meeting students at their level of knowledge and learning skills, teachers as well as speech-language pathologists, assist students in moving to the next level of understanding (Frey & Fisher, 2010; Fisher & Frey, 2010b; Linebaugh & Lehner, 1977; Love & Webb, 1977; McGregor, 1994; Nickels, 2002, 2010; van de Pol, Volman and Beishuizen, 2010).

In the case of the D2 Cuing Method, scaffolding is provided by use of a five-tiered (leveled) hierarchy of cues that a teacher may move through to help elicit a correct answer when the student incorrectly answers or does not respond. The five-tiers of cues include imitation, choice of 2 or 3 answers, phonemic cue, sentence completion, and semantic cue. Chapter three describes each of these tiers and the implementation of the D2 Cuing Method. Contingent upon a student's response, cuing is intended to systematically reduce support over time, and transfer the responsibility from teacher to student to complete a task.

Feedback is another component of the D2 Cuing Method. Brookhart (2008) defined feedback as "just in time, just-for-me information delivered when and where it can do the most good" (p. 1). The D2 Cuing Method is an individualized, in-the-moment approach that guides a student to success. The D2 Cuing Method delivers support that the student can use immediately, thereby empowering the student to succeed. Brookhart explained that effective feedback allows the student to correct him/herself, make meaning of the information, and use that information to take next steps toward improvement. Feedback should not be critical in nature, but address both the cognitive and motivational elements of learning. Hattie and Timperley (2007) suggest that effective feedback provides information for learning and also empowers the student to be in control of that learning as an active participant in the process.

The use of wait time was incorporated into the D2 Cuing Method. Wait time is an instructional strategy that has been reported to make a positive impact on student learning as discussed by Marzano, Pickering, & Pollock (2001) and Marzano (2007). Rowe (1974) generally described wait time as allowing students several seconds to formulate an answer to a question before being called on to answer. The element of pause helps students process information more thoroughly, gives students who were not as quick as their peers an opportunity to formulate an answer, improves attention to task, and increases student participation (Atwood & Wilen, 1991; Rowe, 1987; Tobin, 1987). All are positive aspects of student learning and create a supportive classroom environment conducive for learning. Wait time is central to the D2 Cuing Method.

The D2 Cuing Method relies upon repetition of the question as a strategy once a correct response is elicited through use of the cuing hierarchy. Repetition allows for practice of information retrieval that was elicited through the cuing technique. The intention is to create cognitive pathways enabling the storage and retrieval of learned information (Willis, 2006). Marzano (2007) endorsed the use of repeated exposure to, and practice of, new knowledge as a positive instructional strategy. Rosenshine (2002) noted that teachers are effective when guiding student practice in a way that students may, “engage in the cognitive processing activities of organizing, reviewing, rehearsing, summarizing, comparing, and contrasting” (p. 7). Practice, then, does not become an exercise in rote memorization, but the execution of higher functioning cognitive skills that help in the storage and retrieval of new information. Brain research supports this notion, as repetition after elicitation of a correct response enhances neural connections (Willis, 2006).

Finally, there is the element of verbal praise. At any time in the process of questioning a student, if a correct answer is elicited verbal praise consisting of positive feedback is provided to the student when using the D2 Cuing Method. Researchers have reported inconsistent findings regarding the effectiveness and impact that verbal praise has on student achievement (Marzano, 2007). The magnitude of the effect ranges from minimal positive influence (Wilkinson, 1981) to considerable positive gain (Bloom, 1976). Despite the variability in research outcomes, it is generally agreed that verbal praise (positive comments and acknowledgment of learning) provides a positive influence on learning. More importantly, verbal praise may help to create a positive classroom culture that fosters a sense of safety and encouragement (Marzano, 2007). This positive environment contributes to the increased learning and memory skills of students, as Willis (2006) underscored.

Large group instruction, also known as Tier I instruction, is the most common method used to teach students. Research suggests that strategies and teacher-led instruction make an impact on student achievement (Hattie, 2012, 2009; Marzano, 2003; Marzano, Pickering, & Pollock, 2001). Wright, Horn, and Sanders (1997) went so far as to say that the teacher him/herself is “the most important factor affecting student learning" (p. 63). More recently, however, researchers have suggested that it is not so much the teacher, but more specifically *how* a teacher systematically responds to his/her students that has the greatest impact on learning (Hattie, 2012, 2009; Marzano, 2003).

Fisher and Frey (2010b) discussed the topic of scaffolding and feedback in detail in *Guided Instruction: How to Develop Confident and Successful Learners*. Guided instruction was defined as a "…means to steer or direct a course. It is showing the way for the learner, but not doing it. In popular educational terminology, it is scaffolding. In essence, guided instruction is saying or doing the just-right thing to get the learner to do cognitive work" (p. vii).

Fisher and Frey (2010b) based their guided instruction model from the work of Pearson and Gallagher (1983). Pearson and Gallagher were the first to introduce the Gradual Release of Responsibility model of instruction. Pearson and Gallagher encouraged a teacher and student to move from a point of maximum support (teacher provides model), to a moderate amount of support (joint responsibility between teacher and student), to the least amount of support (independent performance and application of knowledge by the learner). Pearson and Gallagher's development of the Gradual Release of Responsibility model stemmed from the work of Piaget (1952); Vygotsky (1962, 1978); Bandura (1965, 1977) and Wood, Bruner, & Ross (1976). These researchers presented the idea of scaffolded learning suggesting that when interactions with others are intentional and purposeful, learning occurs.

From this framework of guided instruction and scaffolding came the idea of feedback. Hattie's (2009) definition of effective teaching, suggested that teachers need to know how to maximize the power of feedback, making it useful and purposeful for the student. Feedback becomes the conduit for pushing a student to the next level of understanding and mastery of skills. It is this partnership between student and teacher, sharing the goal of student success, which results in measurable achievement gains for all students (Black & Wiliam, 1998; DuFour, DuFour, Eaker, & Many, 2006; Hattie & Timperley, 2007; Reeves, 2009). A teacher must use assessment data to drive instruction and meet the child at his/her level of development. Feedback that students provide in assessment includes: *here is what I know and don't know.* Feedback that teachers provide from assessment include: *here is what you know and don't know and this is what you need to do to learn.* Feedback must be timely and specific. Where upon feedback becomes an effective scaffolding tool that provides a catalyst for learning in a positive and supportive manner. It is this approach to assessment that seeks to enhance, not just monitor, student learning (Stiggins, 2009).

Teachers should redirect the purpose of student assessment from earning a grade on a report card to giving students useful descriptive feedback. Stiggins (2009) refered to description feedback as "assessment *for* learning." Students, in turn, become part of the learning process and gain confidence that they can improve with carefully guided instruction. To better understand what it is that teachers are doing in the classroom, Frey and Fisher (2010) studied how teachers provide instructional support and feedback during guided learning. They identified the use of questions, prompts (statements that redirect a child's attention to a piece of information), visual cues (such as photographs, charts, graphs), verbal cues (emphasizing a word while speaking), gestural cues (pointing or a head nod), physical cues (touch a student's shoulder), and environmental cues (words on a wall). Teachers used these elements in a purposeful manner and could scaffold the prompts to appropriately support the student. Frey and Fisher (2010) explained:

> The teachers in this study were fairly systematic, yet not scripted, in their approach to small-group guided instruction. They consistently led with questions to check for understanding and then prompted and cued students when errors and misconceptions arose. When the prompts and cues failed to resolve an error, teachers moved to direct explanations and modeling. Whereas prompts and cues were observed regularly during guided instruction, direct explanations were not observed as often. In only about 20% of the exchanges did teachers resort to direct explanations and modeling to ensure student understanding. It is important to recognize that errors that are left uncorrected are unlikely to result in learning. Error identification must be carefully timed within the instructional cycle, because errors that are triggered too early may do more harm than good, as the teacher cannot lead a student through the thinking required to understand. (p. 93)

Frey and Fisher's observations suggested that because teachers followed through with students only 20% of the time to attain a correct answer during question-answer interactions, then 80% of the time errors were left uncorrected. It follows that learning was limited learning, at best. So providing teachers with a systematic method to guide (or scaffold) students to a correct response would improve the frequency of opportunities for student learning and improve the effectiveness of question-answer interactions. Clearly imperative is that teachers be provided with an accessible method for scaffolding students through cuing strategies which provides effective feedback to elicit correct answers to teacher's questions.

Educational researchers have determined that *how* a teacher provides instruction has a measurable effect on a student's ability and willingness to learn and achieve (Hattie, 2009; Marzano, 2003, 2007). Brain research is now being coupled with educational research to better understand the neurological and developmental needs of students to enhance learning. Neuroscience researchers have suggested that significantly raised levels of stress, anxiety, and the perception of failure impede learning, focus, and sense of self-worth (Brookhart, 2008; Jensen, 2005; Marzano, 2007; Sousa & Tomlinson, 2011; Willis, 2006). Willis (2006) and Jensen (2005) suggested that students who experience such negative emotions would require the support of a teacher who could effectively utilize teaching strategies to maximize their learning in order to garner success. Jensen (2005) reported that brain-based teaching and learning, when neuroscience research is applied to classroom interventions and the development of instructional strategies, could make a significant impact on student achievement. "Students of all backgrounds and ages, with every imaginable history of failure, can succeed and have succeeded with a brain-based approach to teaching and learning" (Jensen, 2005, p. ix).

Jensen's work is important too for its references to *all* students. In order for instructional strategies to be effective, the strategies should be applicable to large group instruction with every student. Response to Intervention (RTI) and the multi-tiered description of instructional settings often associated with RTI are integral to the context in which the D2 Cuing Method was researched and evaluated. A brief explanation follows to provide an understanding of the context in which this research project was designed, implemented, and evaluated.

In an effort to create a classroom environment that better supports available evidence-based strategies for what works in educating students, RTI has become a central focus for many educators in order to improve student outcomes. Whitten, Esteves, and Woodrow (2009) defined RTI as "…a multi-tiered instruction model designed to promote school success for all learners" (p. 1). More than ten years of research has provided compelling evidence that RTI is an effective means by which all students' learning could be monitored and supported (Batsche, Elliott, Graden, Grimes, Kovaleski, Prasse, Reschly, Schrag, & Tilly, 2005; Bender & Shores, 2007; Burns, Appleton, & Stehouwer, 2005; Fuchs & Fuchs, 2006; Hughes & Dexter, 2009). By using the RTI framework, teachers make informed decisions about the educational needs of students and monitor the effectiveness of support strategies (Fisher & Frey, 2010a).

RTI frequently includes the term "multi-tiered instruction model" because the framework of RTI includes the use of three tiers (levels) of instruction and intervention for students. The following definitions of Instructional Tiers are from Whitten, Esteves, and Woodrow (2009):

- Tier I: High-quality classroom instruction using research-based programs and instructional methods, universal screening a minimum of three times per year.
- Tier II: Focused supplemental instruction in small groups, research-based interventions targeted at specific strengths and needs, progress monitoring.

- Tier III: Intensive interventions specifically designed to meet individual needs, instruction delivered in small groups or individually, frequent progress monitoring. (p. 2)

Within the RTI model teachers are expected to use innovative strategies for teaching and learning which creates an empowering learning environment. Tier I strategies are necessary to provide effective classroom instruction and ultimately high levels of school performance for every student. DuFour and Marzano (2011) stated, “schools can only be as good as the people within them” (p. 20). They explained that quality instruction is one of the most important variables in student learning.

Responsibility for student success has now been shifted from being primarily that of the student to now being that of the teacher. Gone are the days of, *I taught it, but he just didn’t get it*. Teachers are now required to make informed decisions based on student achievement data and team collaboration to drive their instruction (DuFour, et al., 2006; Fisher & Frey, 2010a). In essence, teachers must become diagnosticians of student learning. This paradigm shift makes paramount the role of the teacher as a catalyst for student learning, achievement, and school performance. Educators feel a sense of urgency to create supportive learning environments and provide successful, innovative instructional strategies to meet the educational needs of every student (Hattie, 2009, 2012; Marzano, 2003).

Significance of the Study

Researched-based literature provides hierarchical guidelines for asking questions about learning (Bloom, 1956; Marzano, 2000; Rothstein & Santana, 2011) and information about how to respond to incorrect answers provided by students (Berkeley

New Faculty Newsletter # 7, 2006; Fisher & Frey, 2010b; Marzano, 2007). Missing, however, is evidence that speaks to the effectiveness of a hierarchical cuing method in large group classroom instruction. It is precisely when a student cannot answer a question that teaching and learning need to occur with the support of real-time interventions in the classroom (Brookhart, 2008, Marzano, 2007; Fisher & Frey, 2010b).

Marzano, et al. (2001) reported that 80% of classroom time is spent completing questioning and cuing activities creating a need for instructional strategies that have a positive effect during questioning and cuing. This was also reported by Davis & Tinsley (1967) and Fillippone (1998). These strategies would prove to be useful and valuable to enhance student learning. Use of instructional strategies for intervention within the classroom requires evidence of best practice. With the mandate of No Child Left Behind (NCLB), the Individuals with Disabilities Education Improvement Act of 2004 (IDEIA), and Section 504 of the Rehabilitation Act of 1973, teachers are held accountable for the educational success of all students. Teachers need readily available effective instructional strategies for large group instruction, in Tier I RTI models, when students have not or do not learn curriculum targets in a successful manner.

Van de Pol, et al. (2010) stated that eight out of sixty-six studies in their meta-analysis of scaffolding focused on the effectiveness of scaffolding use in the classroom. These authors generally concluded that scaffolding was effective, but failed to provide a systematic method to apply the strategy in the classroom. If in fact scaffolding techniques are effective, but there is little information regarding how to apply the techniques as discussed by Frey and Fisher (2010), it would be reasonable to develop such an instructional strategy to enhance Tier I instruction and be sufficiently differentiated to be effective for all students in general education classrooms. The diverse setting of general education classrooms include students receiving gifted education programming, special education instruction, and those who are considered at risk for low academic achievement because they come from low socio-economic homes and qualify for free and reduced lunch. If teachers were given a systematic technique that could be easily learned and applied, the needs of all students could be met in an effective and efficient manner. Providing an efficient and effective education for all could be less daunting.

Larkin (2002), Lipcomb, Swanson, and West (2004), and Pressley, Hogan, Wharton-McDonald, Mistretta, and Ettenberger (1996) delineated specific challenges that come with scaffolding. Demands on the teacher, time constraints, and insufficient suggestions and tips for teaching in the teacher edition of textbooks are problematic (Fisher & Frey, 2010). The D2 Cuing Method attempts to address each of these concerns. Instructional teaching strategies must be practical and cost effective in order to be viable. Because the D2 Cuing Method is a real-time strategy that is implemented when a student does not answer a question correctly, the demands on the teacher are limited. No preparation or planning is needed to use the strategy. The teacher can cycle through as many of the five levels as needed within a 15 – 20 second period of time to elicit a correct answer. This D2 Cuing Method is applicable to all subjects, it is not scripted, and it is potentially viable across a broad spectrum of curricula at all grade levels.

The D2 Cuing Method is a systematic and readily accessible instructional strategy that teachers can immediately apply in teachable moments with real time results. As such, the D2 Cuing Method can aid the teacher in accurately judging the level of support a student requires to elicit a correct answer, allowing for a predictable next step should a child require more or less support based upon his/her answer/response. Because the D2 Cuing Method is structured but not scripted and includes professional development materials that provide visual supports, teachers can learn the technique quickly and apply it immediately after instruction. Viable professional development that is cost effective and incorporates evidence-based practice aligned to a common core curriculum is a fundamental need in today's educational system (King, 2009). The D2 Cuing Method aligns to 21st Century learning principles including RTI, use of formative feedback and evidence-based instructional strategies, and assessment *for* student learning.

Finally, Jensen (2005) has stated that there is a need for action-research that incorporates brain-based learning and teaching strategies in the classroom. The D2 Cuing Method answers Jensen's challenge by creating an instructional strategy that incorporates principles of learning and instruction found in the educational research literature with neuroscience and speech-language pathology research specific to language learning, word recall, memory, and emotional states required for student achievement.

Purpose Statement

The purpose of this research is to investigate and determine if the use of the D2 Cuing Method in fourth and fifth grade classrooms had a statistically significant effect ($\alpha = 0.05$) on student achievement in the areas of reading, mathematics, social studies, and science. A related question for determination is if the effect of the D2 Cuing Method is greater between grade levels, subject areas, and subgroups of students.

Subgroups included those who received special education services, qualified for free and reduced lunch, or participated in gifted programming. Students who received special education services were defined as students who meet Missouri eligibility criteria to qualify as a student with a disability. To be included in this study, students who qualified for special education were required to be in the placement category of "in the regular education classroom at least 80% of the time." Students who qualified for free and reduced lunch were defined as those students who were eligible for free or reduced lunch based on the criterion set in Public Law 111-296, the Healthy and Hunger-Free Kids Act of 2010. Students in gifted programming were defined as students who met the following criteria as set by the participating school district: School District X: attained a score in 95th percentile on the Naglieri Nonverbal Ability Test – 2nd edition (NNAT2), attained a score in the 95th percentile on the Woodcock Johnson III Test of Achievement, and qualified for the testing via referral and/or by a data analysis of grade-level achievement scores.

Finally, the purpose of this study was to document teacher knowledge and opinion of the instructional strategies currently in use in the classroom across various curricula, specifically reading, mathematics, social studies, and science. Interview data was collected from those teachers who implemented the D2 Cuing Method in their classrooms to determine the perceived effectiveness of the D2 Cuing Method.

Delimitations

The delimitations for this study were few but they require elaboration. First, eight classrooms (4 fourth grade and 4 fifth grade) from two elementary schools were selected for this study. Second, the classrooms were intentionally chosen because they were general education classrooms. Third, data from this study was only collected for one semester. And finally, specific subject areas were selected for inclusion in this study.

Eight classrooms (4 fourth grade and 4 fifth grade) were selected for this study in order to maintain a more manageable and controlled learning environment. The classrooms came from two elementary buildings within the same school district. Fourth and fifth grade classrooms were selected because they were judged to appropriately represent elementary level grades, commonly described as kindergarten through sixth grade. However, some school districts place sixth grade in a middle school building. Other school districts group kindergarten, first, and second grade in a primary building. Fourth and fifth grade are typically common to the elementary school building. Additionally, the Missouri Show-Me-Standards and Missouri Grade Level Expectations (GLEs) overlap at the fourth and fifth grade levels, allowing common standards to be assessed between the two grade levels (DESE, 2011). In the participating school district the science and social studies curricula are consistently taught throughout the year at the fourth and fifth grade level allowing for adequate teaching opportunities consistent with the timeline of this study (DESE, 2011).

The second delimitation was the use of a general education classroom, which included students who received general education services, special education services, gifted programming, and free and reduced lunch. The general education classroom was selected as the initial place to study the D2 Cuing Method for its more representative sample of the general elementary school population. Specifically, this researcher attempted to determine if specific subgroups within the general education population benefitted from the D2 Cuing Method more or less than typically developing students.

A third delimitation was that data was only collected for one semester. It is during the fall semester of the school year that specific Missouri Grade Level Expectations (GLEs) and Missouri Show-Me Standards were consistent between the two grade levels. Consequently pre- and post-testing comparisons within a class as well as between grade levels could be made. Had the collection of data extended for more than one semester comparisons between grade levels could not have been completed.

Finally, the fourth delimitation was the selection of subject areas. The fourth and fifth grade curricula in School District X included reading, mathematics, science, and social studies as mandated by the Missouri Department of Elementary and Secondary Education (DESE, 2011). Subjects, like these, that are primarily language-based with novel vocabulary and concepts lend themselves to question-and-answer interaction during large group instruction. The learning concepts identified by the Missouri GLEs and Missouri State Standards are the guiding standards for Missouri fourth and fifth grade classrooms and aligned with district curriculum.

Assumptions

Lunenburg and Irby (2008) define assumptions as the "postulates, premises, and propositions that are accepted as operations for purposes of the research" (p. 135). The assumptions of this research study were identified as those factors that could affect the effectiveness of the D2 Cuing Method and data collection process. Consideration was given to the population, participants, setting, data collection method, and statistical analysis method.

With consideration to these factors, the following assumptions were identified: (a) the subjects were representative of typical fourth and fifth grade classrooms in an urban public elementary school; (b) the teachers involved in this study understood the instructions they were given and carried out the use of the D2 Cuing Method accurately, even when not observed; (c) the pre- and post-tests administered in this study adequately assessed curriculum content that aligned to Missouri Grade Level Expectations (GLEs) and Missouri Show-Me Standards as mandated by the Missouri Department of Elementary and Secondary Education; (d) the pre- and post-tests were administered and scored correctly; and (e) the data collection and input process used with the Statistical Package for the Social Sciences (SPSS) software program was accurate and appropriate.

Research Questions

To determine if the D2 Cuing Method was a viable strategy to assist students in attaining academic goals as defined by the Missouri Show-Me Standards and Missouri GLEs research questions regarding quantitative and qualitative data were posed. This researcher determined that statistically significant differences should be measured using the following independent variables: subject area, student sub-groups, grade level, and control/experimental group. Growth scores in reading, mathematics, social studies, and science were identified dependent variables. Variables were judged to best represent elements common to general education classrooms in the fourth and fifth grades. This data would align to student achievement and provide quantitative evidence of positive effect, negative effect, or no effect of the D2 Cuing Method on pre- and post-test scores.

In addition to collecting data related to the identified independent and dependent variables, qualitative data was collected to assess teachers' perceptions of the D2 Cuing Method. Instructional strategies can only be successful if the teachers who employ them implement strategies effectively. This researcher determined that feedback from the teachers who employed the D2 Cuing Method would prove valuable in helping understand its practicality and effectiveness.

The following research questions were posed:

1. Was there a statistically significant difference ($\alpha = 0.05$) between pre-and post-test scores for students in the experimental group versus the control group for each subject area?
2. Was there a statistically significant difference ($\alpha = 0.05$) between pre-and post-test scores for students in the experimental group versus the control group qualifying for special education services, gifted programming, or free and reduced lunch versus those who did not qualify for special education services, gifted programming, or free and reduced lunch?
3. Was there a statistically significant difference ($\alpha = 0.05$) between pre-and post-test scores for students in the experimental group versus the control group for any one-grade level?
4. Was there a statistically significant difference ($\alpha = 0.05$) in growth scores for students in the experimental group versus the control group across the four subject areas?
5. Did teacher perception of the implementation of the D2 Cuing Method (or lack of implementation) align with the outcomes associated with the quantitative data?

Overview of Methodology

The following section gives a brief overview of the methods used to assess the effectiveness of the D2 Cuing Method in fourth and fifth grade classrooms. A description of the quantitative and qualitative methods used is provided.

A mixed-methods research design was utilized for this study. The quantitative component of this study consisted of a quasi-experimental research methodology pre-test - post-test design using an experimental group and control group. For the purpose of this study, two fourth grade and two fifth grade classes were selected as the experimental group in one elementary school (School A), and two fourth grade and two fifth grade classes were selected as the control group in another elementary school (School B). The experimental group was defined as those students whose teachers used the D2 Cuing Method as an instructional strategy during large group instruction. The control group was defined as those students whose teachers did not use the D2 Cuing Method as an instructional strategy during large group instruction. Hypothesis testing was completed to determine if the difference between the two groups was statistically significant ($\alpha = 0.05$).

The qualitative component of this study consisted of a post-study interview of the four teachers who were trained in and implemented the D2 Cuing Method and the four teachers who were not trained in the D2 Cuing Method. For those teachers in the experimental group, the interview data was used to assess the teachers' perception of the effectiveness of the D2 Cuing Method. Additionally, they were asked to share their opinions about the ease and convenience of using the method. The focus of the interview for the four teachers who were not trained in nor implemented the D2 Cuing Method was to determine the type of instructional strategies they used when conducting question-answer interactions with students during large group instruction.

Organization of the Study

This chapter has provided a preliminary introduction to the literature and research design utilized for this study. The following four chapters will discuss this research study in greater depth. Chapter two will review the literature regarding neuroscience, language, and educational theories of learning as they relate to the D2 Cuing Method. Chapter three will present the research methodology employed in this study, including quantitative and qualitative methods. Chapter four reviews the results of the study, including statistical analyses, hypotheses testing, and qualitative data analysis. Chapter five will interpret the results presented in chapter four. Major findings and how they relate to existing literature as well as implications of the study and recommendations for future research will conclude the study.

Chapter Two

Literature Review

In the name of school reform recently enacted public policy affecting the education of elementary and secondary school-aged children has moved in the direction of making building principals and classroom teachers directly and, in some cases, personally responsible for the success of every student in the classroom. School reform, as defined by the federal initiative No Child Left Behind (NCLB, 2002) has attempted to set unprecedented and lofty goals for improved student achievement in public schools across the country. The NCLB legislation holds teachers and educational administrators accountable for demonstrating annual improvement of student achievement on standardized state tests with the expectation that every student will attain a rating of proficiency in communication arts, mathematics, and science. With this federal expectation, administrators and teachers are required to orchestrate an effective educational setting that is conducive to student learning and achievement for all students.

The implementation of NCLB has resulted in limited overall improvement in childhood education (Petrelli, 2007). As a result, federal and state leaders are currently revising NCLB. Recent proposals include the expectation that educators prepare every high school graduate for college or skills training. Schools with achievement scores that did not meet expectations have created a need for evidence-based strategies to improve teaching methods that will result in improved student achievement. (DuFour & Marzano, 2011).

A twenty-year study released in December 2011 by Harvard economists Raj Chetty and John Friedman, and Columbia University economist Jonah Rockoff, looked at the long-term effects of quality teaching as measured by the "value-added" approach. "Value-added" (VA) was defined as "the average test-score gain for…students, adjusted for differences across classrooms in student characteristics such as prior scores" (Chetty, Friedman, & Rockoff, 2011, p. 1).

Two and one-half million children from a large urban school district were tracked from fourth grade into adulthood for over 20 years. Examined in two parts, the first part addressed two primary questions. The first question evaluated the accuracy of VA measures regarding teachers' impact on scores and if VA unfairly penalized teachers who had a classroom of lower achieving students. The second question evaluated whether or not high VA teachers had a long-term impact on their students' achievement for grades four through eight, or if those teachers were more skilled at teaching to the test. A high VA teacher was defined as one who maintained a VA in the top five percent of the distribution for his/her subject. Conversely, a low VA teacher was defined as one who maintained a VA in the bottom five percent for his or her subject (Chetty, et al., 2011, p. 30-31). The second portion of the study looked at what long-term impact, if any, high VA teachers had on students.

Chetty, et al. (2011) reported "when a high VA teacher joins a school test scores rise immediately in the grade taught by that teacher; when a high VA teacher leaves, tests scores fall" (p. 1). This rise and fall of grades was predictable based on the teacher's VA and could be linked specifically to the course that teacher taught. However, the lasting effect of this teaching was minimal. Tracking of student achievement data four years after being taught by a high VA teacher showed gradual regression of skill.

Value added does in fact accurately measure a teacher's impact on academic achievement. Students taught by high VA teachers were "more likely to attend college, earn higher salaries, live in better neighborhoods, and save more for retirement" (Chetty, et al., 2011, p. 1). They are also less likely to become parents as teenagers. A high VA teacher assigned at any time in grades four through eight was shown to have an immediate impact on student achievement, but these effects faded over time if a lower VA teacher was assigned during subsequent school years.

The social and economic impact of teacher quality was determined to be significant and results were correlated to larger economic and social returns. It was estimated that a classroom assigned to an average VA teacher versus a low VA teacher would predictably generate a cumulative earnings gain of $52,000 per student; more than $1.4 million for an average classroom (Chetty, et al., 2011).

This study further substantiates the need for high quality teachers in our classrooms across the nation. Immediate effects will be recognized in student achievement data, and long-term results will be realized for better quality of life. In this study, value-added teachers are acknowledged to be catalysts to enable learning in students and effective change agents well into the student's adult life. By empowering teachers with research-based, innovative instructional strategies, value-added learning is more likely to occur.

Research continues to substantiate the need for providing equal opportunities of class participation among all students (Marzano, 2003, 2007; Hattie 2009, 2012; Stiggins, 2009; Whitten, Esteves, & Woodrow, 2009; Fisher & Frey, 2010a). Although not all students participate in the same way, all students are provided the opportunity to participate equally in ways that facilitate learning. Consequently, the onus is on the teacher to structure a classroom environment that is conducive to learning and to present information with differentiated instruction supporting all students and culminating in high academic achievement.

Chapter two will present the educational theories and teaching methods that are fundamental to creating effective and efficient instructional strategies. This literature review will incorporate research from the fields of psychology, speech-language pathology, education, and neuroscience. Focus will be directed at the most successful and frequently used methods of cuing, scaffolding, and feedback as they relate to language development and rehabilitation, memory, and word recall/retrieval skills. (German, 2009; Linebaugh & Lehner, 1977; Love & Webb, 1977; Nickels, 2002, 2010; Wisenburn & Mahoney, 2009; Wiig & Semel, 1984). How these methods work within the educational framework of Response to Intervention (RTI) and classroom culture will be discussed. The literature review will begin with a discussion of meta-analysis and effect size to explain a method of data analysis when comparing various research studies and literature.

Meta-Analysis and Effect Size

The literature reviewed is replete with references to *effect size* and *meta-analysis*. The following is a brief description of these terms and how they are applied to educational research. Data referenced herein will be easier to interpret.

Historically in order to draw conclusions, make comparisons, and study trends from the available research, researchers would synthesize data in the form of a large literature review. However statistical analysis could not be applied to the study as a whole. In response Gene Glass (1976) first introduced the idea of meta-analysis. Hattie (2009) describes Glass' notion as:

> whereby the effects in each study, where appropriate, are converted to a common measure (an effect size), such that the overall effects could be quantified, interpreted, and compared, and the various moderators of this overall effect could be uncovered and followed up in more detail. (p. 3)

In order to accurately combine the results of various studies, researchers must choose studies with a number of sufficiently similar characteristics. Meta-analysis is helpful in identifying common effects when the treatment effect (or effect size) is consistent from one study to the next. Meta-analysis is also helpful in identifying reasons for variations between and among studies when the effect varies.

Hattie (2009) defines effect size as, "a common expression of the magnitude of study outcomes for many types of outcome variables, such as school achievement. An effect size of $d = 1.0$ indicates an increase of one standard deviation on the outcome" (p. 7). He states that one standard deviation increase is equivalent to improving student achievement by two to three years, improving the rate of learning by 50%, or a correlation between some variable and achievement of approximately $r = 0.05$.

Hattie (2009, 2012) explained that in the field of education, the baseline for effect size is not set at zero ($d = 0.0$). He argued that any educational method worthy of investigation would have to show an improvement of at least average gain. This is equivalent to an effect size of at least $d = 0.40$. Hattie termed this the "hinge- point" for identifying what is and is not effective in teaching and learning (Hattie, 2009, 2012).

Marzano, et al. (2001) and Marzano (2007) discussed effect size as well. One benefit to using effect size is converting this information to percentile gain. An effect size of 1.0 would equate to a percentile gain of 34 points. So if an effect size was reported as being one standard deviation above the mean, or an effect size of 1.0, the result would be a 34-point gain in scores for those students receiving an intervention or treatment. Consequently the hypothetical students performed better than 84% of those students who did not receive the intervention or treatment. Hattie (2009) reported these measures, as well.

Cohen (1988, cited in Marzano, et al. 2001) suggested interpreting effect sizes in the following manner:

- Small effect size: .20;
- Medium effect size: .50; and
- Large effect size: .80. (p. 6)

While these effect sizes are not to be read as exact values, they are to be interpreted in a manner that allows the reader a mental framework for relative comparison of results.

Measurement of effect size and the use of meta-analysis allows for the comparison of data from various research studies. This is advantageous as comparisons are no longer a synthesis of ideas but a comparison of data. More accurate results and more informed analysis are produced. Throughout the next sections of this chapter effect size and meta-analysis will be discussed specific to the topics of brain-based learning, emotion and learning, storage and retrieval of words, cuing strategies and hierarchies, feedback, scaffolding, wait time, and response to intervention.

Brain-Based Learning: Memory, Rehearsal, Storage, and Recall

Learning is "the process by which we acquire knowledge about the world, while memory is the process by which that knowledge is encoded, stored, and later retrieved" (Kandel, Schwartz, & Jessell, 2000, p. 1227). Learning is a neurological process completed by the brain. The brain takes in sensory (environmental) information, and through a systematic trail of neural pathways, acquires new information. As neuroscience researchers continue to better understand brain function in acquiring new information, teachers benefit from this knowledge when it is paired with learning activities involving their students and the presentation of curriculum. The ongoing exploration of brain-function in learning has led to the idea of *brain-based learning* (Jensen, 2005, 2008; Sousa, 2010; Tate, 2003; Willis, 2006, 2007, 2008; Wolfe, 2010). Jensen (2005) reported that brain-based teaching and learning, where neuroscience research is applied to classroom interventions and the development of instructional strategies, is likely to have a significant impact on student achievement. "Students of all backgrounds and ages, with every imaginable history of failure, can succeed and have succeeded with a brain-based approach to teaching and learning" (Jensen, 2005, p. ix).

Jensen (2008) explained the historical background that led to the idea of brain-based education. He identified two groundbreaking books published in the 1970s: *Use Both Sides of Your Brain* by Tony Buzan (1974) and *Drawing on the Right Side of the Brain* by Betty Edwards (1979) which introduced the idea of understanding the *brain* versus understanding the *mind*. By the 1980s a whole new field of research evolved in which there was an emergence of brain-based investigations that attempted to better understand education and learning as they related to neurologic (brain) function. The development of Positron Emission Tomography (PET scans), Computed Axial Tomography (CAT scans), and Functional Magnetic Resonance Imaging (fMRI) were revolutionary. These advances in technology provided the ability to look at living subject brain function, as opposed to post-morbid brain study. Researchers could now look inside the working brain. By using this technology, researchers could pair behaviors with brain activity, function, and structure to complete hypothesis testing.

Leslie Hart published his book, *Human Brain and Human Learning*, in 1983. Hart argued that the nature of the classroom could impede or enhance learning. He promoted the concept that the educational setting and instruction should be "brain-compatible." Rather than forcing the brain to comply with the learning environment, the learning environment should be adapted to best suit the needs of the individual's brain. Hart asserted that by understanding the physiology (working) of the brain, learning outcomes could be improved.

Other researchers in the 1980s and early 1990s linked brain research to models of thinking and classroom pedagogy. Howard Gardner (1983) published *Frames of Mind: The Theory of Multiple Intelligences*, while Caine and Caine (1991) wrote *Making Connections: Teaching and the Human Brain*. Caine and Caine (1991, 1994) are credited as the first to use the phrase *brain-based learning* which is now referred to as *natural learning*. Renata Caine explained in an interview with Carolyn Pool (1997) that although all learning is brain-based, Renata and Geoffrey Caine wanted to stress the idea that maximizing learning can only occur if an educator understands how the brain works best. Subsequently they developed the Twelve Brain/Mind Learning Principles (Caine & Caine, 1997) to guide educators in their understanding of the brain and link that understanding to appropriate instructional methods. The principles described in their book, *Education on the Edge of Possibility*, and listed in Pool (1997) are as follows:

- The brain is a complex, dynamic system;
- The brain/mind is social;
- The search for meaning is innate;
- The search for meaning occurs through patterning;
- Emotions are critical to patterning;
- The mind/brain processes parts and wholes simultaneously;
- Learning involves both focused attention and peripheral perception;
- Learning always involves conscious and unconscious processes;
- We have at least two ways of organizing memory: A spatial memory system and a set of systems for rote learning;
- Learning is developmental;
- Complex learning is enhanced by challenge and inhibited by threat; and
- Each brain is uniquely organized. (p. 11-12)

Jensen (2008) concluded in his historical review that the field of brain-based research is a legitimate field of research as evidenced by such publications as *Biological Psychiatry*, *the Journal of Social Neuroscience*, *the Journal of Nutritional Neuroscience*, and the peer review journal *Mind, Brain, and Education*. Additionally, Harvard University currently offers through its Graduate School of Education an Educational Masters (Ed.M.) with a concentration in Mind, Brain, and Education, as well as a Doctorate of Education (Ed.D.) with a concentration in Human Development and

Education (Harvard, 2012). This field of study enhances the knowledge and ability of educators while encouraging trained professional to meet the needs of all children through differentiated, brain-based instruction.

Review of the physiological underpinnings of brain-based learning as it applies to various topics discussed in this chapter is critical and lays the foundation for the *why* to develop, implement, and assess appropriate instructional strategies. Better understanding of the physiological functioning of the brain allows teachers to make informed choices and better assess how to support student learning in the classroom. The traditional education model must shift to embrace an approach that views teaching and learning as a neurological function. Hence, the medical model of learning can inform the educational field.

Medically based information has been available since the 1970s, but just recently has a sufficient amount of valid research been available to allow application to the classroom. Improved teacher effectiveness, and ultimately, high levels of student achievement will result. Teachers are empowered, therefore, to better capitalize on the teachable moment. Information on brain-based learning is not only important for understanding memory, storage, and recall, but is also valuable when determining appropriate methods for feedback, verbal praise, rehearsal, and establishing the emotional tone of a classroom. Each topic will be elaborated upon.

Understanding brain-based learning requires understanding of the physiology behind learning. Willis (2008) explained how learning takes place in the brain in *How Your Child Learns Best: Brain-Friendly Strategies You Can Use to Ignite Your Child's Learning and Increase School Success*. Two filters in the brain allow information into the thinking brain: the reticular activating system (RAS) and the amygdala. The RAS is responsive to new and novel information that catches a person's attention such as color, surprise, and curious events. Once information is filtered through that level of intake, it continues on to the amygdala. The amygdala is part of the limbic system, which processes emotion. When the brain is under high stress the amygdala diverts information to the RAS in which survival instincts such as flight or fight kick in. These non-thinking reactions do not promote learning, just survival. However when the amygdala is in a safe state where positive emotions are prominent, information is diverted to the learning and thinking network of the brain where memory systems are activated (Sousa & Tomlinson, 2011; Wolfe, 2010). Willis (2008) goes on to explain:

> In successful learning, children are stimulated to pay attention to important information by getting the attention of their RAS. Listening to lectures and doing drills and worksheets are not novel or engaging experiences, so they do not contain the sensory stimulation sufficient to power information through the RAS's brain filters. (p. 5)

When children receive sensory information, such as what they see, hear, taste, smell, or touch; brain centers beyond the RAS are stimulated. The information is transported to the limbic system, predominantly the amygdala and hippocampus, where information and emotions are linked together. The more pleasurable the experience, the further the information is allowed to travel into the brain. When applied to the classroom setting it would stand to reason the more pleasurable the learning experience, the greater the chance for novel information to be allowed to travel to higher cognitive levels in the brain (Jensen, 2005; Wolfe, 2010).

If a child feels threatened, bored, stressed, or struggles to attend to the input data, the information is diverted. The brain then blocks this information from the memory centers and thinking brain. Negative emotions, therefore, create difficult and less successful learning experiences (Jensen, 2005; Sousa & Tomlinson, 2011; Wolfe, 2010). Conversely if the learning experience is pleasurable and paired with positive emotions felt during moments of success, goal achievement, and introduction of high interest materials; information is permitted into the higher, thinking brain (Jensen, 2005; Sousa & Tomlinson, 2011; Wolfe, 2010).

Information then travels from the amygdala to the hippocampus. The hippocampus, known as the consolidation center, allows new sensory information to be paired with previous knowledge and experiences that are retrieved from the memory centers of the brain (Willis, 2008). At this point in the learning process, Dopamine is released. Dopamine is a neurotransmitter; a chemical in the brain that carries information from one nerve ending to another, by helping it across synapses (spaces) between the nerve endings. Dopamine increases attention, focus, and memory formation. During pleasurable experiences, Dopamine is released, and a child's capacity to attend to and store long-term memories is increased (Jensen, 2005; Sousa & Tomlinson, 2011; Willis, 2008; Wolfe, 2010). Release of Dopamine and the consequential outcomes would be a desirable occurrence in the classroom, as increased levels of attention, focus, and memory are believed to promote greater learning.

Willis (2008) explained that once information is received at and processed at the hippocampus, the brain continues to move the information to the prefrontal lobes of the brain, where executive functions occur. Executive functions include but are not limited to organizing, thinking, and reasoning. Processes involved at this level of cognition include judgment, analysis, prioritizing, and decision-making. Here information becomes committed to memory. New information is transformed from short-term to long-term memory.

Memory is required for survival so one can learn, store, and recall how they should respond in a variety of situations. While the skill of memory can be primal; keeping humans safe from harm and providing basic needs such as food, shelter, and water; memory also allows for learning. Ultimately, learning allows humans to survive in the real world through such tasks as reading, problem solving, decision-making, and acquiring new skills (Jensen, 2005; Sousa & Tomlinson, 2011; Wolfe, 2010).

As the brain builds memory it learns. Memory allows for prediction and recall. When a child remembers, physical changes in the brain occur, new memories are stored, and neural networks are strengthened and expanded with more connections being developed between nerve cells (Jensen, 2005; Sousa & Tomlinson, 2011; Wolfe, 2010). Willis (2008) explained "the more we learn, the more information stored in our neural networks, the more likely our brains are to relate to new information- hence, learning promotes learning" (p. 10).

Four types of memory are rote memory, working memory (also known as short-term memory), long-term memory, and relational memory (Willis, 2008). Rote memory is often required of children as they learn for such tasks as memorizing vocabulary lists, spelling words, and math facts. Rote memory also allows for quick forgetting, especially when data is not paired with contextual information or personal experiences that are necessary links for the creation of long-term memory (Jensen, 2005; Wolfe, 2010).

Information in working memory is held for less than a minute and is required to be moved into long-term memory in order that it be retained (Willis, 2008). McGee and Wilson (1984) suggested that without rehearsal and attention to a task, information is only available in working memory, also known as short-term memory, for approximately 15-20 seconds. While some may view this phenomenon as a disadvantage, Wolfe (2010) explained this is actually appropriate.

If information cannot be remembered for at least 18 seconds the beginning of a sentence would be forgotten when reading. Information from that sentence could, therefore, not be comprehended. On the other hand, if the brain remembered every word ever read, use of memory would be inefficient. Therefore, the brain's use of working memory is sufficient as an area of temporary storage. In the course of learning, the brain is moving information from working memory to long-term memory when that information is vital to being remembered for more than 18 seconds (Willis, 2008; Wolfe, 2010).

Long-term memory is created as information is passed on from short-term memory and occurs through "review and meaningful association with existing patterns and prior knowledge" (Willis, 2008, p. 11). As rehearsal and practice help create patterns, relational memory can then take place. New information is linked to stored information in the memory system. The brain actively works to create links to previous information. But if the brain is unsuccessful in identifying these links and use of strategies to create these links is not successful, new information is lost (Jensen, 2005; Willis, 2008; Wolfe, 2010).

Helping a child to identify patterns and make successful predictions results in the building of relational memories. Teachers can help a child through this process with use of cuing, scaffolding, and feedback so that the information used for linking new information to existing information is correct. Multiple connections can be made, and in turn, more neural pathways are developed, creating stronger understanding and solidification of memory (Jensen, 2005).

Within the process of creating memory, neuroplasticity or brain plasticity (Willis, 2008) involves the growth of new neural connections and the pruning of unused ones. With the construction of neural connections when new information is learned, the pathways to this information become stronger and more efficient. Researchers have shown that dendrite growth, branched extensions from the cell body that receive information from other neurons, increases through repetition of an activity or task, and thereby strengthens neuron connections (Jancke, 2000). Dendrite growth is not limited to childhood and adolescence as once believed.

The creation of such networks is lifelong. While neurons that provide memory storage are not replenished, the dendrites that connect neurons continue to develop and create new circuits with other dendrites when learning occurs (Willis, 2006, 2008). Nerve pathways that are not used are pruned or eliminated to reduce the maintenance of these areas and help conserve the brain's nutrients, known as the "use it or lose it" phenomenon (Sousa & Tomlinson, 2011; Willis, 2008; Wolfe, 2010). Therefore, repetition of skill work in the classroom could potentially increase the development of neural pathways and strengthen learning.

Rehearsal and recall are required to preserve information and prevent it from being lost. The purpose of repetition in learning is to allow for practice of information retrieval with the intention of creating cognitive pathways enabling the storage, processing, and recall of newly learned information (Willis, 2006). Willis (2008) observed:

> The more times one repeats an action (practice) or recalls the information (review), the more dendrites sprout to connect new memories to old ones (plasticity), the stronger the connections between neurons becomes, and the more efficient the brain becomes at retrieving that memory or repeating that action. (p. 13)

Wolfe (2010) reminded teachers that, "the person doing the work is the one growing the dendrites" (p. 216). She stresses that students must be actively involved in the repetition/rehearsal process to encourage long-term memory, storage, and retrieval. Westwater and Wolfe (2000) encouraged teachers to engage students in the *doing* as neural networks are most strongly created in actual experiences rather than pencil and paper tasks.

With this information about brain-based physiology, educators now have greater understanding and insight into the value of repetition and practice with which to help embed new learning into long-term and relational memory. Marzano (2007) endorsed the use of repeated exposure to and practice of new knowledge as a positive instructional strategy. Rosenshine (2002) noted that teachers are effective when they guide student practice in a way that students may "engage in the cognitive processing activities of organizing, reviewing, rehearsing, summarizing, comparing, and contrasting" (p. 7).

Practice then, does not become an exercise in rote memorization, but the execution of higher functioning cognitive skills that help in the storage and retrieval of new information.

Marzano, et al. (2001) presented a meta-analysis on practice in learning. Effect-sizes ranged from .54 to 1.58. Two major conclusions were drawn regarding practice; (1) "mastering a skill requires a fair amount of focused practice and (2) while practicing, students should adapt and shape what they have learned" (p. 67 & 69). Marzano, et al. specifically reviewed the works of Anderson (1995) and Newell and Rosenbloom (1981). It was concluded that students have to practice a new skill approximately 24 times before reaching a competency level of 80 percent. Each subsequent student practice yielded less of an increase in competence. The first four practice sessions yielded a competency level of 47.9 percent while the next four practice sessions added only a 14 percent increase. Marzano, et al. (2001) concluded:

> Learning new content…does not happen quickly. It requires practice spread out over time. The results of such practice will be increments in learning that start out rather large but gradually get smaller and smaller as students fine-tune their knowledge and skill. (p. 68-69)

Marzano, et al. (2001) also observed that students must adapt or *shape* skills as they are learned. By shaping skills students gain a greater conceptual knowledge about the information they learn. Shaping in the classroom requires a balance between getting through a task quickly while taking the time to learn the information or process a level sufficient enough to be applied with greater meaning and depth of understanding.

Marcia Tate (2003) wrote *Worksheets Don't Grow Dendrites: 20 Instructional Strategies that Engage the Brain*. Tate suggested twenty instructional strategies that promote the active engagement of a student in the learning processes and which according to research (Jensen, 2005, 2008; Sousa, 2010; Willis, 2006, 2007, 2008; Wolfe, 2010) enhance learning and maximize achievement potential. Over 200 research rationales were provided by Tate to explain why these twenty strategies support how the brain learns best. The twenty strategies include: "brainstorming and discussion; drawing and artwork, field trips; games; graphic organizers, semantic maps, and word webs; humor; manipulatives, experiments, labs and models; metaphors, analogies, and similes; mnemonic devices; movement; music, rhythm, rhyme, and rap; project-based and problem-based instruction; reciprocal teaching and cooperative learning; role plays, drama, pantomimes, and charades; storytelling; technology; visualization and guided imagery; visuals; work study and apprenticeships; and writing and journals" (p. xii). Each of these strategies seek to create links for children so that long-term and relational memory can be activated, emotional states are positive, and the child is actively engaged in the learning process.

Abdeleal (2008), Jensen (2005, 2008), Sousa (2010), Willis (2006, 2007, 2008), and Wolfe (2010) reported similar findings and made instructional suggestions that closely mirror the aforementioned strategies of Tate. McGeehan (2001) encouraged educators to consider the "role of emotions in focusing attention, the importance of providing many first-hand experiences, and building in personal meaning from the student's point of view" (p. 12). Emotions, first-hand experience, and personal point of view link to the literature on brain-based research as it relates to memory, rehearsal, storage, and recall. Clearly, Hart (1983) may be seen as the impetus and launching point for why educators should approach teaching and learning with methods and strategies which are *brain-compatible*, not *brain-antagonistic*. The following sections of this chapter will highlight research-based instructional strategies and methods that are supported by the notion of brain-based learning.

Emotion and Learning

An extensive review of brain-based learning literature clearly demonstrated that emotions and learning are interconnected (Abdeleal, 2008; Brookhart, 2008; Jensen, 2005, 2008; Marzano, 2007; Sousa, 2010; Sousa & Tomlinson, 2011; Willis, 2006, 2007, 2008; and Wolfe, 2010). Neuroscience researchers have suggested that significantly raised levels of stress, anxiety, and the perception of failure impede learning, focus, and sense of self-worth (Brookhart, 2008; Jensen, 2005; Marzano, 2007; Sousa & Tomlinson, 2011; Willis, 2006; Wolfe, 2010). Researchers (Jensen, 2005; Sousa & Tomlinson, 2011; Willis, 2006; Wolfe, 2010) have concluded that students who experience negative emotional states would require the support of a teacher who can effectively utilize teaching strategies to reduce the negative effects of these feelings and maximize their learning to garner success.

Willis (2006) stated that when the brain is in positive states of emotion such as "contentment, joy, play, and comfortable but, stimulating, amount of challenge" (p. 24), there is evidence of increased working memory, greater verbal fluency, and increased flexibility in thinking which enhances creative problem solving. Additionally, positive changes in social behaviors have been observed which include increased helpfulness, focus, social interactions, patience, decision-making, and use of higher order executive functions.

Sousa and Tomlinson (2011) explored the idea that a classroom must feel safe and secure to be a conducive environment for learning. Memory is linked to the limbic system (emotional center) of the brain. It was established the brain is an organ designed for the purpose of survival. When negative sensory input is received, a rush of adrenaline is sent to the brain which shuts down all extraneous activity and brings focus to the stimulus causing the experience. Here the fight or flight reaction occurs making learning increasingly more difficult (Willis, 2006; Wolfe, 2010).

Other powerful emotions can also make learning difficult. However, the ability to recall an event is enhanced when the strength of the emotion is high. “The more intense the emotional state, the more likely we are to remember the event” (Jensen, 2005, p. 56).

Endorphins, chemicals in the body that act as a natural painkiller and improve mood, rise stimulating the frontal lobe. The release of endorphins help regulate memory and higher cognitive functions. Frontal lobe stimulation supports learning (Sousa and Tomlinson, 2011). When negative emotions are experienced, cortisol (a steroid) is released in the body raising anxiety levels. Cortisol also stimulates the frontal lobes, but prompts the frontal lobes to ignore low priority information and focus on how to remove or reduce the cause of stress. In turn, the chances of learning and committing new information to memory are reduced (Sousa and Tomlinson, 2011).

Jensen (2005) reviewed memory, learning, and stress. Mixed research was found about when the ability to learn is observed and measured in the presence of stress. Some researchers discovered that moderate, not high-levels, of cortisol in the brain assist in encoding information, but hinder information retrieval (Cahill, Gorski, & Le, 2003; Van Honk, Kessels, Putman, Jager, Koppeschaar, and Postma, 2003). Other studies suggested that increased cortisol levels enhance memory when information contains an emotional component (Abercrombie, Kalin, Thurow, Rosenkranz, & Davidson, 2003). One study suggested that too much cortisol impaired semantic memory, but use of norepinephrine created stronger memory (Cahill, Prins, Weber, & McGaugh, 1994). Clearly the relationship between memory, learning, emotions, and chemical reactions in the brain is complex. While researchers continue to gain understanding of these dynamics, it is evident that emotions and learning are connected to each other.

It is well documented that students who gain a sense of academic success will engage in classroom activities and take risks in learning, thereby maximizing their learning experience (Marzano, 2007; Sousa & Tomlinson, 2011; Willis, 2006; Wolfe, 2010). The converse is also true. When compared to their peers students who are at risk for failure and perform poorly experience higher levels of stress and anxiety. A culture of success in the classroom is necessary which promotes optimal learning.

Sousa (2009) concluded that since children and adolescents are still developing social and emotional processes, teachers are more likely to succeed when they support children's social and emotional development which in turn helps to promote better learning. Because students and teachers spend so much time together during the course of a school day the teacher takes a primary role in perceiving, assessing, and responding to each student's emotional needs (Sousa and Tomlinson, 2011). Sousa and Tomlinson (2011) suggested that teachers demonstrate empathy, allow students to feel a sense of ownership in their education, identify and reinforce student strengths, address fears and humiliation, and acknowledge that discipline is a teaching process so that positive student-teacher relationships can be built. Consequently, the classroom culture becomes one of positive relationships which enhances student learning.

Jensen (2005) concluded the following about the most recent emotions and learning research. Emotions do the following:

- Constitute the passion for learning;
- Help orchestrate our attentional priorities;
- Support either persistence or retreat;
- Are sources of information about the outside world;
- Evoke necessary empathy, support, or fear;
- Associate our learning with either pain or pleasure;
- Help us make meaning out of our learning, work, and lives;
- Push the pursuit of rewarded behavior;
- Improve social problem solving;
- Provide incentives for desired social behavior; and
- Allow us to enjoy and even celebrate our learning successes. (p. 69)

Wolfe (2010) suggested that "effective teachers, perhaps without knowing the neurological basis for the effect emotion has on learning, intuitively design ways to make the information that students study more meaningful and emotional" (p. 140). By pairing activities and events that instill the positive emotions of pleasure, curiosity, moderate levels of excitement, and humor; the memory of the task is more quickly and strongly committed to memory. This use of emotion and experience can be enhanced with field trips, guest speakers, solving real-life problems, role-playing, and creating.

"Reducing stress and establishing a positive emotional climate in the classroom is arguably the most essential component of teaching" (Hardiman, 2010, p. 236). It is evident in the research that a complex and dynamic relationship exists between emotions and learning. While much remains to be learned and studied regarding the relationship of emotions to learning, it is clear that teachers should promote positive and supportive relationships with their students. The current literature provides abundant evidence that when a student's emotional needs are being met, learning is enhanced with positive learning outcomes.

The following section of chapter two will introduce the literature pertaining to storage and retrieval of words and extends the discussion of memory and learning as it applies specifically to language. The literature review thus far has presented information on memory, rehearsal, recall, and emotions as they pertain to learning. The storage and retrieval of words requires the cognitive processes of memory and recall for efficient use and understanding of words. Given that language is the fundamental conduit to learning, this discussion becomes critical to the literature review.

Storage and Retrieval of Words

The field of speech and language pathology has introduced a number of clinically proven methods that effectively aid in the successful rehabilitation of stroke, head injured, and severely language impaired patients of all ages. Literature detailing word-finding deficits (difficulty storing and recalling specific vocabulary words) and anomia (reduced ability to name items and use specific vocabulary following brain injury from a stroke or head trauma) has resulted in language development, learning theories, and therapeutic protocols. Children and adults are thereby assisted in acquiring skills that enhance storage and recall of words (Bjork & Bjork, 1992; German, 2002, 2009; Linebaugh & Lehner, 1977; Love & Webb, 1977; McGregor, 1994; Nickels, 2002, 2010; Wiig & Semel, 1984; Wisenburn & Mahoney, 2009).

Word finding theories and clinical protocols are relevant to the field of education because they provide information about how an individual's memory stores language and retrieves it. Language and use of words are the primary conduits of teaching and learning. During student-teacher interactions the exchange of ideas, knowledge, questions, feedback, and vocabulary occurs through use of language. It stands to reason that the language centers of the brain are continually stimulated through the learning process. The neural processes involved in learning are complex. When instructional strategies support neural processes the probability of engaging higher cognitive function is significantly improved and learning can occur (Jensen, 2005; Willis, 2006; Wolfe, 2010).

Neural functions involved in word storage and retrieval require review to better understand the use of treatment methods and strategies. German (2009) defined word finding as "the ability to retrieve a desired work in single-word or discourse contexts" (p. 1) and summarized the cognitive process involved in retrieving a single word. Tasks such as picture naming or identifying a vocabulary word would trigger such a neural event. Bandur and Shewan (2008, in Chapey, Ed) observed that the literature generally agrees that there is no one single area of the brain which maintains storage and retrieval of words. The storage and retrieval process occurs with multiple regions working together as one large network. When words are retrieved both semantic (meaning-based) and phonological (sound-based) information are used to access the word. There is debate in the literature as to how much these two cognitive processes interact (Levelt, Roelofs, & Myers, 1999). Levelt, et al. (1999) suggested that there are four stages of lexical (word) access. German (2009) summarizes the stages:

- A word's conceptual structure is elicited;
- Activation spreads to access the word's semantic and syntactic features;
- Elicitation of corresponding phonological features occurs; and
- Execution of a motor plan is created for word production. (p. 2-3)

Essentially, there is a stimulus, such as a picture, that triggers the brain to think of the word. The brain starts to identify the meaning of the word (semantic and syntactic features) then identifies the sounds associated with that word (phonological features). Finally, the brain determines how to say that word by moving the mouth (motor plan) (German, 2009; Levelt, et al., 1999).

McGregor (1994) suggested that children who have difficulty in recalling words have at least partial knowledge of the word, especially when an incorrect response is related to the target word. Word substitutions are thought to occur for three reasons: (1) poor storage: the child's knowledge base is not elaborate enough to distinguish the differences between the target and incorrect answer; (2) poor storage and retrieval: the child's knowledge base and access to the word is limited; and (3) poor retrieval: the child's access to well-stored and understood information is limited. McGregor suggested a lexical storage model that asserts phonological and semantic information is stored separately, but intricately linked. Further, semantic cues have the capacity to activate phonological information about a word.

When a targeted word is retrieved from the long-term memory centers of the brain there has to be a strategy to access the lexical (word) system and find the intended word (Wiig & Semel, 1984). Strategies can include a phonological search where the brain searches out the specific word based on the sounds in the word and the sequence in which the sounds occur. A second strategy is a semantic search. When words are retrieved by sorting them into general groups and then smaller, more specific categories. The third strategy is situational scripting. Here the brain searches for a word based on an experience that the child had and the relevance of the word in the experience.

When a student cannot retrieve a word independently through use of internal cues, external cues are required to stimulate the retrieval process. Recalling (retrieving) words is considered to be cue dependent (Wiig & Semel, 1984). Wiig and Semel (1984) provided a summative list to effectively cue verbal memory:

- Use of specific cues are effective in the retrieval of words;
- Associative cues (words that go together such as hot/cold) are generally more effective than rhyming cues (hot/pot);
- Word recall may be enhanced by increasing the number of sounds or syllables given in a phonemic cue;
- Partial cue words (giving part of a word) is more effective than giving a synonym;
- Cuing the semantic category of a word (i.e., type of fruit) may help retrieve words at an optimal level; and
- Words can be retrieved more easily when they are paired with words that were used when the child first learned the word. (p. 263)

The various types of cues that are available to elicit a word were described by Wiig and Semel (1983). Phonetic cues, in which the first sounds or syllables are presented, allow the child to complete the word. Associative-semantic cues include pairing words that go together (i.e., "peanut butter and _____"), giving a synonym (i.e., "another word for jacket is _____"), giving an antonym (i.e., "not day but ______"), serial cuing (i.e., "Sunday, Monday, ______"), and semantic cuing (giving the word category or descriptive terms for the word). Sentence completion cues allow the child to finish a sentence the teacher has started, and are formulated to help the child predict the word (i.e., "I swim in a _____"). Melodic-stress cuing involves singing a known song, such as the alphabet, or tapping out the syllables of a multi-syllabic word (i.e., el-e-phant). Multiple choice cuing provides the child with a choice of two or three words.

From the literature it is clear that both phonological and semantic methods of cuing for the treatment of word-finding deficits are successful. But there is little conclusive evidence that one form of cuing is more successful than another, especially in the treatment of aphasic (language impairment following stroke or head injury) adults (Nickels, 2002). A meta-analysis of treatment methods for word-finding deficits in aphasic adults conducted by Wisenburn and Mahoney (2009) concluded that all treatment approaches including semantic, phonological, and mixed, were effective. Effect sizes ranged from 0.16 (no treatment) to 1.55 (mixed-semantic/phonological). Determination of success of generalization of word recall to words that were untrained yielded that semantic cuing seemed to be more effective than phonological or mixed.

Marshall, Freed, and Phillips (1994) reported similar results. They studied the effectiveness of phonological and semantic cuing, and concluded that while both phonological and semantic cuing were beneficial in increasing the naming abilities of aphasic adults, semantic cuing was more effective for maintaining word-naming skills outside the therapy room. Marshall, et al. (1994) suggested that, "the quality of stimulus presentation may be more important than the quantity" (p. 341). Bombarding a subject with repeated naming trials only provides phonological information. But when the subject analyzed the semantic features of a target word he/she is helped to generalize the information, as semantic analysis involved higher levels of thinking in the brain.

Lowell, Beeson, and Holland (1995) concluded in their study of semantic cuing that generalization was improved when treatment included rehearsal of the task and receiving accurate corrective feedback. Their results are interesting when considering what is known about learning in general. The work of Hattie (2009, 2012) and Hattie and Timperley (2007) indicated that corrective feedback is a powerful learning tool. The opportunity to rehearse the task ties into the brain-based learning literature, as repeated opportunities to complete a task improves overall memory of new information (Willis, 2006, 2008; Wolfe, 2010).

While a classroom teacher is not expected to treat word-finding deficits in his/her classroom, knowledge of the theoretical underpinnings of how words are stored and recalled and how to support word retrieval is valuable. As previously stated, language is the means by which communication for learning and socialization occurs within the classroom. When new vocabulary words and concepts are introduced in the classroom, students are faced with the challenge to learn, recall, and apply that word knowledge quickly.

Marzano, et al. (2001) reported there is a "strong relationship between vocabulary and the following elements of learning: intelligence, the ability to comprehend new information, and level of income" (p. 123). Chetty, et al. (2011) supported Marzano's findings. If vocabulary knowledge is enhanced in the classroom setting, student achievement should improve. The evidence in the literature therefore supports the use of cuing and word retrieval strategies to benefit student learning. The following section will review the literature on cuing strategies and hierarchies as they apply to language learning and language therapy techniques. Discussion will include application to the classroom setting.

Cuing Strategies and Hierarchies

Recall that the literature regarding language impairments presents two main categories for cuing strategies for teaching word recall, semantic approaches and phonological approaches (Nickels, 2010). Semantic approaches strengthen word meaning, while phonological approaches improve phonological production of the word (German, 2009). Nickels (2010) and Wisenburn and Mahoney (2009) concluded that various approaches for word-finding deficits, including semantic (word based) and phonological (sound based), were effective for improving naming abilities in aphasic (language impaired) adults. Gains varied widely across studies and generalization of skills to untrained stimuli was limited.

Nickels' (2010) review suggested that of the treatment strategies reviewed multi-component strategies, defined as those containing both phonological and semantic elements in the cuing hierarchies, may be the most efficacious. Nickels (2010) and Wisenburn and Mahoney (2009) observed that much is unknown about rehabilitation of word retrieval and storage in aphasic patients. More research is required to make broad statements regarding treatment since studies often contained single-subject designs and large degrees of variability between subjects regarding the extent of language disability and brain trauma.

The idea of a cuing hierarchy comes from the work of Linebaugh and Lehner (1977), Wiig and Semel (1984), and Linebaugh, Shisler, and Lehner (2003). Wiig and Semel (1984) proposed that the cuing strategies of semantic cues (word meaning); sentence completion (starting a sentence and leaving a word or information to be filled in); phonological cues (giving first sounds of a word); choice of two or three items (providing answers to choose from); and imitation (providing the answer) were viable and effective. Students were assisted in learning fundamental elements of language including semantics (vocabulary and word meaning), syntax (sentence formulation), morphology (grammar), and phonology (sounds in words). These cuing strategies and the areas in which they can be applied, continue to be considered beneficial among Speech-Language Pathologists (Linebaugh, Shisler, & Lehner, 2003; Nickels, 2002; Wisenburn & Mahoney, 2009).

Linebaugh and Lehner (1977) were the first researchers to put cuing strategies into a hierarchical order. Prior to their research two studies investigated the use of cuing aphasic patients in therapy. Neither study attempted systematic applications to therapy nor reported upon effectiveness (Berman & Peele, 1967; Rochford & Williams, 1962). The work of Love and Webb (1977) supported Linebaugh and Lehner’s attempt to place cuing strategies into a hierarchical order.

Love and Webb (1977) proposed the idea that cues used in therapy with aphasic patients had "cueing potency." Love and Webb discovered that direct imitation of a targeted word production had the greatest "cueing potency" or likelihood for success for eliciting and encouraging a correct response. Followed by an initial syllable cue (subject was given the first syllable of a targeted word production), with both sentence completion (subject had to complete a given sentence with a single word) and reading the printed word ranked third. The order of these cues was judged to be contingent upon dependency of the cue to general language processing (understanding and formulating language) versus specific motor-planning (coordinating movement of the lips, tongue, and jaw) for articulation. In other words, motor-planning cues supported the subject more than cues that required greater cognitive skills.

The cuing hierarchy proposed by Linebaugh and Lehner (1977) provides logic. Linebaugh and Lehner based their hierarchy on two main principles. The first principle was the foundational idea that language "rehabilitation is the elicitation of a response. They suggested that the recovery process was best served by eliciting the desired response with a minimal cue" (Linebaugh & Lehner, 1977, p 19).

Cues were drawn from three areas: verbal (also known as semantic), gestural (to act out an idea), and phonological (sound-based). The arrangement of those cues was based on their "stimulus power," described as the degree to which a cue provided a subject with support working from the least amount of cuing support to the most amount of cuing support. Linebaugh and Lehner suggested that the power of stimulus for any of the given cues would differ across subjects; and as such, stimulus power should be assessed for each subject before treatment begins.

The second fundamental principal employed in cuing hierarchy is fading of the stimulus. By fading cues and offering the least amount of support required to elicit a correct response, subjects were required to utilize the process of word retrieval and thereby stimulate the cognitive process required to retrieve and store lexical (word) information. Success would act in and of itself as positive reinforcement for the subject, potentially evoking a spontaneous correct response when the stimulus was presented another time. The following is the Cueing Hierarchy proposed by Linebaugh and Lehner (1977):

- "What's this called?" (directly request name of the target item);
- Directions to state the function of the item;
- Directions to demonstrate the function;
- Statement of the function by the clinician;
- Statement and demonstration of the function by the clinician;
- Sentence completion;
- Sentence completion and the silently articulated first phoneme (sound) of the response;
- Sentence completion and the vocalized first phoneme (sound);
- Sentence completion and the first two phonemes (sounds) vocalized; and
- Say "______." (sentence completion). (p. 21)

Glynn, McNaughton, Robinson, and Quinn (1979) developed a tutoring program at the University of Auckland in New Zealand entitled, *Remedial Reading at Home: Helping You to Help Your Child*. Designed to give parents and tutors a systematic method to help struggling students learn how to read, this program encouraged selfcorrection of reading errors with opportunity to practice strategic problem solving when faced with a reading challenge. The method has come to be known as the *Pause, Prompt, and Praise* method (Glynn & McNaughton, 1985; McNaughton, Glynn, Robinson, 1987; Merrett & Thorpe, 1996).

The systematic method of cuing a child through a challenging, unsuccessful attempt to read a word involves three steps: pause, prompt, and praise. The first step, *pause*, occurs when the teacher encourages a student to stop his/her attempt at reading for 5 seconds allowing the student to reassess the challenge. The second step, *prompt*, occurs when the tutor or parent provides a prompt to elicit the correct reading of a word. Although specific types of prompts are not named the types of cues fall into two categories: contextual and grapho-phonic. Contextual cues encourage the child to figure out a word given the information derived from the text. Prompts are by sentence completion, questioning, or discussing the meaning of the text or word just read. Grapho-phonic cues encourage the student to more closely look at the word and try to better sound it out. If two prompts are given and the student still has not corrected his/her error the word is provided for him/her. The student is then encouraged to go back and re-read the sentence with the correct word. Finally, the third step is then implemented: *praise*. Students are provided praise specific to what they did correctly. Praise is provided when the correct word is read or when the student re-reads the sentence after being provided the answer.

The Pause, Prompt, Praise method of reading instruction is of particular interest as it incorporates three strategies covered in this literature review: cuing and hierarchies, wait time, and praise. A synthesis study completed by Glynn and McNaughton (1985) reviewed 12 studies that measured the effectiveness of this program. In each of the 12 studies, students made significant gains in their reading ability and it was concluded the Pause, Prompt, Praise method was effective in helping parents and tutors guide students to higher levels of reading. Clearly, cuing hierarchies can translate into instructional strategies that are advantageous for students.

The overall premise demonstrated by Webb and Love (1977) and Linebaugh and Lehner (1977) is that cues do have a logical stimulus power or cuing potency. Cues should be arranged and presented from the least powerful/potent cue to the most powerful/potent cue. Each cuing type whether semantic, phonological, modeled, or direct imitation is evidence- based in and of itself as an effective means to elicit and train a correct response from a subject (Wiig & Semel, 1984). Fading of these cues, which aligns to the guided instruction method of Fisher and Frey (2010b) and meta-analysis of scaffolding research by van de Pol, et al. (2010, 2011), was determined to be beneficial to the learning process.

Similar to cuing, feedback is a supportive instructional strategy that bridges a student's current level of knowledge to the next step. While cues help a student recall information, feedback is information the student uses to guide him/her to greater levels of achievement. The following section will discuss the concept of feedback and the evidence-based research that explains its use and benefits in the classroom setting.

Feedback

Feedback is another instructional strategy that works in tandem with cuing. While cuing assists students to recall information, feedback aims to guide a student to the next level of achievement. Feedback as defined by Brookhart (2008) is, "just in time, just for me information" (p. 1) which guides students to the next level of understanding and learning. Brookhart explained that feedback addresses both the cognitive and motivational needs of a student. When students are given feedback to help them understand what is required to improve their academic performance, their cognitive needs are met. Such feedback can lead children to play an active role in their own learning and success, which is the motivational factor. Winne and Butler (1994, Cited in Hattie & Timperley, 2007) summarized, "feedback is information with which a learner can confirm, add to, overwrite, tune, or restructure information in memory, whether that information is domain knowledge, meta-cognitive knowledge, beliefs about self and tasks, or cognitive tactics and strategies" (p. 82).

The nature of the feedback is critical to its success (Brookhart, 2008; Hattie, 2009, 2012; Hattie & Timperley, 2007). Not all feedback is equally effective (see Table 1). Hattie and Timperley (2007) concluded from more than 7,000 studies that the most effective forms of feedback provided cues; specific information; were reinforcing; and in the form of video, audio, or computer-assisted feedback. The least effective feedback included that which was delayed, offered punishment or praise and involved programmed instruction. Hattie and Timperley (2007) argued that extrinsic rewards such as stickers or awards should not be viewed as feedback, as it limits intrinsic motivation and undermines the self-regulatory process as described in the following table (see Table 1).

Table 1

Summary of effect sizes relating to feedback effects

Variable	Number of meta-analyses	Number of studies	Number of effects	Effect Size
Cues	3	89	129	1.10
Feedback	74	4,157	5,755	0.95
Reinforcement	1	19	19	0.94
Video or audiofeedback	1	91	715	0.64
Computer-assisted instructional feedback	4	161	129	0.52
Goals and feedback	8	640	121	0.46
Student evaluation feedback	3	100	61	0.42
Corrective feedback	25	1,149	1,040	0.37
Delayed vs. immediate	5	178	83	0.34
Reward	3	223	508	0.31
Immediate vs. delayed	8	398	167	0.24
Punishment	1	89	210	0.20
Praise	11	388	4,410	0.14
Programmed instruction	1	40	23	-0.04

Hattie & Timperley (2007) p. 84

Nuthall (2005) suggested that feedback had to be received and then acted upon by students in order to carry out maximum effect. While teachers reported numerous examples of feedback, students did not necessarily act upon the feedback or interpret it accurately. Limited amounts of feedback in the course of the day were observed to be beneficial. Most of the feedback that students received was from other students and a majority of that feedback was incorrect. Nuthall (2007) conducted a study of in-class observations noting 80 percent of verbal feedback came from peers and most of the feedback was incorrect. Frey and Fisher (2010) warned against reliance on poor feedback and concluded that when errors were left uncorrected learning was less likely to occur.

Although feedback that provides positive reinforcement is beneficial, it is not a reinforcer because feedback can be “accepted, modified, or rejected” (Hattie & Timperley, 2007, p. 82). Feedback that occurs within a model of self-regulated learning is most beneficial for student achievement (Butler & Winne, 1995; Nicol & Macfarlane-Dick, 2007). Self-regulation feedback is the degree to which a student can create meaning and regulate that meaning through thinking, motivation, and behaviors during the learning process. Self-regulation feedback is most important in the upper elementary grades when a student solidifies his/her self-identity as a learner. As students continue through elementary school feedback becomes a collective experience that continues to shape learner identity. Those who see themselves as able, successful learners confidently take the necessary risks to expand their learning. Those who have experienced less than desirable results often exhibit a negative attitude toward school and will not strive to achieve (Stiggins, 2009).

Important to understand is that a teacher cannot make a student learn; teachers can merely guide the student to a greater level of understanding (Fisher & Frey, 2010b). Students themselves are ultimately responsible for attaining their goals. In order to promote this student success, students require specific learning targets and goals against which performance can be compared. The feedback students receive identifies their gains toward those goals (Nicol & Macfarlane-Dick, 2007). The combination of internal feedback (student self-evaluation) and external feedback (teacher evaluation) that encourages self-regulation maximizes student learning (Butler and Winne, 1995).

Nicol and Macfarlane-Dick (2007) concluded from their literature review the following points about feedback:

- Feedback must not just come from the teacher, but from the student as well to empower their role as an active participant in the learning process;
- Feedback must be specific and clear so that a student can decode and act upon it successfully;
- Feedback should not be interpreted by a student as highly critical or negative. This reduces motivation and in turn reduces learning; and
- As teachers are faced with larger class sizes, empowering students to provide self-feedback reduces teacher demands. (p. 200-201)

Hattie and Timperley (2007) in their meta-analysis proposed a model of feedback that contains four specific levels driven by three main feedback questions: *Where am I going?* (goals); *How am I doing?* (identifies progress toward goals); and *Where to next?* (action required to meet goals). When the answers to these questions are specific the answers meet the needs of the student at their level and effective feedback is provided. The four levels of feedback include (Hattie & Timperley, 2007):

- Task Level (tasks are understood/performed);
- Process Level (process needed to complete task);

- Regulatory/Meta-Cognitive Process Level (student's self-monitoring of actions); and
- Self or Person Level (personal evaluation/effect on learner). (p. 90)

Hattie and Timperley (2007) stressed the key to the success of their model was addressing the three questions in tandem rather than in isolation. By working within the four levels of feedback a student can be guided to higher levels of learning. By closing the gap between where the student is and where the student needs to be feedback can become a very powerful method to guide student learning.

The first question, "Where am I going?" provides the opportunity to set appropriate goals. Goal setting should be specific to a learning task, such as completing multiplication facts, not an assessment of judgment, such as getting a 100% on a test. A shared commitment between teacher and student is also required. The student must be engaged in the learning goal, in order that he/she can determine the needed direction to go.

The second question, "How am I going?" provides the student with information from the teacher regarding the success or failure of a specific element of the expected task/goal. Such information is most effective when it addresses a student's progress and next steps for engagement. Important to remember is that this step does not always require the element of testing. Knowing whether a question is right or wrong is not sufficient. A student must receive feedback that directly addresses *why* his/her work was/was not successful.

The third question, "Where to next?" should not necessarily focus on more tasks and expectations, but instead upon more learning. The idea of more learning may include greater challenges, greater independence in the learning process, increased fluency/mastery of the task, increased use of strategies, increased depth of understanding, and better understanding of what should be understood.

Feedback is powerful when the three questions work in tandem to close the gap between where a child is and where he/she needs to be (Sadler, 1989). By allowing the questions to work together the student and teacher can maintain a discourse, verbal and written, which enhances learning.

Focus upon feedback directly influences effectiveness (Hattie & Timperley, 2007) and is critical to the process of learning. Recall that the four levels of feedback are: feedback about the task, feedback about processing the task, feedback about self-regulation, and feedback about the self as a person. The student is helped to determine if an answer is correct from feedback about the task. Likewise useful is knowing if more or different information is needed. Feedback about the process includes information about strategies to use, or a process that needs to be put in place to better attain a goal. Feedback about self-regulation can help a student monitor his/her confidence and better evaluate his/her own work. Likewise this feedback helps to foster the belief that the student's effort is valuable. Feedback that is related to the "self" versus the actual task, with such comments as "Excellent thought!" and "Good job!" is often unrelated to the task and not as effective as the other levels. Hattie and Timperley (2007) explained that feedback about the task helps to increase learning in processing strategies whereas feedback about the process and feedback about self-regulation increase processing and mastery of tasks. Of the four levels of feedback, that related to the "self" is least effective.

Black and Wiliam (1998) completed a meta-analysis that reviewed 250 studies published between 1987 and 1998. Researchers reported convincing evidence that when teachers used assessment *for* learning versus assessment *of* learning, a substantial increase in student achievement was realized. Five key elements were summarized by Hattie (2012):

- Students are actively involved in their own learning processes;
- Effective feedback is provided to students;
- Teaching activities are adapted in a response to assessment results;
- Students are able to perform self-assessments; and
- The influence of assessment on students' motivation and self-esteem is recognized. (p. 127)

Black and Wiliam (2009) followed by creating five major strategies that were summarized by Hattie (2012):

- Clarifying and sharing learning intentions and criteria for success;
- Engineering effective classroom discussions and other learning tasks that elicit evidence of student understanding;
- Providing feedback that moves learners forward;
- Activating students as instructional resources for one another; and
- Activating students as the owners of their own learning. (p. 127)

It is this partnership between student and teacher to share the goal of student success that results in measurable achievement gains for all students (DuFour , DuFour, Eaker, & Many, 2006; Hattie 2009, 2012; Hattie & Timperley, 2007; Reeves, 2009).

Nicol and Macfarlane-Dick (2007) synthesized the literature on feedback and formulated seven effects of feedback:

- Helps clarify what good performance is (goals, criteria, expected standards);
- Facilitates the development of self-assessment (reflection) in learning;
- Delivers high quality information to students about their learning;
- Encourages teacher and peer dialogue around learning;
- Encourages positive motivational beliefs and self-esteem;
- Provides opportunities to close the gap between current and desired performance; and
- Provides information to teachers that can be used to help shape teaching. (p. 205)

Hattie's book, *Visible Learning for Teachers* (2012), created a checklist for teachers to help make learning more visible in the classroom. In this way Hattie moved from theory to action plan. He identified behaviors for teachers to create effective feedback in the classroom:

Teachers:

- are more concerned with how students receive and interpret feedback;
- know that students prefer to have more progress than corrective feedback;
- know that when students have more challenging targets, this leads to greater receptivity to feedback;
- deliberately teach students how to ask for, understand, and use the feedback provided; and

- recognize the value of peer feedback, and deliberately teach peers to give other students appropriate feedback. (p. 134)

Evident from this review of research is that the work of Black and Wiliam (1998, 2009), Hattie and Timperley (2007), Hattie (2009, 2012), and Nicol and Macfarlane-Dick (2007), mirror many of the same assumptions and ideas with regard to feedback, the effectiveness of feedback, and the principles of feedback. Sadler (2008) suggested that three conditions must be met in order for feedback to be effective: the student actually requires the feedback, he/she must receive the feedback and incorporate it into his/her learning, and he/she is willing and able to use the feedback. Clearly, Sadler's suggestions mirrored prevailing literature.

Hattie (2009, 2012), however, cautioned that while feedback is complex and is found to be highly effective, it is not the sole answer to teaching and learning. Feedback is a powerful tool that students and teachers can utilize to increase learning. Hattie pointed out that feedback is dependent upon many variables for success, the most important being effective instruction. Feedback, then, becomes the second stage in the learning process as rich instruction is required prior to any learning.

Hattie (2009) summarized the work of Kluger and DeNisi (1996):

> a feedback intervention provided for a familiar task that contains cues that support learning, attracts attention to feedback-standard discrepancies at the task level, and is void of cues that direct attention to the self, is likely to yield impressive gains in students' performance. (p. 178)

This element of teaching and learning lends itself to scaffolding and cuing and helps to create a more rich and supportive teaching environment to maximize learning potential. The following section will discuss the use of scaffolding in the classroom and how the framework of scaffolding can be applied while incorporating cuing and feedback strategies in an effort to enhance student learning.

Scaffolding

Cuing and feedback are effective instructional strategies when applied skillfully to student learning. Use of these strategies can be applied within the framework of scaffolding. Scaffolding is an effective instructional method to guide students in their learning of new ideas and concepts (van de Pol, Volman, & Beishuizen, 2010, 2011). By meeting students at their own level of knowledge, teachers assist students in moving to the next level of understanding. For the purposes of this research, the definition of scaffolding provided by van de Pol, et al. (2010) is used. Scaffolding is a teacher-student interaction in which the teacher applies strategies for learning that are contingent upon student responses, fades support over time, and as a result transfers the responsibility from teacher to student for completing a particular task.

Historically scaffolds have been linked to the socio-cultural theory of Vygotsky (1978) which includes the Zone of Proximal Development (ZPD) learning model. Vygotsky theorized that children develop thinking and reasoning skills through social interactions just as they do any other skill, such as language, behaviors, and preferences. These skills are first learned socially and then learned psychologically, as the skills are internalized for deeper understanding and meaning. The ZPD model to learn these skills is defined as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). Emphasis is placed upon learning through social interactions, specifically between child and parent. Vygotsky believed that if a parent interacted with his/her child at a level that was neither too hard nor too easy for the child and systematically gave the child new information in a supportive manner, learning would occur. Vygotsky described the ZPD as the instructional level at which a child is neither too frustrated nor too under challenged and which allows for engagement in learning.

While Vygotsky did not use the term *scaffold* or *scaffolding* in his work, Wood, Bruner, and Ross (1976) introduced this term. Often discussed in the literature as an accurate metaphor, scaffolding was used to best describe how to engage a child in the ZPD to enhance learning. Wood, et al. (1976) suggested that use of the scaffolding model "enables a child or novice to solve a problem, carry out a task, or achieve a goal which would be beyond his unassisted efforts" (p. 90). Cazden (1979, Cited in van de Pol, et al., 2010) suggested Vygotsky's theory be expanded from parent-child interactions, to teacher-student interactions, thus shifting this method of teaching into the realm of schools. Stone (1993) stressed the idea that scaffolding is not a teaching method in which the student is passive. Both the teacher and student learn from each other, creating an interactive dialogue in which both parties are actively engaged.

Van de Pol, Volman, and Beishuizen (2010) completed a synthesis of the literature from the past decade that discussed scaffolding. But while their meta-analysis concluded that scaffolding is an effective teaching method, some literature stated the contrary. Critics of scaffolding suggested that this method has been too broadly applied in the educational and psychological research. Pea (2004) argued the definition of scaffolding is so broad it has lost its significance. Puntambekar and Hubscher (2005) claimed that scaffolding has become synonymous with instructional support and has lost its true meaning. Stone (1998a, 1998b) contended that some researchers have removed the idea of scaffolding from its original context of being a process involving student-teacher interaction, to that of a teacher-directed instructional strategy.

Van de Pol, et al. (2010) discussed overall findings in their meta-analysis. The first is scaffolding as an effective instructional method (Cole, 2006; Hogan & Presley, 1997; Pawan, 2008). However, scaffolding is mostly discussed in the research as it applies to literacy. Studies are predominantly conducted in one-to-one and small group instructional settings with very simple, straightforward tasks. Recommended future research to be conducted in large group, classroom settings within a variety of tasks and subjects could help to answer critics and enhance the method.

Problematic as well is that there was no true consensus regarding the definition of scaffolding. Van de Pol, et al. (2010) stressed that scaffolding must consist of three parts: contingency teaching, fading, and transfer of responsibility. Incorporating these three elements, scaffolding is described as a method of engaging in teacher-student interaction in which the teacher applies strategies for learning that are contingent on student responses, gradually removes (fades) support over time, and as a result, transfers the responsibility from teacher to student for completing a particular task. Three elements are claimed to work interdependently and are necessary for scaffolding to be faithfully implemented in the classroom (Many, Dewberry, Taylor, & Coady, 2009; Murphy & Messer, 2000; Pratt & Savoy-Levine, 1998; Wood, Wood, & Middleton, 1978).

Frey and Fisher (2010) attempted to define scaffolding by observing teachers as they checked for understanding in their classrooms and identified the prompts and cues offered during instruction. Teachers exhibited four distinct and observable behaviors when they used scaffolding with their students. These behaviors included "using questions to check for understanding, prompting cognitive and meta-cognitive work, cues to focus the learner's attention, and direct explanations or modeling when the learner continued to struggle" (p. 86). While Frey and Fisher (2010) could describe what scaffolding looked like, a systematic method of how to implement scaffolding has not been defined in the literature.

Van de Pol, et al. (2010) noted further that some research has equated scaffolding to implementing the teaching strategies of modeling and questioning. Van de Pol, et al. (2010) warned that while those teaching strategies may be useful in the classroom, they do not include the three required components of contingency, fading, and transfer of responsibility. While talented teachers have been observed to instinctively use scaffolding in their teaching, they report not having the words to describe what they did nor a clear definition of the steps involved in the process (Frey & Fisher, 2010). The lack of a systematic approach to use scaffolding in classrooms poses a challenge for lesser skilled teachers when attempting to learn the method (Lesley, Hamman, Olivarez, Burton, & Griffith, 2009). These problems lead to misrepresentation of what scaffolding is, and how to implement it effectively.

The research of Tharp and Gallimore (1988) and Wood, et al. (1976) produced two classifications of scaffolding: means and intention. Tharp and Gallimore (1988) identified "six means of assisting performance: modeling, contingency management, feeding back, instruction, questioning, and cognitive structuring" (Cited in van de Pol, et al., 2010, p. 276). Wood, et al. (1976) identified "six scaffolding functions: recruitment, reduction of degrees of freedom, direction maintenance, marking critical features, frustration control, and demonstration" (Cited in van de Pol, et al., 2010, p. 276). The six means of assisting performance were described as the ways scaffolding can be carried out. The six scaffolding functions were described as the intentional outcome of using scaffolding. Van de Pol, et al. (2011) concluded that scaffolding is any combination of means and intention that are used in an interactive exchange between student and teacher and which include the three elements of contingency, fading, and transfer of responsibility to the student.

Based on the work of Tharp and Gallimore (1988) and Wood, et al. (1976); van de Pol, et al. (2011) developed a three-step method to carry out contingency teaching. The three-steps were: (1) use of diagnostic strategies (questioning and reading student work to gather information); (2) checking diagnostic information through questioning thereby clarifying what the student relayed to teacher; and (3) contingent intervention strategies (altering teaching and providing support to meet the student at his/her level of understanding through such techniques as feedback, hints, instruction, explaining, modeling, and questioning, among others).

Van de Pol, et al. (2011) sought to investigate the process of scaffolding in a classroom setting with specific focus on the use of contingency. In an attempt to measure the use of scaffolding, a coding scheme was developed which revealed different patterns of contingent and non-contingent teaching among teachers. Three Social Studies teachers were observed teaching in large group, small group, and one-to-one instruction. Results revealed little contingent teaching across all three teaching situations. Van de Pol, et al. (2011) explained,

> For contingent teaching, the teacher can utilize several tools such as diagnostic strategies and various intervention strategies. Ongoing diagnosis as an element of scaffolding allows the teacher to teach contingently (Puntambekar & Hubscher, 2005). This phenomenon was already mentioned by Dewey (1900) who argued that the diagnosis of a child's capacities should provide the starting point for instruction. Such diagnosis should thus determine the type and level of support to be provided by the teacher. (p. 2)

Shepard (2005) linked the method of scaffolding to formative assessment. In so doing she stressed that diagnostic information (what does the student know/does not know) should be obtained as well as utilized to drive instruction. Formative assessment becomes an effective means through which one gains insight about the student's level of knowledge and gears instruction to specifically meet that student's needs. In and of itself that process becomes a collaborative process to determine the level of understanding, learning expectations, and the best means by which to improve outcomes. Closely aligned to scaffolding, such formative assessment can be used to encourage learning in the ZPD.

Ruiz-Primo and Frutak (2006, 2007) investigated scaffolding during whole-class instruction. They discovered that teachers were capable of gathering diagnostic information, but demonstrated difficulty in applying that diagnostic information to the intervention strategies required to support students. Nathan and Kim (2009) reported the mathematics teacher who participated in their study demonstrated no adjustment in instruction to the level of the student more than fifty percent of the time when teaching in whole-class, small-group, and one-to-one settings. Elbers, Hajer, Jonkers, Koole, and Prenger (2008, Cited in van de Pol, et al. 2011) and Lockhorst, van Oers, and Wubbels (2006) reported they observed no evidence of the teacher gathering diagnostic information in the observed teacher-student interactions. In Oh (2005) and Myhill and Warren (2005) evidence of scaffolding was scarce. Myhill and Warren (2005) tried to explain this result with the claim that when a teacher has to attend to 30 students at one time, contingent teaching became difficult.

Evident from the literature scaffolding is accepted as an effective teaching strategy. Teachers are aware of the method, but are unable to identify teaching behaviors that best encompass the elements of scaffolding. Teachers who are observed using scaffolding cannot explain the method nor have a systematic means to teach that method to less successful teachers. The literature suggests there is lack of congruency when attempting to define scaffolding, measure scaffolding, and utilize scaffolding as it applies to classroom instruction (Frey & Fisher, 2010; van de Pol, et al., 2010, 2011). Van de Pol (2010) encouraged future research in all aspects of scaffolding with specific attention to be paid to student outcomes as they relate to the implementation of scaffolding.

Within the framework of scaffolding wait time can be applied to student-teacher interactions. Wait time allows for greater processing time for the student resulting in increased participation and more accurate understanding of information. The following section will discuss wait time in detail offering an overview of the literature, discuss efficacy of use, and expected outcomes when applied skillfully.

Wait Time

The instructional strategies of cuing, feedback, and scaffolding have been discussed in detail. The instructional strategy of wait time can be readily applied to student-teacher interactions within the framework of scaffolding, while providing cuing and feedback. Wait time is an instructional strategy that has been identified and studied for many years (Atwood & Wilen, 1991; Rowe, 1974, 1987; Tobin, 1987). Rowe's (1974) general description of wait time included allowing students several seconds to formulate an answer to a question before being called upon to answer. This element of pause was thought to help students process information more thoroughly, give students who were not as quick as their peers an opportunity to formulate an answer, improve attention to task, and increase student participation.

Rowe's (1974) study of wait time analyzed 200 recordings of science instruction in suburban, urban, and rural classrooms. While the science curricula varied among the classrooms, one congruent aspect of instruction was the amount of wait time provided to students following a question. With the exception of three out of two hundred recordings, the average wait time allowed to students following a direct question was one second. When a response was not elicited within that one-second period of time, teachers generally repeated the question, or called on another student to answer the question. When a response was elicited, teachers waited an average of 0.9 seconds before commenting, asking another question, or switching topic.

Analysis of the three classrooms that used a greater amount of wait time was measured to be in excess of slightly more than three seconds. Evidence of classroom discussion included speculation, rich conversation, alternative explanations, and arguments regarding the presented topic. Inquiry learning was more evident in these classrooms. Rowe stated that the only identified difference in these classrooms was use of wait time.

Continuing to investigate this phenomenon, Rowe asked teachers to identify the five highest performing students and the five lowest performing students in their class. When wait time was analyzed with specific reference to these students, the top five performing students received an average of approximately two seconds to answer a question, while the lowest performing students received an average of 0.9 seconds to answer a question. Rowe suggested teacher expectation patterns placed lower performing students at an unfair disadvantage. "Teachers unconsciously act in such a way as to confirm their expectations" (Rowe, 1974, p. 3).

Rowe also observed changes in student and teacher behavior when teachers were instructed to use a wait time of at least three seconds or more. Observations of student behaviors were made (Rowe, 1978):

> The length of student responses increased, the number of unsolicited but appropriate student responses increased, failures to respond decreased, confidence, as reflected in fewer inflected responses, increased, the incidence of speculative thinking increased, teacher-centered show and tell decreased and student-student comparing increased, more evidence of inference statements, and the number of questions asked by children increased and the number of experiments they proposed increased, 'slow' student contributions increased. (p. 7-8)

Likewise, observations of teacher behaviors were made:

> Teachers exhibited greater response flexibility as indicated by the occurrence of fewer discourse errors, the total number of questions asked by the teacher decreased as student discourse increased, question variability increased, and teacher expectations for performance of certain children seemed to change. (p. 9)

Rowe suggested this system of wait-time was a dynamic relationship between teacher and student, as evidenced by changed behavior of both parties.

Tobin (1987) found similar results to Rowe's research. His meta-analysis reviewed studies involving wait time in various subject areas and grade levels across elementary, middle, and high school. When teachers allowed an average wait time of more than 3 seconds, positive changes in teacher and student discussions were observed and higher cognitive level achievement was obtained in elementary, middle, and high school science, as well as middle school mathematics. Tobin concluded wait time is one variable that facilitates higher cognitive level learning as it provides opportunity for teachers and students to think.

Stahl (1990) suggested the term "think time" over the term "wait time" for three reasons. The primary academic purpose for delay in response is for both the teacher and students to think. Moments of silence that last for more than three seconds are important at times other than question-answer tasks. And third, concept of "impact pause-time" allows for a silent time of less than three seconds. Stahl suggested that while the research concluded using at least a three second wait-time was the apparent threshold for observable positive change in teacher and student behaviors; it does not suggest that "2.9 seconds is bad, while 3 seconds is good, and 5.3 seconds of silence is even better" (Stahl, 1994, p. 2). Stahl stressed it is not the presence of wait time that is important, but that the wait time is provided in a manner that is beneficial to all students.

Stahl (1994) has identified eight categories of periods of silence. These categories fall under the overarching concept of think-time,

- Post-Teacher Question Wait-Time. The typical teacher pauses, on the average, between 0.7 and 1.4 seconds after his/her questions before continuing to talk or permitting a student to respond. When teachers perceive a student as being slow or unable to answer, this period of time is frequently less than .7 seconds. Post-teacher question wait-time occurs when a period of 3 or more seconds of uninterrupted silence follows a teacher's question, so that students have sufficient uninterrupted time to first consider and then respond to the query. To be most effective, this period of silence should follow a clear, well-structured question with the cues students need to construct adequate answers. Conversely, extended periods of silence following imprecise questions tend to increase the confusion, heighten the frustration, and lead to no response at all.
- Within-Student's Response Pause-Time. Within-student's response pause-time occurs as a student pauses or hesitates during a previously started response or explanation for up to or more than 3 seconds of uninterrupted silence, before continuing his/her answer. By definition, no one except the student making the initial statement can interrupt this period of silence. The student may or may not need or take the full

3 seconds, or he/she may need more than 3 seconds; it is up to the student to make this decision. Having an opportunity for sufficient time to finish their previously started answers is an uncommon occurrence for students. The widespread practice is for teachers to interrupt or cut students off from completing their responses, especially when the pauses are beyond .5 seconds. Students often follow these periods of silence by volunteering, without teacher prompts, information that is usually sought by the teacher.

- Post-Student's Response Wait-Time. This 3 or more seconds of uninterrupted silence occurs after a student has completed a response and while other students are considering volunteering their reactions, comments, or answers. This period allows other students time to think about what has been said and to decide whether they want to say something of their own. If students are to interact with one another during academic discussions, they must be given the time needed to consider one another's responses so that they can have dialogue among themselves.
- Student Pause-Time. Student pause-time occurs when students pause or hesitate during a self-initiated question, comment, or statement for 3 or more seconds of uninterrupted silence before finishing their self-initiated statements. By definition, no one except the student making the initial statement can interrupt this period of silence. The student

may or may not need or take the full 3 seconds or may need more than 3 seconds. It is up to the student to make this decision.

- Teacher Pause-Time. Teacher pause-time, which occurs at a variety of places during a class period, is characterized by a 3 or more second period of uninterrupted silence that teachers deliberately take to consider what just took place, what the present situation is, and what their next statements or behaviors could and should be. One example of when the 3 seconds or longer of reflective thought would be beneficial for the teacher--and eventually students--after a student has asked a question that requires more than an immediate, short recall answer. Other examples are when students have asked for further clarifications, clearer explanations, or better examples than those already provided.
- Within-Teacher Presentation Pause-Time. Within-teacher presentation pause-time occurs during lecture presentations or other extended information input periods, when teachers deliberately stop the flow of information and give students 3 or more seconds of uninterrupted silence to process the just-presented information. These pauses allow students time to consolidate their thinking, with no request of them to follow with a public response. In effect, this period of silence provides students uninterrupted time to momentarily consider the information of the teacher's presentation in smaller, "bite-sized" chunks, rather than all at once.

- Student Task-Completion Work-Time. Student task-completion work-time occurs when a period of 3-5 seconds; several seconds (e.g. 15, 20, 30, or 90); or 2 or more minutes of uninterrupted silence is provided for students to remain on-task. This period allows students to complete a short or lengthy academic task that demands their undivided attention. Each period of uninterrupted silence should be appropriate to the length of time students need to complete the particular task.
- Impact Pause-Time. Impact pause-time occurs when the most dramatic way to focus attention at a given time is to provide a period of uninterrupted silence. Impact pause-time may continue for less than 3 seconds or far longer periods, up through several minutes, depending upon the time needed for targeted cognitive or affective impacts. One example of a desired result is creation of a particular mood or affective environment, such as when sudden silence may generate a feeling or mood of anticipation, expectation, drama, suspense, or uncertainty. Another example is providing time for students to consider and internally respond to the rhetorical question before continuing with additional information or activity. (p. 2 – 4)

Stahl suggested that the skilled use of think-time in the eight scenarios described above will result in "significantly improved teaching and learning in the classroom" (Stahl, 1994, p. 4).

According to the literature wait time, as well as the concept of think-time, have positive outcomes in the classroom for both teachers and student. Marzano (2007) encouraged use of wait-time in his book, *The Art and Science of Teaching,* as a relatively simple research-based instructional strategy to increase student attention during classroom instruction. The review of literature did not yield any research that referenced negative outcomes from implementation of wait-time or think-time.

The instructional strategy of verbal praise can be implemented like wait time within the framework of scaffolding, cuing, and feedback. Unlike wait time, however, the review of literature yielded evidence of both positive and negative outcomes for the instructional strategy of verbal praise. The following section will discuss the historical use of verbal praise and more recent literature that strongly cautioned the use of verbal praise when it did not hold specific feedback related to student learning and achievement.

Verbal Praise

Within the framework of scaffolding, cuing, and feedback, multiple instructional strategies can be employed to support student learning. Along with wait time is the instructional strategy of verbal praise. Verbal praise is a method of reinforcement that teachers have historically used during instruction. It is not uncommon to walk into a classroom and hear a teacher say, “Nice job!” or “Good try!” As teachers work to scaffold a child to higher levels of academic achievement, and provide cuing strategies to elicit correct answers or behaviors to tasks, praise is often employed as a method to keep a student motivated when challenged. However, researchers have reported inconsistent findings regarding the effectiveness and impact verbal praise has on student achievement (Hattie, 2009, 2012; Marzano, 2007).

Willis (2007) suggested verbal praise be “specific to the tasks or goals that students achieve…Sincere praise is also more constructive than extrinsic rewards, which can reduce intrinsic motivation and interfere with the development of a true joy of learning" (p. 78-79). Those comments were paralleled in the work of Brophy, (1981), Dean, Hubbell, Pitler, and Stone (2012), Hattie (2009, 2012), Jensen (2008), and Marzano, et al. (2001). The literature agreed that while verbal praise can have a positive impact for a student the type of praise given, how it is given, and when it is given is likely to impact the degree of benefit.

Hattie (2012) discussed verbal praise within the context of feedback. Recall that there are four levels of feedback that are critical to the learning process (Hattie & Timperley, 2007). These four levels include: "feedback about the task, feedback about processing the task, feedback about self-regulation, and feedback about the self as a person" (p. 90). It is the fourth level of feedback that is related to the "self" versus the actual task. Hattie (2009) warned that feedback about the self offers marginal positive effect as a form of feedback. Feedback about "self" is provided with such comments as, "Excellent thought!" and "Good job!" which are empty comments of praise and carry little specific feedback information. Because these comments are related to the task but offer no specific direction feedback related to "self" is not as effective as the other three levels of feedback. Hattie and Timperley (2007) explained that feedback about the task helps increase learning in strategy processing, whereas feedback about the process and feedback about self-regulation increase processing and mastery of tasks.

Marzano (2007) reported effect sizes for reinforcing effort, verbal praise, and rewards. Reinforcing effort was defined as helping students recognize the link between their level of effort and their level of success at a particular task. Effect sizes were all positive, ranging from 0.54 – 2.14. Marzano commented that the use of formative assessments may enhance this effect as students are provided with the opportunity to track their improvements over time.

Verbal Praise, as reviewed by Marzano (2007), included two synthesis studies, which provided varied definitions of verbal praise. Effect sizes ranged from 0.16 (Wilkinson, 1981) to 0.54 (Bloom, 1976). This broad range of effect size was contributed to the non-specific definition of what constituted verbal praise.

Merrett and Thorpe (1996) investigated the importance of the praise step in the *Pause, Prompt, and Praise* tutoring procedure discussed previously in this chapter. Three groups of students were used for the study. The first experimental group received the tutoring procedure as designed, with all three steps in place. The second experimental group received the tutoring procedure without the implementation of the praise step. The third group was a control group that received no treatment but was included in the study for comparison. When pre- and post- measures of reading level were assessed, it was evident that praise was a highly significant factor for improving reading skills. Students who received praise made greater gains than those that did not receive praise or those who did not receive any treatment.

Rowe (1972) focused primarily on wait time in her study and commented on the use of verbal praise in the classroom. An unexpected observation revealed that teachers provided more “overt verbal praise” (p. 3) to children who were ranked as the lowest-performing students, as compared to the highest-performing students, who received fewer verbal comments. The type of praise differed as well. The highest-performing students received comments that were “more pertinent to the responses made by the children” (p. 3) with the lowest-performing students receiving “far more ambiguous comments” (p. 3) that included negative comments as well. In summary Rowe observed, “It seemed that teachers rewarded the top groups for correct responses but they rewarded the bottom groups for both correct and incorrect responses” (p. 3). And with regard to praise and reward Rowe (1972) concluded:

- Rewarded behavior may function as an attempt to encourage participation;
- Teacher expectation patterns develop early on in a student-teacher relationship;
- Teachers unconsciously act according to their expectations for a student;
- Exploratory and inquiry learning requires a safe environment;
- Judgments by teachers may undermine student risk taking in the classroom;
- Teachers should preserve the “right to be wrong” to encourage students to take risks in learning and exploring;
- Intrinsic reward is more valuable than extrinsic reward;
- Reward schedules should be low in frequency as so not to undermine confidence and become distractors in learning; and
- External rewards and praise might deter group learning and the sharing of ideas, as successful work may be credited to the wrong student. (p. 2-3)

Marzano (2007) reviewed literature on rewards, as well. Reported effect sizes ranged from -.24 to 0.21. Studies that used rewards for free-choice behavior (students engaged in tasks strictly for the reward) had effect sizes below zero compared to studies that used tasks and were high interest for the student that showed the task itself to be the intrinsic reward yielding positive effects.

Marzano (2007) further reviewed the literature to determine trends when abstract (verbal) versus tangible rewards were used. Effect sizes ranged from -.34 to 0.45. Verbal rewards yielded higher effects than tangible rewards.

Hattie (2012) commented that intrinsic motivation is more valuable than extrinsic motivation or rewards for enhancing learning experiences. "Too much external motivation can lead to shallow learning of the surface features, completion of work regardless of the standard, and completing work for the sake of praise or similar rewards" (p. 42). Hattie (2012) advised teachers to keep praise and feedback separate.

Praise, as Hattie (2012) explained, differs from feedback. Praise offers "little task-related information and is rarely converted into more engagement, commitment to the learning goals, enhanced self-efficacy, or understanding about the task" (p. 120). It was suggested that praise actually undermines the learning process as it dilutes the learned information. Kessels, Warner, Holle, and Hannover (2008, Cited in Hattie, 2012) studied the effects of student learning when feedback was provided with and without praise. Findings suggested feedback paired with praise resulted in lower student engagement and effort. While the findings may appear to be counterintuitive, Hattie (2012) concluded in his review that "praise included little information about performance on the task and praise provides little help in answering the three feedback questions" (p. 121).

Kamins and Dweck (1999) researched differences in praising a child as a whole;

for example “You are a smart boy!” versus praising a child’s effort “You are working hard!” The effects of each praise type upon learning and achievement were reported as zero. Effects were noted to be negative when praise was offered even if a student did not understand information or was demonstrating risk of failure. Hyland and Hyland (2001, 2006; cited in Hattie, 2012) observed that approximately half of teacher feedback consisted of praise. When praise did not coincide with a student’s performance the praise caused confusion for the student and limited further attempts to improve his/her performance on a task. Frequently, teachers paired praise with constructive criticism for the intention of reducing the potential that students would view the comment as being negative. The result was dilution of the feedback. Research by Skipper and Douglas (2011) suggested that use of praise when children are not successful promoted a sense of learned helplessness.

Hattie (2012) commented that although the literature does not support the use of praise for the purposes of enhancing student achievement praise helps create positive student-teacher relationships that improve esteem when earned. Praise should be utilized to create a classroom culture that welcomes a child, but when learning objectives need to be met, the use of feedback has the power to make a measurable difference.

Despite the variability in research outcomes, the research generally agreed that verbal praise (positive comments and acknowledgment of learning) may help create a positive classroom culture that fosters a sense of safety and encouragement (Marzano, 2007). Positive environment contributes to increasing the learning and memory skills of students as reported by Abdeleal, 2008; Brookhart, 2008; Jensen, 2005, 2008; Marzano, 2007; Sousa, 2010; Sousa and Tomlinson, 2011; Willis, 2006, 2007, 2008; and Wolfe, 2010.

Willis (2006) reported that recent studies on praise and intrinsic motivation "revealed that effective teacher recognition has positive correlation to student motivation as measured by the brain's dopamine-reward cycle on scans and neurochemical analysis. Therefore, effective praise is a useful tool in motivating student effort and achievement" (p. 98). She further asserted praise should be predictable (set expectations as to how and when praise will happen), specific to the task or behavior observed, be relative to the student's work rather than comparative to his/her peers, and specifically acknowledge the level of the student's effort in relation to achievement. These guidelines paralleled the work of Brophy (1981) and Dean, et al. (2012).

Given this review of literature it would stand to reason that while praise may not be responsible for enhancing learning, and at times may be detrimental to the learning process, praise does in fact promote a positive learning environment. The creation of a praise filled environment has a direct effect upon the ease with which students will access learning opportunities and take risks necessary to achieve. Sylwester (1997) suggested that positive feedback and social interactions have a dynamic influence on brain chemistry which is critical for elevating self-esteem and building a positive sense of self. And from the earlier review of neuroscience research, a positive environment is required for the brain to maintain optimal learning. With judicious use, it is concluded that verbal praise can enhance the learning experience for a student.

The review of literature suggested the instructional strategies of cuing, feedback, scaffolding, wait time, and praise when skillfully applied can support student learning and enhance achievement outcomes. In an effort to better support all students in learning, Response to Intervention (RTI) was developed and applied to classroom instruction across the nation. The instructional strategies presented in this literature review can be employed within the model of RTI. The following section will review the historical development of RTI, application in the classroom, and effect on learning outcomes when used efficaciously.

Response to Intervention

The application of cuing, feedback, scaffolding, wait time, and praise can be incorporated and readily used within the framework of Response to Intervention (RTI). In recent years, Response to Intervention (RTI) has become a central focus for many educators. Whitten, Esteves, and Woodrow (2009) define RTI as "…a multi-tiered instruction model designed to promote school success for all learners" (p. 1). More than ten years of research has provided compelling evidence that RTI is an effective means by which all students' learning could be monitored and supported (Batsche, Elliott, Graden, Grimes, Kovaleski, Prasse, Reschly, Schrag, & Tilly 2005, Bender & Shores, 2007; Burns, Appleton, & Stehouwer, 2005; Fuchs & Fuchs, 2006; Hughes & Dexter, 2009).

RTI gained popularity in 2001 when the President's Commission on Excellence in Special Education issued a report that called for an alternative means by which children with disabilities were identified. That same year the National Summit on Learning Disabilities introduced RTI as a more effective process to detect learning disabilities when compared to the popularly used discrepancy model (Whitten, et al., 2009). Although RTI was initially linked to the special education process, it has become an integral part of the general education framework.

Historically, the special education testing and eligibility process used a discrepancy model to identify learning disabilities in students. The method of determining eligibility required evidence of a statistically significant difference between expected performance using Intelligence Quotient (IQ) and actual performance as measured by current level of academic achievement (Meyer, 2000). If a significant gap (at least 1.5 standard deviations below the norm) between the two measures was present, the student would become eligible for services and identified as possessing a learning disability. If a gap was not present the "wait and see" approach was taken in the hope that the child would "catch-up" to his/her peers. However, too often, the child continued to fall behind and the achievement gap became great enough in terms of statistical significant that he/she eventually qualified for services. The wait-to-fail method took months or even years during which valuable time was lost, the gap became overwhelmingly wide, and remediation success rates were low. The student displayed feelings of inadequacy and failure that led to poor self-esteem, depression, and lack of interest in learning (Buffum, Mattos, & Weber, 2010; Fisher & Frey, 2010a; Whitten, et al., 2009).

RTI was referenced in 2004 with the reauthorization of the Individuals with Disabilities Education Improvement Act (IDEIA) as an assessment and intervention process that would enable schools to provide effective education to all students. Although RTI emerged from special education legislation, it is a general education classroom initiative (Whitten, et al., 2009). RTI is a method designed to provide continuous progress monitoring for all students with the intent of identifying struggling students early in the learning process. Once a student is identified as not meeting learning targets, systematic and targeted interventions can be provided for the purpose of preventing an achievement gap. Teachers make informed decisions about the educational needs of students and monitor the effectiveness of support strategies. Only when these support strategies fail to produce results is the child referred for special education testing to rule-out or determine the presence of a learning disability (Fisher & Frey, 2010a).

RTI stresses the importance of meeting the needs of each individual student. Buffum, Mattos, and Weber (2010) created an effective learning and teaching formula: Targeted Instruction + Time = Learning (p. 14). They define Targeted Instruction as, "teaching practices designed to meet his or her individual learning needs" (p. 14). The inclusion of "Time" recognizes that all students learn at their own individual pace. When offered the combination with additional support and increased time, rigorous learning can occur. RTI yields similar results.

The definition of RTI frequently includes the term *multi-tiered instruction model*, because the framework of RTI includes the use of three tiers or levels of instruction and intervention for students (Figure 1). What follows are definitions of Instructional Tiers provided by Whitten, et al., (2009):

> Tier I: High-quality classroom instruction using research-based programs and instructional methods, universal screening a minimum of three times per year;
>
> Tier II: Focused supplemental instruction in small groups, research-based interventions targeted at specific strengths and needs, progress monitoring; and
>
> Tier III: Intensive interventions specifically designed to meet individual needs, instruction delivered in small groups or individually, frequent

progress monitoring. (p. 2)

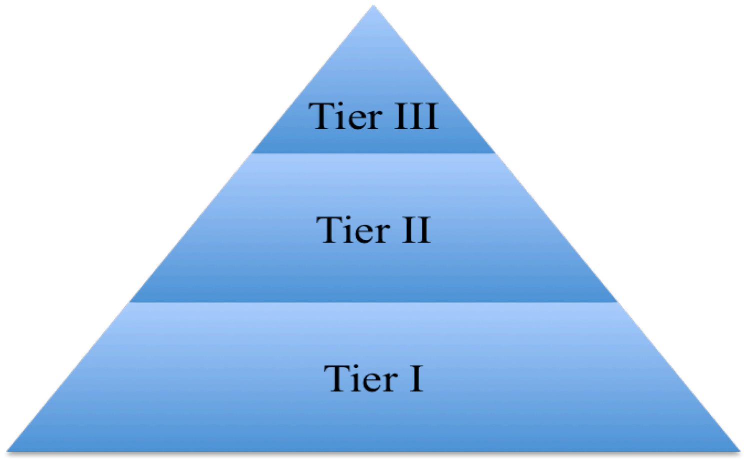


Figure 1. RTI Framework.

By utilizing the multi-tiered model, students are systematically placed in the relevant tier to meet individual education needs and support academic learning. Essentially RTI is a framework that scaffolds student learning and offers enhanced support as needed. Because children can move up and down the tiers based on their needs, a gradual release of support can be achieved. At all levels student learning is monitored through the use of formative assessments. All students in a classroom receive the support of Tier I (research-based learning strategies), with Tier II (increased duration and frequency of instruction), and Tier III (individualized, intensive teaching) reserved for students who require more intensive support. When a lack of learning at the Tier I level is identified, students are placed in Tier II. If strategies at this tier are unsuccessful, they are offered Tier III services. Small group differentiated instruction can be provided in a timely and structured manner at these levels. When students continue to produce unsatisfactory results after the three levels are utilized they are often referred for special education testing.

Use of RTI has been positively linked to early identification of learning difficulty, designing instruction to meet the individual needs of students, using assessment to drive instruction, improvement in the quality of instruction, the creation of positive relationships within the classroom, and as a catalyst for school-wide collaboration among administrators, teachers, special education service providers, and other teaching staff (Whitten, et al., 2009). RTI can provide immediate support to students with frequent progress monitoring, thus preventing the development of an achievement gap. Students' needs are met with a sense of urgency and purpose resulting in rigorous student learning. In as much as RTI is a successful framework for supporting teaching, it is reasonable to suggest that evidence-based teaching strategies applied to the general education classroom as a Tier I level would support student achievement.

The use of instructional strategies within the framework of RTI can be successful when implemented skillfully. Ultimately it comes to the ability of the teacher to utilize these strategies, methods, and frameworks effectively in the classroom to enhance student learning. The following section will discuss the role of the teacher in creating situations that provide learning opportunities for students.

Summary: The Role of the Teacher

It is imperative that teachers understand and utilize instructional strategies appropriately to support and enhance student learning. The literature review has discussed the strategies of cuing, scaffolding, feedback, praise, and wait time. RTI has been discussed as a common framework in which teachers conduct large and small group instruction. However, without the skills of a knowledgeable teacher, use of these strategies and methods becomes futile. The following will discuss the role of the teacher in student learning.

Innovative teaching strategies are the key elements through which effective learning environments are created and sustained. DuFour and Marzano (2011) asserted, "schools can only be as good as the people within them" (p. 20). Quality instruction is one of the most important variables in student learning. Two meta-analyses (Hattie, 2009; Marzano, et al., 2001) investigated the factors that impact student achievement. Both meta-analyses concluded along with others that the quality of classroom instruction was the most important variable in student learning. Hattie (2009) warned, however, that although teachers do make a difference, this difference varies significantly between and among teachers. "Not all teachers are effective, not all teachers are experts, and not all teachers have powerful effects on students" (p. 34).

Chetty and Friedman (2011) have demonstrated how high value-added teachers can have an impact on students' lives that extends far beyond the time spent in the classrooms. With federal mandates and initiatives driving educational policy that demands annual improvement and proficient performance from students, it becomes the task of teachers and administrators to continually seek innovative, evidence-based teaching strategies that propel students to higher levels of learning.

Marzano (2007) stated "that there is not (nor will there ever be) a formula for effective teaching" (p. 4), and "research will never be able to identify instructional strategies that work with every student in every class" (p. 5). Marzano believes that research can inform a teacher in a way that allows the educator to select strategies that have a high probability of yielding maximum results, when employed at the right time, with the appropriate student. When teachers act as true practitioners of education, the needs of each individual student are assessed, identified, and treated. These elements of the teaching and learning process, when successfully orchestrated, create a safe and positive environment for students that is capable of scaffolding each student to higher levels of learning and achievement. This paradigm shift from the days of I taught it, but he just didn't get it to differentiating instruction through scaffolding, cuing, and feedback empowers teachers to be the primary catalyst for effective instruction. Marzano (2007) refers to this sequence as the art and science of teaching.

In determining how to best identify characteristics of a successful teacher, Lesley, Hamman, Olivarez, Button, and Griffith (2009) concluded that master teachers have an observable ability to skillfully guide students through the learning process using effective instructional strategies. Less skilled teachers, on the other hand, struggle to incorporate these strategies into their teaching practices. Thus teachers must be provided with an arsenal of tools that align to best practices and aims to help all students reach their potential. Research continues to substantiate the effort of educators to provide classroom instruction that is equally accessed by all students (Marzano, 2003, 2007; Marzano, et al., 2001; Hattie 2009, 2012; Stiggins, 2009; Whitten, et al., 2009; Fisher & Frey, 2010a; Frey & Fisher, 2010).

The review of literature has discussed a variety of elements that support and encourage student learning. Brain-based learning; the neurology of memory, storage, rehearsal, and recall; scaffolding; cuing; feedback; word storage and retrieval; wait-time; verbal praise, and a classroom culture that supports emotions and learning are crucial to educational success. Response to Intervention (RTI) was also discussed in an effort to better understand the instructional framework used to assist students through their learning.

The theories, methods, and strategies presented in this chapter support the notion that teaching is both an art and science. As the fields of medicine and education continue to inform each other, teachers will be more prepared to face the challenges associated with educating each child. While there is no one formula for success, a greater probability exists of enhancing learning when research and skillful teaching intersect in the classroom.

The next chapter, chapter three, will discuss the research methodology utilized in this study. The research design was based on the conceptual framework and purpose of the study presented in chapter one and literature review presented in chapter two. Research design, population and sampling techniques, instrumentation, measurement, validity and reliability, qualitative and quantitative data collection procedures, data analysis and hypothesis testing will be reviewed.

Chapter Three

Methods

The literature in chapter two presented the foundation for the creation of the D2 Cuing Method. Evidence-based research suggested the use of cuing, scaffolding, feedback, wait time, praise, and RTI would positively impact student achievement in the classrooms. The D2 Cuing Method incorporates these instructional strategies to apply language therapy techniques to the general education classroom in an effort to increase engaged learning and ultimately, student achievement.

Research was conducted to investigate the effectiveness of the D2 Cuing Method on student outcomes in the areas of reading, mathematics, social studies, and science in fourth and fifth grade classrooms. The effect of the D2 Cuing Method was assessed specific to the subgroups of children qualifying for free and reduced lunch, special education services, and gifted programming was assessed. This study determined if the D2 Cuing Method was more effective in the fourth or fifth grade and if it had greater effect in one subject area versus another. The purpose of this study was to document teacher perception regarding cuing methods and teaching strategies in the classroom. Specifically the teachers in the experimental group were asked to comment on the effectiveness of the D2 Cuing Method in his/her classroom across various curriculum subjects. Those teachers not trained in the D2 Cuing Method were asked to comment on the strategies they used in their classroom. In order to dissect and assess the D2 Cuing Method research design, population and sample, sampling procedures, instrumentation, data collection procedures, data analysis and hypothesis testing, as well as limitations are discussed in this chapter.

Research Design

When determining the research design of this study consideration was given to single-subject design, quantitative data collection only, and qualitative data collection only. The researcher determined use of a single-subject design would hold little weight for application to whole class instruction. Collection of quantitative data would determine impact of the D2 Cuing Method on student test scores, but would limit hypothesis testing for teacher perception and change in classroom culture. Collection of qualitative data would determine teacher perception of the D2 Cuing Method but limit hypothesis testing to determine statistically significant impact on student test scores and achievement. Therefore, a mixed-method research design was utilized for this study. By combining both quantitative and qualitative research data the strength of the research becomes greater than the quantitative or qualitative data alone (Creswell, 2009).

Quantitative research has been described as "a means for testing objective theories by examining the relationship among variables" (Creswell, 2009, p. 4). The quantitative component of this study consisted of a quasi-experimental research methodology pre-test - post-test design using an experimental group and control group. The experimental group was defined as those students who received classroom instruction in each of the four subjects with implementation of the D2 Cuing Method during large group instruction. The control group was defined as those students who received classroom instruction in each of the four subjects without use of the D2 Cuing Method.

Qualitative research has been described as "a means for exploring and understanding the meaning individuals or groups ascribe to a social or human problem"

(Creswell, 2009, p. 4). The qualitative component of this study consisted of a post-study interview of the four teachers who were trained in and implemented the D2 Cuing Method and the four teachers who were not trained in the D2 Cuing Method. For those teachers in the experimental group, the interview data was used to assess the teachers' perception of the effectiveness of the D2 Cuing Method. They were asked to share their opinions about the ease and convenience of using the method. The focus of the interview for the four teachers who were not trained in nor implemented the D2 Cuing Method was to determine the type of support these teachers gave to students when conducting question-answer interactions with students.

Population and Sample

With the collection of quantitative and qualitative information, population of study was considered. Students in elementary public school classrooms in the United States were the population of interest. However, since the logistics of conducting a study of that magnitude was not possible, a sample was selected to represent United States students enrolled in a diverse, public, urban elementary school.

The elementary schools for this study were part of an urban school district in Missouri consisting of approximately 11,400 students. This school district is referred to as District X. One-hundred seventy-five students participated in this research study. Specifically, the experimental group contained 83 students, with 92 students in the control group. The sample for this study was obtained from fourth and fifth grade classes in two elementary schools. These elementary schools were selected as they were comparatively equal in size and the student population profile was similar in each for socio-economic status, achievement, race, and grade levels contained in each building.

The experimental group consisted of two 4th grade classes and two 5th grade classes in School A. The control group was composed of two 4th grade classes and two 5th grade classes in School B (Table 2).

Table 2

Sample Size by School/Group, Grade, and Classroom

School/Group	Grade	Classroom	*N*
Experimental Group A	4	1	23
		2	23
	5	1	17
		2	20
Control Group B	4	1	24
		2	20
	5	1	23
		2	25

Sampling Procedures

The population for this study coincided with the researcher's access to District X. A purposive sampling technique was utilized to complete this study. As defined by Lunenburg and Irby (2008), purposive sampling is the process by which participants are selected based on the researcher's knowledge of the group. In the instance of this study the researcher had access to the fourth and fifth grade classes in District X. A sample size of at least 30 participants is determined to be sufficient for hypothesis testing that involves the sample mean assumptions to be met (Lunenburg and Irby, 2008). Given that each grade level consisted of only two classes and each class was made up of fewer than

30 students, at least four classrooms, for both the experimental and control groups, were required for adequate sampling.

Two elementary schools were utilized to ensure that teachers trained in the D2 Cuing Method would not influence untrained teachers. All fourth and fifth grade students actively enrolled in class by the fifth day of school, with an attendance rate of at least 80% were included in this study. Students who did not meet these criteria were not included. The selected fourth and fifth grade classrooms were defined as regular education classrooms, representing an urban public school classroom.

This research cohort of students provided a diverse population in that students came from general education, qualified for special education services, gifted programming, and free and reduced lunch status. Students who received special education services were defined as students who met Missouri eligibility criteria to qualify as a student with a disability. Special education students in the research cohort had to be placed in the regular education classroom at least 80% of the time. Students who qualified for free and reduced lunch were eligible for that benefit based on the criterion set in Public Law 111-296, the Healthy and Hunger-Free Kids Act of 2010. Cohort students in gifted programming were defined by criteria as set by District X: attained a score in the 95^{th} percentile on the Naglieri Nonverbal Ability Test – 2^{nd} edition (NNAT2), attained a score in the 95^{th} percentile on the Woodcock Johnson III Test of Achievement, and either qualified for the testing via referral and/or by a data analysis of grade-level achievement scores.

Instrumentation

Once the population sample was defined and selected instrumentation was determined for data collection purposes. Consideration was given to grade level, curriculum content, and School District X's assessment protocol. The reading, mathematics, social studies, and science curriculum taught at the elementary level is a Missouri State curriculum that was adopted by the School Board of Education at District X. A cadre or committee of elementary teachers developed teaching units based on state standards. This curriculum aligns to Missouri Grade Level Expectations (GLE), and the Missouri Show-Me Standards, which are the mandated teaching objects developed, monitored, and assessed by the Missouri Department of Elementary and Secondary Education (DESE, 2011).

Support documents were provided by District X for each core curriculum subject including quiz and test materials that aligned to the Missouri GLE and Missouri Show Me Standards. Test questions were derived from this material by the researcher to create the pre- and post-test measures. Use of this material was deemed appropriate as it aligned to the curriculum objectives (see Appendix A) and reduced the possibility of the bias associated with a teacher-created assessment. Additionally, the curriculum objectives were consistent between the two grade levels and elementary schools. Pre- and post-tests for both the 4th and 5th grades assessed identical curriculum objectives, however, test content was appropriate for each grade level.

A selected response (multiple-choice) format was used for assessment in all four subject areas. Pre- and post-test content was identical but the order of the questions was different for each. Order A was the pre-test and Order B was the post-test. The change in the order of the questions reduced the effect of test practice (Miller, Effeney, & Gough, 1993). Students did not receive their corrected tests, eliminating feedback on their test performance as a moderator variable.

Specific standards, assessment tasks, assessment timeline, and example test questions were established to standardize the instrumentation used in this study (see Appendix A). The table provided in Appendix A informed teachers of the Missouri Show Me Standard or GLE that was being assessed, the assessment task that would be conducted, the desired week that a pre- or post-test should be administered as it aligned to District X's curriculum calendar, and sample test questions. Use of the table helped ensure that experimental and control group teachers were teaching the appropriate standards and administering the pre- and post-tests at the appropriate times.

For the qualitative portion of the D2 Cuing Method study, teachers in the experimental and control groups were interviewed. Interview questions were developed (see Appendices B & J) utilizing the guidelines suggested by Creswell (2009). Questions were designed to be open ended, specific to the D2 Cuing Method study, and pin-point specific topics including use of instructional strategies, classroom culture, and the effectiveness of instructional strategies in large group instruction. Questions presented intended to elicit opinions and views from the teachers. Interview group size was limited, involving no more than 6-8 participants in a group to promote interactive dialogue (Creswell, 2009).

Measurement.

With consideration to the collected quantitative and qualitative data, measurement of the data had to be determined. For the quantitative portion of this study, pre- and post-test scores were obtained from the experimental and control group teachers to determine if significant growth had been made in the experimental and control group classrooms. A perfect test score was ten out of ten questions correct or 100%. The pre- and post-tests were comprised of test questions that were published in the *Buckle Down* test practice book series in the subjects of reading, science, and mathematics (Ham, 2008; Hamer 2007, 2008; Meyers, 2008a, 2008b; Smith, 2009; Wolfe, 2007). Test questions were chosen based on specific Missouri Show Me Standards and GLE's obtained from DESE (2011) that were taught during the first semester of the school year at District X in both the fourth and fifth grades.

The four core curriculum subjects of reading, mathematics, social studies, and science were assessed. Specific standards according to DESE (2011) were chosen for assessment. Reading assessment aligned to GLE R2C4 and R2C5 (DESE, 2011). The standard states a student will develop and apply skills and strategies to comprehend, analyze, and evaluate fiction, poetry, and drama from a variety of cultures and times. Mathematics assessment aligned to GLE N1C4 and N1C5 (DESE, 2011). The standard states a student will recognize equivalent representation for the same number and generate them by decomposing and composing numbers. Social Studies was assessed based on non-fiction reading skills, per the Missouri Show-Me Standards and Missouri GLE (DESE, 2011). Non-fiction reading is taught in District X as a skill within core curriculum classes. Social Studies assessment aligned to GLE R3C4 and R3C5 (DESE, 2011). The standard states a student will develop and apply skills and strategies to comprehend, analyze, and evaluate non-fiction from a variety of cultures and times. Science assessment aligned to Missouri GLE Strand 7 (DESE, 2011). The standard states a student's science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking.

For the qualitative portion of this study researcher-developed interview questions were asked of the teachers in the experimental group and in the control group in an interview format conducted by this researcher. These questions obtained descriptive information regarding the use of teaching strategies in the classroom during large group instruction involving question-answer interactions. For the experimental group, questions were asked to gain information on the perceived effectiveness of the professional development provided for the D2 Cuing Method, the effectiveness of the D2 Cuing Method in large group instruction, the ease of use during instruction, and the effect upon students as perceived by the teachers. Additionally, teachers were asked how the D2 Cuing Method compared to instructional strategies they regularly used, and how the D2 Cuing Method might fit in with their current instructional methods. Teachers' answers to these questions were important in the analysis of the overall effectiveness of the D2 Cuing Method, as teachers must value use of the D2 Cuing Method in order for it to be accepted and utilized. Answers to the interview questions helped explain the effect of the D2 Cuing Method on student achievement outcomes as measured by pre- and post-test scores.

Teachers in the control group were asked similar questions but not specific to the D2 Cuing Method as they did not learn the D2 Cuing Method. Questions focused on prior training in, use of, and efficacy of instructional strategies. Questions also focused on teachers describing which instructional strategies they used in large group instruction during question-answer interaction, the ease of use, and the perceived effect on students.

Questions were asked of both the experimental and control groups to determine if teachers felt successful when using these methods for instruction. This information was important for provision of a baseline about what teachers were doing. Likewise useful was to determine if control group teachers could identify specific instructional strategies. Debriefing was intended to determine if teachers generally felt successful in the classroom when guiding students in their learning.

Established was the collection of quantitative and qualitative data. Validity and reliability testing was required to better ensure valid results. The validity and reliability testing completed is discussed in the next sections.

Validity and Reliability.

Consideration was given to the means by which quantitative and qualitative data was collected in order to establish validity and reliability of the instrumentation. Validity and reliability of testing procedures must be established as a critically important means to validate or invalidate results (Lunenburg & Irby, 2008). According to Lunenburg and Irby (2008) "validity is the degree to which an instrument measures what it purports to measure. …Content validity is the degree to which an instrument measures an intended content area. …Content validity is determined by expert judgment" (p. 181). For the purpose of the D2 Cuing Method study, content validity was investigated for the pre- and post- tests administered to students and the interview questions asked of participating teachers for data collection.

Buckle Down Publishing was contacted to request validity and reliability data for the pre- and post-test questions that were selected as they aligned to the curriculum. A phone interview with the regional support manager on August 2, 2011 was conducted.

The interview revealed that Buckle Down Publishing had not established validity and reliability of their product. When asked to explain, Buckle Down personnel stated that because the curriculum series aligns 100% with state standards and the Missouri Assessment Program (MAP), the yearly update cycle does not make it possible to complete a reliability and validity study. The company representative claimed, however, that informal outcome measures have been favorable.

Despite lack of available formal reliability and validity testing, the *Buckle Down* series was utilized. Some teachers from District X have used this series of testing questions. The testing questions align to the MAP and it was common to both the fourth and fifth grades in both elementary schools. Use of this practice series was deemed appropriate.

Content validity was established for the qualitative interview questions. Five elementary teachers who were not participating in the study were given a brief description of the study, a list of the guiding interview questions, and a list of feedback questions regarding the interview questions (Appendix B). The five elementary teachers agreed 100% that these questions were easy to read and understood, could be answered by fourth and fifth grade teachers, aligned with the research study, and would target and elicit useful information. No suggestions were made for changes to the existing questions or for additional questions to be included. Given these results, content validity for the qualitative interview questions was established.

Completion of validity allowed for development of the implementation and data collection procedures for the D2 Cuing Method study. Detailed information will be provided in the next section about the three phases of implementation of the D2 Cuing

Method, professional development procedures, pre- and post-test administration procedures, and interview procedures.

Implementation and Data Collection Procedures

Once validity of testing procedures was established implementation and data collection procedures could be determined. In accordance to Baker University policy and procedure a Proposal for Research (Appendix C) was submitted to the Baker University Institutional Review Board (IRB) July 13, 2011. The research application was approved by the IRB under Expedited Review on September 21, 2001 (Appendix D). A Proposal for Research (Appendix E) was submitted to School District X on June 26, 2011, in accordance with set policy and procedures. School District X IRB granted approval for the research study on July 14, 2011 (Appendix E).

Both quantitative and qualitative data were collected for comparison of student achievement with teacher perception to better understand the impact of the D2 Cuing Method on student achievement. Collection of both qualitative and quantitative data was judged to be congruent with best practices for conducting research and would provide a multi-dimensional view of the D2 Cuing Method. Three phases of implementation were developed. They included: (1) pre-implementation phase, (2) implementation phase, and (3) post-implementation phase. The pre-implementation phase and implementation phase allowed for collection of quantitative data. The post-implementation phase allowed for collection of qualitative data. Procedures completed during each of these phases are described below.

Pre-Implementation Phase.

In August 2011, prior to the start of the school year, participating teachers signed an agreement (Appendix F) to participate in the study of the D2 Cuing Method. Contracted teachers agreed to follow the research project protocol and requirements for timely completion of project phases. Student anonymity was maintained by assigning a number to each student and was used throughout the study to refer to specific students. During the first week of school, participating teachers in the experimental and control groups were observed for a total of 20 minutes during large group instruction to ensure they were not using a cuing and scaffolding style of teaching that was identical to the D2 Cuing Method. Lack of use of instructional strategies that mirrored the D2 Cuing Method had to be established to ensure implementation of the D2 Cuing Method was the differentiating variable in instructional methods between the experimental and control groups.

Implementation Phase.

The teachers in the experimental group underwent a 60-minute professional development session in which the D2 Cuing Method was described, demonstrated, and practiced. Professional development materials were provided (see Appendix G and H). Experimental group teachers were required to use the D2 Cuing Method in the classroom during all large group instruction. Use of the 4x6 notecard as a guide was encouraged. Use of this notecard was intended to be employed as a reference to help teachers implement the D2 Cuing Method. The 4x6 notecard format was selected as it was practical and could be easily used during large group instruction activities. The D2 Cuing Method consisted of following the steps:

1. Teacher delivers classroom instruction;
2. Teacher asks a specific question and waits 3 seconds for an answer;

3. If answer is correct the teacher offers verbal praise;
4. If answer is incorrect the teacher starts at any level of the D2 Cuing Method and moves up and down the hierarchy as deemed appropriate. (Level 1 least amount of support/ Level 5 greatest amount of support);
5. Teacher continues to move through the hierarchy until a correct answer is elicited;
6. Once a correct answer is elicited the teacher restates the question and waits for a spontaneous, correct answer;
7. Teacher offers praise for the correct answer; and
8. Teacher cycles back into the instruction phase, or asks another question.

Experimental group teachers were instructed to start at the cuing level they believed was appropriate for the knowledge base of the child. The teacher was not required nor encouraged to start at level 1 and work up to level 5. Based upon the child's response to the cue the teacher moved through the cuing hierarchy (toward level 5) until the correct answer was elicited. The original question was asked again allowing the child to answer spontaneously, without benefit of a cue, demonstrating correct generation of the answer. Verbal praise was offered as reinforcement. See Figure 2 for a visual depiction of the D2 Cuing Method.

D2 Cuing Method

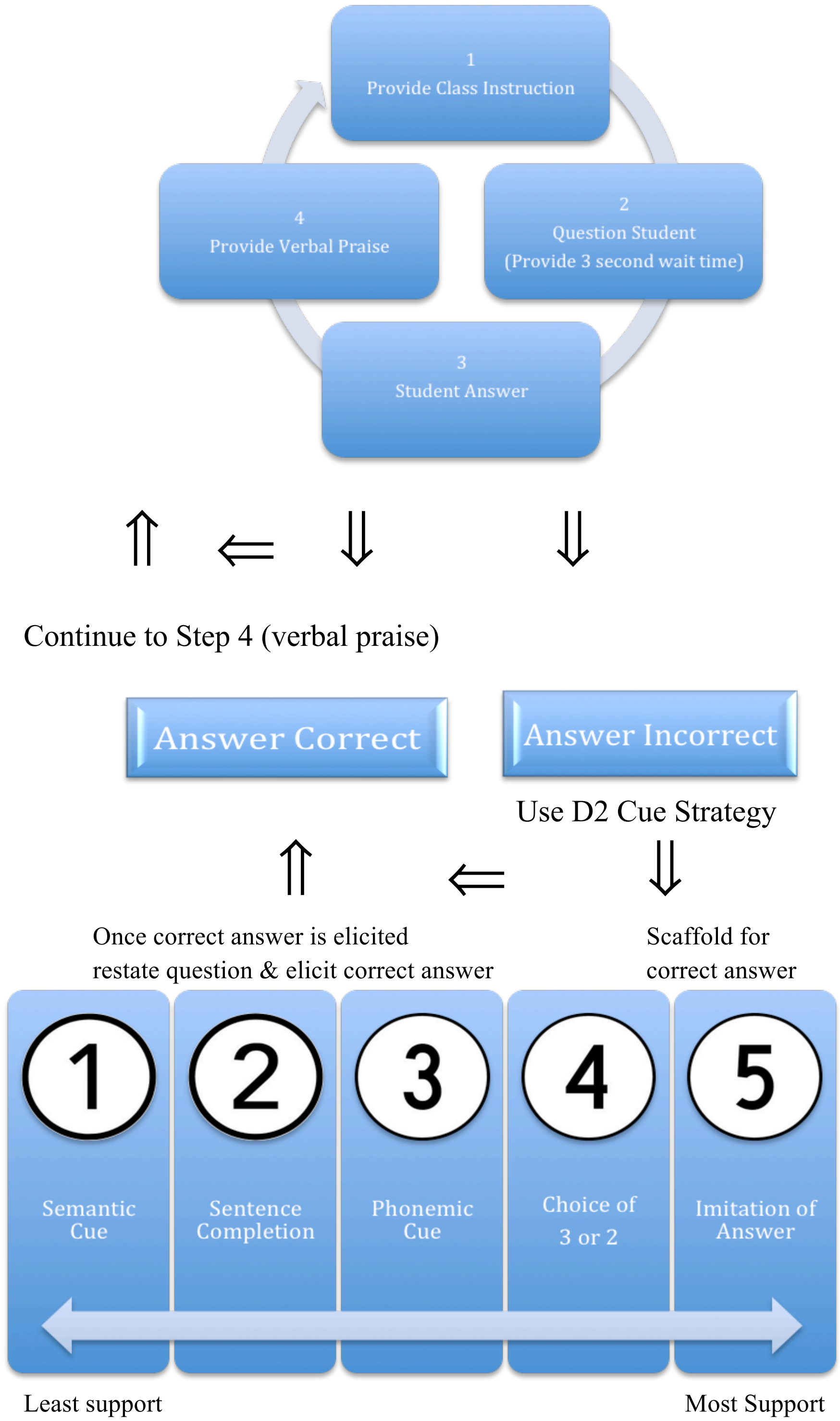


Figure 2. D2 Cuing Method.

Three 15-minute large group instruction times were observed in the experimental group during the first week of implementation. This researcher provided feedback on the use of the D2 Cuing Method as well as suggestions, if any, for improvements. Fifteen-minute classroom observations to ensure usage of the D2 Cuing Method were made by this researcher every week thereafter. After each observation, written and verbal feedback was provided to the experimental group teachers.

Professional development and feedback included modeling and examples given by this researcher of question-answer dialogue between teacher and student. Modeling occurred during the large group instruction observations when a teacher was not correctly or adequately utilizing the D2 Cuing Method. Examples were giving during the initial professional development period and during feedback sessions to assist experimental group teachers in mastering the D2 Cuing Method. The following illustrates use of the D2 Cuing Method in an example question-answer dialogue between teacher and student during large group instruction:

(T = teacher, S = student)

* T: What is the best unit of measure to determine the length of a pencil? (Wait 3 seconds before calling on a student.)

* S: Miles.

(Student states an incorrect answer, teacher cycles into the D2 Cuing Method.)

* T: Miles is a unit of measure, but it is too big to measure a pencil. That is a good way to measure distance between two far away places. I need a smaller unit of measure.

(Level one: Semantic Cue)

* S: I don't know another unit of measure.

(Student continues to be incorrect, teacher must utilize another level of cuing.)

* T: It starts with "in____."

(Teacher has moved to Level Three: Phonemic Cue, as student has indicated he does not have a reference point to generate a correct answer.)

* S: Is it "information?"

(Student has used the phonemic cue, but has generated the wrong word.)

* T: Is it "inches" or "miles" or "feet?"

(Teacher has moved to Level 2: Choice of 3, as he requires a model of the correct answer.)

* S: It's inches.

(Student identifies correct answer.)

* T: Yes, that is correct. What is the best unit of measure to determine the length of a pencil?

(Teacher has affirmed correct answer, restates the original question, and allows for 3 seconds of wait time.)

* S: Inches.

(Student has generated correct answer.)

*T: Yes. That is correct. Good job thinking that through!

(Teacher has affirmed answer is correct, offers praise, then resumes teaching or asks a different question.)

Determination of student growth and learning was documented. Pre-test measures were completed to attain a baseline of student knowledge of assessed GLE and

MO Show Me Standards prior to implementation of instruction and the D2 Cuing Method. Post-test measures determined the extent to which students improved their knowledge base and measured the impact of the D2 Cuing Method. Pre- and post-tests were administered to students in both the experimental and control groups in the subjects of reading, mathematics, social studies, and science. Prior to the instruction of an identified unit, the pre-test was administered. When a classroom teacher indicated completion of teaching a particular concept or unit in the curriculum that was targeted by the D2 Cuing Method study, the post-test was administered to the students. Grades were recorded on the Data Collection table (Appendix I).

Post-Implementation Phase.

Qualitative data was also collected which focused on teacher perception of the D2 Cuing Method. Qualitative data was determined to be important to the D2 Cuing Method study to enhance the researcher's understanding of the implementation and impact of the D2 Cuing Method on the experimental group student cohort and teachers. Qualitative data was collected to determine current instructional strategy methods used by control group teachers.

The post-implementation phase of the study was initiated once the control and experimental groups completed all of the post-tests. A qualitative interview was conducted with both the experimental and control group teachers who participated in this study. Qualitative interview questions were created by the D2 Cuing Method researcher (see Appendix J). Each qualitative interview was recorded and transcribed.

Teachers were interviewed in a group setting to encourage group conversation and help develop an enriched discussion about experiences in the classroom specific to the use of instructional strategies. Two group interviews were conducted. One interview was conducted with the experimental group teachers and one with the control group teachers. Perceptions about the D2 Cuing Method were collected from those teachers in the experimental group. Teachers who did not utilize the D2 Cuing Method were asked to identify teaching methods used that provided support to students during question-answer interactions. Once all of the data were collected, data analysis and hypothesis testing were completed to determine statistical significance between pre- and post-test scores as applied to the research questions.

Data Analysis and Hypothesis Tests

Quantitative and qualitative data were collected during the pre-implementation, implementation, and post-implementation phases of the D2 Cuing Method research study. Quantitative and qualitative methods were used to analyze the data collected in this study. Quantitative methods which included all pre- and post-test scores were used to analyze the student data. The Statistical Package for the Social Sciences (SPSS) software program was used to complete statistical analyses on these scores. Pre- and post-test comparisons were made between the control groups and the experimental groups, as well as within each of the subgroups. Subgroups included children who qualified for special education services, gifted programming, and free and reduced lunch. Pre- and post-comparisons between the four subject areas (reading, mathematics, social studies, and science) were also assessed.

By using data from each of the subject areas including reading, mathematics, social studies, and science, a two-factor analysis of variance (ANOVA) was conducted to address research Question 1: Was there a statistically significant difference ($\alpha = 0.05$)

between pre- and post-test scores for students in the experimental group versus the control group for each subject area? The two categorical variables used to group the students scores were test time (pre- and post-test) and group (experimental and control). The two-factor ANOVA can be used to test three hypotheses including a main effect for test time, a main effect for group, and a two-way interaction effect (test time x group). The two-way interaction effect was used to address research Question 1.

By using data from each of the subject areas including reading, mathematics, social studies, and science, as well as test time and group, a three-factor analysis of variance (ANOVA) was conducted to address research Question 2: Was there a statistically significant difference ($\alpha = 0.05$) between pre- and post-test scores for students in the experimental group versus the control group qualifying for special education services, gifted programming, or free and reduced lunch versus those who did not qualify for special education services, gifted programming, or free and reduced lunch? The three categorical variables used to group the students' scores for the first ANOVA were: test time (pre-and post-test), group (experimental and control), and special education status (special education or no special education). The three factor ANOVA can be used to test seven hypotheses including a main effect for time, a main effect for group, a main effect for special education status, a two way-interaction effect (time x group), a two-way interaction effect (time x special education status), a two-way interaction effect (group x special education status), and a three-way interaction effect (time x group x special education status). The three-way interaction effect (time x group x special education status) was used to address research Question 2.

By using data from each of the subject areas including reading, mathematics, social studies, and science, a second three-factor analysis of variance (ANOVA) was conducted to address research Question 2 with three categorical variables used to group the students' scores: test time (pre-and post-test), group (experimental and control), and gifted programming status (gifted programming or no gifted programming). The three-factor ANOVA can be used to test seven hypotheses including a main effect for time, a main effect for group, a main effect for gifted programming status, a two-way interaction effect (time x group), a two-way interaction effect (time x gifted programming status), a two-way interaction effect (group x gifted programming status), and a three-way interaction effect (time x group x gifted programming status). The three-way interaction effect (time x group x gifted programming status) was used to address research Question 2.

By using data from each of the subject areas including reading, mathematics, social studies, and science, a third three-factor analysis of variance (ANOVA) was conducted to address research Question 2 with three categorical variables used to group the students' scores: test time (pre-and post-test), group (experimental and control) and free and reduced lunch status (free and reduced lunch or no free and reduced lunch). The three-factor ANOVA can be used to test seven hypotheses including a main effect for time, a main effect for group, a main effect for free and reduced lunch status, a two way-interaction effect (time x group), a two-way interaction effect (time x free and reduced lunch status), a two-way interaction effect (group x free and reduced lunch status), and a three-way interaction effect (time x group x free and reduced lunch status). The three-way interaction effect (time x group x free and reduced lunch status) was used to address research Question 2.

By using data from each of the subject areas including reading, mathematics, social studies, and science, a three-factor analysis of variance (ANOVA) was conducted to address research Question 3: Was there a statistically significant difference ($\alpha = 0.05$) between pre- and post-test scores for students in the experimental group versus control group for any one grade level? The three categorical variables used to group the students scores were test time (pre- and post-test), group (experimental versus control) and grade (4^{th} grade versus 5^{th} grade). The three-factor ANOVA can be used to test seven hypotheses including a main effect for time, a main effect for group, a main effect for grade, a two-way interaction effect (time x group), a two-way interaction effect (time x grade), a two-way interaction effect (group x grade), and a three-way interaction effect (time x group x grade). The three-way interaction effect (time x group x grade) was used to address research Question 3.

By using data from each of the subject areas including reading, mathematics, social studies, and science, a two-factor analysis of variance (ANOVA) was conducted to address research Question 4: Was there a statistically significant difference ($\alpha = 0.05$) in growth scores for students in the experimental group versus control group across the four subject areas? The two categorical variables used to group the students' scores were: group (experimental versus control), and subject (reading, mathematics, social studies, science). The two-factor ANOVA can be used to test three hypotheses including a main effect for group, a main effect for subject, and a two-way interaction effect (group x subject). The two-way interaction effect (group x subject) was used to address research

Question 4.

Content analysis methods were used to analyze qualitative data obtained from the teacher interviews in both the experimental and control groups to answer research Question 5: Did teacher perception of the effects of the D2 Cuing Method align to the quantitative data? Creswell (2009) suggested the following steps be taken to perform qualitative data analysis: collection of the raw data (taken through recording of interview questions), organizing data (transcription of interview recordings), reading through all data, coding the data by hand (to determine themes or categories of information, common words, similarities and differences in answers), interrelating the themes/descriptions derived from the data, and interpreting the meaning of those themes/descriptions. These steps were implemented to analyze and interpret the qualitative data.

In order that interpretation of data is accurate limitations to the D2 Cuing Method Study were identified. The next section presents limitations for the study.

Limitations

Limitations are defined as those factors in a research study that cannot be controlled (Lunenburg & Irby, 2008). Identification of limitations is critical to better ensure limits on interpretation and generalization of results. Limitations are commonly sourced from research methods, data collection, or data analysis.

The limitations for this study were:

1. The curriculum in this study is specific to School District X and aligns to Missouri Grade Level Expectations and Missouri Show-Me Standards. The outcomes of this study may not be generalized to other reading, mathematics, social studies, and science curricula.

2. Teachers' use of the D2 Cuing Method in the classroom could not be controlled. Some teachers may have more naturally adopted this method compared to others.

Summary

The purpose of this research was to investigate the effectiveness of the D2 Cuing Method on student outcomes in the areas of reading, mathematics, social studies, and science in fourth and fifth grade classrooms. The effect of The D2 Cuing Method was also assessed specific to the subgroups of children qualifying for free and reduced lunch, special education services, and gifted programming. This study sought to determine if the D2 Cuing Method was more effective in the fourth or fifth grade and if it had greater effect in one subject area versus another.

Methodology utilized in this study were discussed in this chapter including research design, population and sample, sampling procedures, instrumentation, data collection procedures, data analysis and hypothesis testing, and limitations. Qualitative data was used to obtain descriptive information regarding the use of teaching strategies in the classroom during large group instruction involving question-answer interactions. Experimental group questions aimed to generate and obtain information about the perceived effectiveness of the D2 Cuing Method.

Results of statistical analyses and hypothesis testing completed on the collected data are discussed in chapter four. An overview of the study will be presented followed by the presentation of hypothesis testing completed to answer the five established research questions. Quantitative and qualitative data will be discussed in detail. Chapter five contains a discussion about the statistical findings in relation to the literature review and identifies trends in the research data. Suggestions will be presented for future research considerations.

Chapter Four

Results

Chapter four presents results of the hypothesis testing in relation to the five research questions presented. The purpose of this research was to investigate through quantitative analysis the effectiveness of the D2 Cuing Method on student outcomes in the areas of reading, mathematics, social studies, and science in fourth and fifth grade classrooms. The effect of this cuing method was also assessed specific to the subgroups of children qualifying for free and reduced lunch, special education services, and gifted programming. This study determined if the D2 Cuing Method was more effective in the fourth or fifth grade and if it had greater effect in one subject area versus another.

The final purpose of this study was to document through a qualitative analysis of interview responses teacher perceptions regarding cuing methods and teaching strategies in the classroom. Specifically, the teachers in the experimental group were asked to comment on the effectiveness of the D2 Cuing Method on his/her classroom across various curriculum subjects. Those teachers who were not trained in the D2 Cuing Method were asked to comment on the strategies they used in their classroom. A mixed-method research design was utilized for this study.

Hypothesis Testing

The following section presents the results of hypothesis testing for each of the five research questions. Quantitative and qualitative analysis results are presented.

Research Question 1.

A two-factor analysis of variance (ANOVA) was conducted in each of the four subject areas including reading, mathematics, social studies, and science, to address

Research Question 1: Was there a statistically significant difference ($\alpha = 0.05$) between pre- and post-test scores for students in the experimental group versus the control group for each subject area? The two categorical variables used to group the students scores were test time (pre- and post-test) and group (experimental and control). The dependent variable for this hypothesis test was the reading score. Analysis of the interaction between the independent variables of test time and group indicated no statistically significant differences between the mean reading scores ($F = .474$, $df = 1, 157$, $p = .492$). A post hoc analysis was not warranted.

A second two-factor ANOVA was conducted to address Research Question 1. The dependent variable for this hypothesis test was the mathematics score. Analysis of the interaction between the independent variables of test time (pre- and post-test) and group (experimental and control) indicated no statistically significant differences in the mean mathematics scores ($F = 2.153$, $df = 1, 166$, $p = .144$). Although not statistically significant, differences in statistical measures moved in a positive direction. Experimental group student scores increased more (1.05) than control group student scores (0.67) (see Table 3).

Table 3

Descriptive Statistics for Pre- and Post-test Mathematics Scores in Experimental (A) and Control (B) Groups

School/Group	*M*	*SD*	*N*
Pre-test Math School A	8.13	1.62	79
Post-test Math School A	9.18	0.96	79
Pre-test Math School B	8.55	1.73	89
Post-test Math School B	9.22	1.18	89

A third two-factor ANOVA was conducted to address Research Question 1. The dependent variable for this hypothesis test was the science score. Analysis of the interaction between the independent variables of test time and group indicated no statistically significant differences in the mean science scores ($F = .989$, $df = 1, 164$, $p = .322$). A post hoc analysis was not warranted.

A fourth two-factor ANOVA was conducted to address Research Question 1. The dependent variable for this hypothesis test was the social studies score. Analysis of the interaction between the independent variables of test time and group indicated no statistically significant differences in the mean social studies scores ($F = .328$, $df = 1, 159$, $p = .567$). A post hoc analysis was not warranted.

Research Question 2.

A three-factor ANOVA was conducted in each of the four subject areas including reading, mathematics, social studies, and science, to address Research Question 2: Was there a statistically significant difference ($\alpha = 0.05$) between pre- and post-test scores for students in the experimental group and the control group for students qualifying in special education services, gifted programming, or free and reduced lunch, versus those students who did not qualify for special education services, gifted programming, or free and reduced lunch? The three categorical variables used to group the students' scores were: test time (pre-and post-test), group (experimental and control), and special education status (special education or no special education). The dependent variable for this hypothesis test was the reading score. Analysis of the interaction between the independent variables of test time, group, and special education status indicated no statistically significant differences in the mean reading scores ($F = .019$, $df = 1, 155$, $p = .890$). A post hoc analysis was not warranted.

A second three-factor ANOVA was conducted to address Research Question 2. The dependent variable for this hypothesis test was the mathematics score. Analysis of the interaction between the independent variables of test time, group, and special education status indicated statistically significant differences between the mean mathematics scores ($F = 12.713$, $df = 1, 164$, $p = .000$). A post hoc analysis was completed to discover which two sets of means differed using the Tukey HSD (Honestly Significant Difference) test. If the difference between any pair of means is greater than or equal to the figured HSD then they are significantly different using this Tukey's HSD procedure.

> Tukey's HSD was designed for a situation with equal sample sizes per group, but can be adapted to unequal sample sizes as well (the simplest adaptation uses the harmonic mean of n-sizes as n*). The formula for Tukey's is:

$$\varphi\ (\text{HSD}) = q_{\alpha,p,r}\sqrt{\frac{MSError}{n}}$$

where q = the relevant critical value of the studentized range statistic and n is the number of scores used in calculating the group means of interest. (Stevens, 1999, p. 3)

Statistically significant differences (HSD = 1.46) were detected between pre- and post-test mathematics scores in the experimental special education group with a pre-test mean score of 8.20 and a post-test mean score of 6.50 yielding a mean difference of -1.70. Statistically significant differences (HSD = 1.46) were detected between pre- and post-test mathematics scores in the control special education group with a pre-test mean score of 5.29 and a post-test mean score of 8.40 yielding a statistically significant mean difference of 3.11 (see Table 4).

Table 4

Descriptive Statistics for Pre- and Post-test Mathematics Scores in Experimental (A) and Control (B) Groups by Special Education Status

School/Group	Status	*M*	*SD*	*N*
Pre-test Math School A	Not SpEd	8.12	1.66	74
	SpEd	8.20	0.84	5
Post-test Math School A	Not SpEd	9.23	0.85	74
	SpEd	8.40	1.95	5
Pre-test Math School B	Not SpEd	8.83	1.23	82
	SpEd	5.29	3.20	7
Post-test Math School B	Not SpEd	9.30	1.04	82
	SpEd	8.29	2.21	7

Note. SpEd = Special Education

A third three-factor ANOVA was conducted to address Research Question 2. The dependent variable for this hypothesis test was the science score. Analysis of the interaction between the independent variables of test time, group, and special education status indicated no statistically significant differences between the mean science scores ($F = .011$, $df = 1, 162$, $p = .915$). A post hoc analysis was not warranted.

A fourth three-factor ANOVA was conducted to address Research Question 2. The dependent variable for this hypothesis test was the social studies score. Analysis of the interaction between the independent variables of test time, group, and special education status indicated statistically significant differences between the mean social studies scores ($F = 4.556$, $df = 1, 157$, $p = .034$). A post hoc analysis was completed to detect the significant difference between any pair of means using Tukey's HSD test.

While the *F* statistic was significant, there were no statistically significant differences (HSD= 2.00) detected between pairs of mean social studies scores (see Table 5). For the purposes of this research, the Tukey HSD was deemed to be an appropriate post hoc analysis. However, the Tukey HSD is a conservative test and sometimes misses differences that less restrictive post hocs might detect.

Table 5

Descriptive Statistics for Pre- and Post-test Social Studies Scores in Experimental (A) and Control (B) Special Education Groups

School/Group	Status	*M*	*SD*	*N*
Pre-test SocStd School A	Not SpEd	6.27	1.68	73
	SpEd	5.50	1.29	4
Post-test SocStd School A	Not SpEd	6.63	1.95	73
	SpEd	4.00	2.94	4
Pre-test SocStd School B	Not SpEd	6.33	1.96	78
	SpEd	3.83	2.79	6
Post-test SocStd School B	Not SpEd	6.71	1.72	78
	SpEd	5.16	2.48	6

Note. SocStud = Social Studies; SpEd = Special Education

By using data from each of the four subject areas including reading, mathematics, social studies, and science, a three-factor ANOVA was conducted to address Research Question 2 with three categorical variables used to group the students' scores: test time (pre-and post-test), group (experimental and control), and gifted programming status (gifted programming or no gifted programming). The three-way interaction effect (time x group x gifted programming status) was used to address Research Question 2. The dependent variable for this hypothesis test was the reading score. Analysis of the interaction between the independent variables of test time, group, and gifted programming status indicated no statistically significant differences between the mean reading scores (*F* = .175, *df* = 1, 155, *p* = .676). A post hoc analysis was not warranted.

A second three-factor ANOVA was conducted to address Research Question 2. The dependent variable for this hypothesis test was the mathematics score. Analysis of the interaction between the independent variables of test time, group, and gifted programming status indicated no statistically significant differences between the mean mathematics scores (*F* = .503, *df* = 1, 164, *p* = .479). A post hoc analysis was not warranted.

A third three-factor ANOVA was conducted to address Research Question 2. The dependent variable for this hypothesis test was the science score. Analysis of the interaction between the independent variables of test time, group, and gifted programming status indicated no statistically significant differences between the mean science scores (*F* = .002, *df* = 1, 162, *p* = .967). A post hoc analysis was not warranted.

A fourth three-factor ANOVA was conducted to address Research Question 2. The dependent variable for this hypothesis test was the social studies score. Analysis of the interaction between the independent variables of test time, group, and gifted programming status indicated no statistically significant differences between the mean social studies scores (*F* = .219, *df* = 1, 157, *p* = .640). A post hoc analysis was not warranted.

By using data from each of the subject areas including reading, mathematics, social studies, and science, a three-factor ANOVA was conducted to address Research Question 2 with three categorical variables used to group the students' scores: test time (pre-and post-test), group (experimental and control), and free and reduced lunch status (free and reduced lunch and no free and reduced lunch). The three-way interaction effect (time x group x free and reduced lunch status) was used to address Research Question 2. The dependent variable for this hypothesis test was the reading score. Analysis of the interaction between the independent variables of test time, group, and free and reduced lunch status indicated no statistically significant differences between the mean reading scores (F = 1.133, df = 1, 155, p = .250). A post hoc analysis was not warranted.

A second three-factor ANOVA was conducted to address Research Question 2. The dependent variable for this hypothesis test was the mathematics score. Analysis of the interaction between the independent variables of test time, group, and free and reduced lunch status indicated no statistically significant differences between the mean mathematics scores (F = .331, df = 1, 164, p = .566). A post hoc analysis was not warranted.

A third three-factor ANOVA was conducted to address Research Question 2. The dependent variable for this hypothesis test was the science score. Analysis of the interaction between the independent variables of test time, group, and free and reduced lunch status indicated no statistically significant differences between the mean science scores (F = .035, df = 1, 162, p = .852). A post hoc analysis was not warranted.

A fourth three-factor ANOVA was conducted to address Research Question 2. The dependent variable for this hypothesis test was the social studies score. Analysis of the interaction between the independent variables of test time, group, and free and reduced lunch status indicated no statistically significant differences between the mean social studies scores (F = .084, df = 1, 157, p = .773). A post hoc analysis was not warranted.

Research Question 3.

By using data from each of the subject areas including reading, mathematics, social studies, and science, a three-factor ANOVA was conducted to address Research Question 3: Was there a statistically significant difference ($\alpha = 0.05$) between pre- and post-test scores for students in the experimental group versus control group for any one grade level? The three categorical variables used to group the students scores were test time (pre- and post-test), group (experimental versus control) and grade (4^{th} grade versus 5^{th} grade). The three-factor ANOVA can be used to test seven hypotheses including a main effect for time, a main effect for group, a main effect for grade, a two-way interaction effect (time x group), a two-way interaction effect (time x grade), a two-way interaction effect (group x grade), and a three-way interaction effect (time x group x grade). The three-way interaction effect (time x group x grade) was used to address Research Question 3. The dependent variable for this hypothesis test was the reading score. Analysis of the interaction between the independent variables of test time, group, and grade indicated statistically significant differences between the mean reading scores (F = 7.508, df = 1, 155, p = .007). A post hoc analysis was completed to detect the significant difference between any pair of means using the Tukey HSD test. Statistically significant differences (HSD= 0.976) were detected between pre- and post-test reading scores in the experimental fourth grade group with a pre-test mean score of 7.78 and a post-test mean score of 9.07 yielding a mean difference of 1.28 (see Table 6).

Table 6

Descriptive Statistics for Pre- and Post-test Reading Scores in the Fourth and Fifth Grade Experimental (A) and Control (B) Groups

School/Group	Grade	*M*	*SD*	*N*
Pre-test Read School A	4	7.78	1.67	46
	5	5.83	1.56	30
Post-test Read School A	4	9.07	1.29	46
	5	5.87	1.72	30
Pre-test Read School B	4	8.83	1.74	40
	5	5.16	2.39	43
Post-test Read School B	4	9.13	1.07	40
	5	5.97	1.92	43

Note. Read = Reading

A second three-factor ANOVA was conducted to address Research Question 3. The dependent variable for this hypothesis test was the mathematics score. Analysis of the interaction between the independent variables of test time, group, and grade indicated no statistically significant differences between the mean mathematics scores ($F = 3.021$, $df = 1, 164$, $p = .140$). A post hoc analysis was not warranted. Although not significant, differences approached a significant value for fourth grade. Fourth grade experimental group mathematics scores increased more (1.24) than fourth grade control group student scores (0.51). Fifth grade growth scores showed less difference, as fifth grade experimental group mathematics scores increased less (0.79) than fifth grade control group student scores (0.83) (see Table 7).

Table 7

Descriptive Statistics for Pre- and Post-test Mathematics Scores in the Experimental (A) and Control (B) Groups in Fourth and Fifth Grade

School/Group	Grade	*M*	*SD*	*N*
Pre-test Math School A	4	8.09	1.66	46
	5	8.18	1.59	33
Post-test Math School A	4	9.33	1.03	46
	5	8.97	0.81	33
Pre-test Math School B	4	8.79	1.52	43
	5	8.33	1.90	46
Post-test Math School B	4	9.30	1.10	43
	5	9.15	1.26	46

A third three-factor ANOVA was conducted to address Research Question 3. The dependent variable for this hypothesis test was the science score. Analysis of the interaction between the independent variables of test time, group, and grade indicated statistically significant differences in the mean science scores (F = 12.985, df = 1, 162, p = .000). A post hoc analysis was completed to detect the significant difference between any pair of means using the Tukey HSD test. Statistically significant differences (HSD=1.15) were detected between pre- and post-test science scores in the experimental fifth grade group with a pre-test mean score of 6.45 and a post-test mean score of 8.48 yielding a mean difference of 2.03 (see Table 8).

Table 8

Descriptive Statistics for Pre- and Post-test Science Scores in the Fourth and Fifth Grade Experimental (A) and Control (B) Groups

School/Group	Grade	*M*	*SD*	*N*
Pre-test Sci School A	4	6.93	1.99	46
	5	6.45	1.64	33
Post-test Sci School A	4	7.13	2.05	46
	5	8.45	2.35	33
Pre-test Sci School B	4	6.73	1.94	41
	5	6.78	1.85	46
Post-test Sci School B	4	7.78	1.68	41
	5	6.93	1.83	46

Note. Sci= Science

A fourth three-factor ANOVA was conducted to address Research Question 3. The dependent variable for this hypothesis test was the social studies score. Analysis of the interaction between the independent variables of test time, group, and grade indicated no statistically significant differences between the mean social studies scores (F = .052, df = 1, 157, p = .820). A post hoc analysis was not warranted.

Research Question 4.

Data from each of the subject areas including reading, mathematics, social studies, and science, a two-factor ANOVA was conducted to address Research Question 4: Was there a statistically significant difference (α = 0.05) in growth scores for students in the experimental group versus control group across the four subject areas? In this analysis, growth score was defined by subtracting the pre-test score from the post-test score for each student to determine if there was greater growth in one of the four subject areas versus another. The two categorical variables used to group the students' scores were: group (experimental versus control), and subject (reading, mathematics, social studies, science). The two-factor ANOVA can be used to test three hypotheses including a main effect for group, a main effect for subject, and a two-way interaction effect (group x subject). The two-way interaction effect (group x subject) was used to address Research Question 4. The dependent variable for this hypothesis test was the growth score. Analysis of the interaction between subject and group indicated no statistically significant differences between the mean growth scores ($F = .564$, $df = 3, 432$, $p = .639$). A post hoc analysis was not warranted.

Research Question 5.

Content analysis methods were used to analyze qualitative data obtained from the teacher interviews in both the experimental and control groups to answer Research Question 5: Did teacher perception of the effects of the D2 Cuing Method align to the quantitative data? The following steps, suggested by Creswell (2009) were taken to perform qualitative data analysis: collection of the raw data (taken from recorded interview questions), organizing data (transcription of interview recordings), reading through all data, coding the data by hand (to determine themes or categories of information, common words, similarities and differences in answers), interrelating the themes/descriptions derived from the data, and interpreting the meaning of those themes/descriptions.

This researcher conducted two interviews, one with the control group and one with the experimental group. All teachers who participated in the study were present at the interviews. Each of the two interviews was recorded. The interviews were transcribed and read. This data was analyzed by looking for common words, similarities and differences in answers, and common themes. The results of this analysis are as follows:

Experimental Group Teacher Interview

1. Describe your training in the D2 Cuing Method and whether or not you felt it was effective.

Four out of four teachers agreed the modeling given during the observations and the written D2 Cuing Method index card, which listed the various steps to the cuing method, were helpful for learning and implementing the D2 Cuing Method. One of the teachers commented that this experience led her to believe that "more training in cuing methods," such as taking a class, would be helpful. She commented she had not received formal college training in instructional strategies.

2. What are five words you would use to describe the D2 Cuing Method?

Teachers found it difficult to generate a list of five words, but they described the D2 Cuing Method as "leveled," "reinforcing," "differentiated," "confidence-builder," and "promoted accountability."

3. How easy was the D2 Cuing Method to implement during large group instruction?

Four out of four teachers agreed that the D2 Cuing method worked better for questions in mathematics, science, and when reviewing for tests. Question type was also a factor. Questions that required a more factual right/wrong answer were better suited for the D2 Cuing method, than open-ended questions requiring a student's opinion.

4. To what degree did the D2 Cuing Method help elicit correct student answers in comparison to other methods you have used?

Four out of four teachers agreed it helped students maintain focus and supported that student throughout the process. It reduced the intimidating feeling a student may experience when having to answer a question in class. It also encouraged full class participation.

5. How have you elicited correct student answers in the past? Describe your procedure.

Four out of four teachers agreed calling on students who "volunteered to answer" a question was their main method for eliciting answers. When a student was incorrect in his/her answer, use of a peer to give the answer was the most common method used. One teacher commented that in the past, he would use this method in the interest of time. But now, after implementing the D2 Cuing Method, he "…sees it as you don't want to move on… it is not a waste of time if you can get them to the correct answer. You can build confidence in that child and get them to start to think about things."

6. To what degree was the D2 Cuing Method effective for all students in your classroom, including gifted students, those with special education needs, and those receiving free and reduced lunch?

The teachers commented they are not allowed to know who qualifies for free and reduced lunch. The question was rephrased as "…those students who you suspect are at risk." Common themes included the D2 Cuing Method helped the highest functioning students in the class "dig deeper" and "stretch their minds." Teachers noted more students raised their hands to answer a question as they observed a child being guided through the D2 Cuing Method.

7. Describe the student participation/engagement when you used this method.

Again the comment was made that time constraints often push a teacher to rush through the question/answer portion of the lesson. But by allowing a student the time necessary to answer a question correctly, it is beneficial to the learning process. Previous comments stating it helped a child focus and other students gained benefit just from observing were reiterated.

8. Describe the correctness of response from your students when you implemented the D2 Cuing Method.

Four out of four teachers commented the D2 Cuing Method "more often than not" elicited the correct answer from a student. They agreed, students demonstrated pride when they responded with a correct answer; the D2 Cuing Method almost "tricks the students" into working for the answer.

9. What makes you feel empowered as a teacher?

The overwhelming response was that teachers do not feel empowered. The one teacher with special education experience stated she felt more confident as a teacher knowing she had "all those tricks up her sleeve" (referring to instructional strategies). Collaboration with other teachers was mentioned too as an empowering activity.

Teachers were asked if they had any final comments or thoughts. The responses were as follows:

- "I liked it and I'm still using it;"
- "I have implemented it as part of my whole cuing method…;"

- "I use it for the kids that I think really need it… so they have the opportunity to finally get the answers right;"
- "They will be more likely to raise their hands in the future;" and
- "I am using it."

Control Group Teacher Interview

1. Describe any training you have received in instructional strategies and whether or not you felt it was effective.

This was a difficult question for four out of four teachers to answer. Teachers commented that they were currently completing the review of curriculum objectives and book studies but were unsure if they were instructional strategies. One teacher discussed the implementation of Cognitive Guided Instruction Math (CGI Math). Four out of four teachers agreed training in instructional strategies was last obtained in college.

2. What are five words that describe the instructional strategy(ies) you use when a student answers a question incorrectly during a question-answer interaction?

Teachers struggled to identify and describe an instructional strategy. They stated feedback was a current strategy they were using, but failed to describe it other than stating that feedback had to be "timely and specific."

3. How easy is this strategy to implement during large group instruction?

Again, the teachers struggled to understand which teaching strategies they used. After rephrasing the question, they stated use of guided practice techniques could be easily implemented in large group instruction.

4. To what degree does this method help elicit correct student answers?

Four out of four teachers commented when using guided practice techniques, they could identify those students who required "extra help." Additionally, the use of writing journals was beneficial as it was "more confidential," and they could provide individualized feedback to every student. However, the teachers did not comment as to how effective these strategies were in eliciting a correct answer.

5. How have you elicited correct student answers in the past? Describe your procedure.

Four out of four teachers commented when a student provided an answer that was incorrect, they would ask the child how he/she got that answer to better understand the thought process. Teachers also stated they called on other students to "get someone else's thinking."

6. To what degree is this method effective for all students in your classroom, including gifted students, those with special education needs, and those receiving free and reduced lunch?

Four out of four teachers agreed that they struggle to teach to the advanced and lower performing students. "We teach to the middle." One teacher stated she often provides "praise" to a child when they get the answer correct.

7. Describe the student participation/engagement when you used this method.

Four out of four teachers agreed that if they "walk around the classroom" to ensure that students are doing work, then students are engaged.

8. Describe the correctness of response from your students when you implemented this method.

Four out of four teachers agreed that when they use guided practice, they could determine who is "getting it" and "who is not."

9. What makes you feel empowered as a teacher?

Four out of four teachers agreed they do not generally feel empowered. However, the teachers appreciated that they were told "what to teach" but not "how to teach."

Trends

Trends were identified within and between the experimental and control group responses. Similar answers were recorded for questions one, five, six, and nine. For question one teachers reported not having formal training in specific instructional strategies. Question five teacher responses in both groups revealed that when a student answered a question incorrectly the teacher typically went on to another student for the answer. Teachers tended to call on students who raised their hands. Comments for question six from both groups revealed there is a need to better reach the upper and lower functioning students, as teachers tend to "teach to the middle." And finally, teachers reported they did not feel empowered as teachers.

Substantial differences overall were discovered between the groups as the teachers in the experimental group could easily discuss the D2 Cuing Method as an instructional strategy, but the control group struggled to identify instructional strategies in general as evidenced from questions one and two. For question three, four, and eight the control group reported use of instructional strategies to identify students who required small group instruction whereas the experimental group reported use of the D2 Cuing Method allowed individual student success within the large group. The experimental group reported use of the D2 Cuing Method encouraged participation from other students who observed the method being used with other students. The control group teachers reported they liked using journaling as the feedback was private and reduced the embarrassment factor when an answer was incorrect.

Overall, the experimental group described the D2 Cuing Method as an effective instructional strategy that could be applied to large group instruction and successfully elicited correct answers. The D2 Cuing Method was used most effectively in mathematics and science and with questions that required more definitive, factual information versus questions that were open ended and asked for opinion. Teachers agreed the D2 Cuing Method positively supported students, and those students who observed the method being used benefited, as well.

The professional development provided was adequate, but teachers reported the need to have a greater understanding about cuing methods in general. Teachers responded positively to the D2 Cuing Method and stated that they were still using it after the completion of this study. Teachers reported that slowing down and taking the time to work a student through to the correct answer was valuable. They noted increased student participation in large group instruction as a result. Still, these teachers do not feel empowered in general.

The control group struggled in general to identify specific instructional strategies and clearly articulate the strategies they used. Instructional strategies control group teachers identified were judged to be more teaching programs than strategies which were used to provide feedback and alert teachers to the need for small group instruction. Control group teachers did not identify a method to help a child attain a correct answer during large group instruction. They generally called on another student when the first child answered a question incorrectly. Teachers reported not having had formal training since college in instructional strategies. In general these teachers did not feel empowered.

Data collected from the experimental group and control group interviews was used to answer Research Question 5: Did teacher perception of the effects of the D2 Cuing Method align to the quantitative data? Results indicated that the teachers' perception of the D2 Cuing Method aligns to some of the quantitative data.

The quantitative data revealed statistically significant change in growth scores for the experimental group for fourth grade students in reading and fifth grade students in science. Although statistically significant growth was not evident for the experimental group in mathematics, special education students in social studies, and fourth grade students in mathematics, there was growth in the right direction. These results aligned to teacher comments that the D2 Cuing Method worked better in mathematics and science for specific right/wrong answers and supported students who qualified for Special Education Services.

Summary

This chapter provided information about the quantitative and qualitative data collected in this study. The quantitative data answered Research Questions 1, 2, 3, and 4. In summary, growth in scores for students who qualified for special education services between the experimental and control groups were significant for mathematics, although the trend was negative. Growth in scores for reading was significant in the fourth grade experimental group and for science in the fifth grade experimental group (see Table 9 for a summary of the findings for Research Questions 1 – 4).

Table 9

Summary of Findings for Research Questions 1 – 4 (α = 0.05)

Research Question	Factor 1	Factor 2	Factor 3	Dependent Variable (test score)	*p* value	*HSD*
1	Test time	Group	-	Reading	.492	-
	Test time	Group	-	Math	.144	-
	Test time	Group	-	Science	.322	-
	Test time	Group	-	Soc Stud	.567	-
2	Test time	Group	SpEd	Reading	.890	-
	Test time	Group	SpEd	Math	.000*	1.46*
	Test time	Group	SpEd	Science	.915	-
	Test time	Group	SpEd	Soc Stud	.034*	2.00
	Test time	Group	GATE	Reading	.676	-
	Test time	Group	GATE	Math	.479	-
	Test time	Group	GATE	Science	.967	-
	Test time	Group	GATE	Soc Stud	.640	-
	Test time	Group	F&RL	Reading	.250	-
	Test time	Group	F&RL	Math	.566	-
	Test time	Group	F&RL	Science	.852	-
	Test time	Group	F&RL	Soc Stud	.773	-
3	Test time	Group	Grade	Reading	.007*	.976*
	Test time	Group	Grade	Math	.140	-
	Test time	Group	Grade	Science	.000*	1.15*
	Test time	Group	Grade	Soc Stud	.820	-
4	Subject	Group	-	Growth Score	.639	-

Note. Test time = Pre-test/Post-test; Group = Experimental/Control; SpEd = Special Education; GATE = Gifted and Talented Education; F&RL = Free & Reduced Lunch; Soc Stud = Social Studies; * = Statistically Significant; HSD = Honestly Significant Difference

Qualitative analysis revealed similarities and differences between responses in the experimental and control groups. The D2 Cuing Method was reported to be easy to learn and implement, successful for use in large group instruction, and a strategy teachers will continue to use.

Chapter five provides a summary of the research findings, conclusions, and recommendations for future research. Both qualitative and quantitative data will be discussed. Major findings, findings related to the literature, and concluding remarks regarding the D2 Cuing Method will be presented. Data from chapter four will be linked to the literature presented in chapters one and two to provide rationales and conclusions for hypothesis test outcomes.

Chapter Five

Interpretation and Recommendations

The D2 Cuing Method was evaluated in fourth and fifth grade classrooms to determine its viability as a large group instructional strategy during question-answer interactions between student and teacher. Chapter one of this study presented the purpose, conceptual framework, background, and significance of this study. A review of literature presented in chapter two discussed research that supported components of the D2 Cuing Method. Chapter three presented the methodology used to conduct this study. Results of hypothesis testing completed to answer the research questions specific to the D2 Cuing Method were presented in chapter four. Both quantitative and qualitative data were collected. Chapter five presents a study summary, overview of the problem, purpose statement and research questions, review of the methodology, major findings, findings related to the literature, and concluding remarks regarding the D2 Cuing Method.

Study Summary

This research study was conducted to determine the impact the D2 Cuing Method had on fourth and fifth grade achievement measured by pre- and post-test scores in reading, mathematics, social studies, and science. The D2 Cuing Method was developed to provide elementary classroom teachers with a new instructional method that was rooted in the treatment protocols traditionally used in clinical settings by speech and language pathologists. It is an instructional strategy based on:

- scaffolding, cuing, feedback, praise, and wait time;
- theories of learning through interaction;

- hierarchical cuing; and
- neuroscience theories of learning and memory/recall.

The D2 Cuing Method is a systematically applied, hierarchical cuing method that incorporates language therapy treatment methods traditionally used with stroke and head injured patients suffering from language deficits. The D2 Cuing Method is a readily applied instructional strategy that the classroom teacher can use spontaneously to assist a student who needs time and/or structured cues to provide the correct response during a question and answer exchange between the teacher and student. The D2 Cuing Method aids the teacher in accurately judging the level of support a student requires to elicit a correct answer and allows the teacher to evaluate the student's need for more or less support. The D2 Cuing Method is structured but not scripted and includes professional development materials that provide visual supports (see Figure 2, chapter three). Teachers can learn the technique quickly and apply it immediately after professional development.

This study was conducted to determine if the D2 Cuing Method would have a positive effect on achievement, as measured by test scores, in fourth and fifth grade regular education classrooms in the core curriculum subjects of reading, mathematics, social studies, and science. It sought to determine if sub-groups of students who qualified for special education services, gifted and talented programming, and free and reduced lunch were positively impacted by the implementation of the D2 Cuing Method. Teacher perception of the effectiveness of the D2 Cuing Method for student achievement was investigated.

Overview of the Problem.

A review of literature provided researched-based evidence of hierarchical methods for asking questions about learning (Bloom, 1956; Marzano, 2000; Rothstein & Santana, 2011) and information about the management of incorrect answers provided by students during an exchange of questions and answers between the teacher and student (Berkeley New Faculty Newsletter # 7, 2006; Fisher & Frey, 2010b; Marzano, 2007). The researched literature provided no evidence of hypothesis testing studies that specifically addressed the effectiveness of a hierarchical cuing method in large group, classroom instruction. Structured cuing as applied in a clinical (patient/therapist) setting has been proven to effectively assist patients to achieve their treatment goals (German, 2009; Nickels, 2010; Wiig & Semel, 1984). This study demonstrated how clinical cuing methods could be successfully adapted for use during large group instruction in regular education classrooms to achieve improved student performance.

According to Marzano, et al. (2001) researchers estimated that 80% of classroom time is spent completing questioning and cuing activities (Davis & Tinsley, 1967; Fillippone, 1998). If 80% of classroom time is spent questioning and cuing students then instructional strategies that have a positive effect on these classroom activities should prove to be useful and valuable. Students who fail to achieve curriculum goals require teachers to develop instructional strategies. Teachers need effective and readily available instructional strategies to assist them in helping students succeed, particularly when students are in large group instruction and Tier I RTI configurations.

Consequentially, an instructional strategy was developed that incorporated principles of learning and instruction found in the educational research literature, neuroscience literature, and speech-language pathology research specific to skills required for student achievement. It was hypothesized that the D2 Cuing Method would positively affect student achievement.

Purpose Statement and Research Questions.

The purpose of this research was to investigate and determine if the use of the D2 Cuing Method in fourth and fifth grade classrooms had a statistically significant effect (α = 0.05) on student achievement in the areas of reading, mathematics, social studies, and science. Subgroups included those who qualified for special education services, free and reduced lunch, or gifted programming. An attempt was made to determine if the effect of the D2 Cuing Method was greater between grade levels, subject areas, and subgroups of students. Data was collected from those teachers who implemented the D2 Cuing Method in their classrooms to determine the perceived effectiveness of this instructional strategy. Teachers in the control group were asked to discuss use of instructional strategies they currently employ. The final purpose of this study was to document teacher knowledge and opinion of the instructional strategies used in the classroom in reading, mathematics, social studies, and science.

To determine if the D2 Cuing Method was a viable strategy to assist students in attaining academic goals as defined by the Missouri Show-Me Standards and Missouri GLEs the following research questions were posed:

1. Was there a statistically significant difference (α = 0.05) between pre-and post-test scores for students in the experimental group versus the control group for each subject area?
2. Was there a statistically significant difference (α = 0.05) between pre-and

post-test scores for students in the experimental group versus the control group qualifying for special education services, gifted programming, or free and reduced lunch versus those who did not qualify for special education services, gifted programming, or free and reduced lunch?

3. Was there a statistically significant difference ($\alpha = 0.05$) between pre-and post-test scores for students in the experimental group versus the control group for any one-grade level?
4. Was there a statistically significant difference ($\alpha = 0.05$) in growth scores for students in the experimental group versus the control group across the four subject areas?
5. Did teacher perception of the implementation of the D2 Cuing Method (or lack of implementation) align with the outcomes associated with the quantitative data?

Review of the Methodology.

A mixed-methods research design was utilized for this study. The quantitative component consisted of a quasi-experimental research methodology pre-test and post-test design using an experimental group and control group. Two fourth grade and two fifth grade classes were randomly selected as the experimental group in one elementary school (School A). Likewise, two fourth grade and two fifth grade classes were randomly selected as the control group in another elementary school (School B). The experimental group was defined as those students whose teachers used the D2 Cuing Method as an instructional strategy during large group instruction. The control group was defined as those students whose teachers did not use the D2 Cuing Method as an instructional strategy during large group instruction. Hypothesis testing was completed through use of two-factor ANOVAs and three-factor ANOVAs to determine if the difference between the two groups was statistically significant ($\alpha = 0.05$). Using Tukey's HSD test, post hoc analysis was completed.

The qualitative component consisted of a post-study interview of the four teachers in the experimental group and the four teachers in the control group. Teachers in the experimental group were interviewed to assess teacher perception of the effectiveness of the D2 Cuing Method. Experimental group teachers were asked to share their opinions about the ease and convenience of using the method. Interview questions for control group teachers who were neither trained in nor implemented the D2 Cuing Method sought to determine the type of instructional strategies the control group teachers used when conducting question-answer interactions with students during large group instruction.

Major Findings

Qualitative and quantitative data was collected to determine the impact of the D2 Cuing Method on student achievement in fourth and fifth grade classrooms. The D2 Cuing Method was developed to assist teachers scaffold their instruction for students through a hierarchy of cues to elicit a correct answer during question-answer interactions between student and teacher. It was hypothesized that the use of the D2 Cuing Method would have a positive impact on student achievement. Differences between pre- and post-test scores in reading, mathematics, social studies, and science were expected to yield supportive evidence for the hypothesis.

Quantitative findings were mixed, however. Statistically significant differences ($\alpha = 0.05$) between mean test scores were discovered to be in both a positive and negative direction as determined by the dependent variable. A negative effect in the experimental group's mathematics scores was observed in students who qualified for special education services in the experimental group. A positive effect in the experimental group's fourth grade student scores was observed in reading. A positive effect in the experimental group's fifth grade student scores was observed in science. While statistically significant differences between test scores were found for the special education subgroup in social studies, it was not confirmed by Tukey's HSD test. Tukey's HSD test is a conservative test that may have been less sensitive than less restrictive post hocs.

Teachers in the experimental group commented that the D2 Cuing Method was easily applied to mathematics because answers were specific and not open-ended. While there were no statistically significant differences between mean mathematics test scores in the experimental and control groups, data revealed that mean differences were approaching statistically significant levels thereby yielding a positive effect. This finding shows warrant for further research of the efficacy of the D2 Cuing Method in mathematics instruction.

Statistically significant differences were not found between the experimental and control groups in reading, social studies, and science. While there were no statistical differences between mean test scores, mean scores overall were improved, indicating a positive trend. Data revealed social studies test scores approached statistically significant differences between means for students qualifying for special education services. Hence the data suggested the D2 Cuing Method had a positive effect. However, the collection of only one data point (test scores) per student limited the amount of change evidenced in the experimental group's mean scores in comparison to the control group's mean scores.

There were statistically significant differences between the special education students and general education students in mathematics scores. The mathematics scores went from a mean of 8.2 to a mean of 6.5, indicating scores decreased by an average of 1.7 points. This direction was not favorable. However, this result could be explained by small sample size with only five students being identified as having special education status. Areas of disability for students who qualified for special education services were not controlled in this study and may have affected outcomes. Multiple data points (test scores) would have provided a more accurate depiction of the effects of the D2 Cuing Method. Finally, students with learning disabilities typically demonstrate inconsistent skills while mastering a learning objective. If performance inconsistency was prevalent it would have contributed to the negative effect.

Fourth grade students in the experimental group achieved improved mean reading scores an average of 1.3 points over fourth grade students in the experimental group. Fifth grade students in the experimental group improved science scores an average of 2.0 points over fifth grade students in the control group. Analysis of this data suggested individual teachers utilized the D2 Cuing Method more effectively than other teachers in specific curriculum subjects.

There was no evidence to suggest that students in the experimental group performed better than the control group in reading, science, mathematics, and social studies; between gifted and talented education (GATE) and Free and Reduced Lunch status subgroups; between fourth and fifth grade mathematics and social studies scores;

and in growth scores in any one subject. Data reported for hypothesis testing in chapter four demonstrated *p* values did not meet statistically significant criteria ($\alpha = 0.05$). This result could be viewed as a negative finding. However, because test scores were moving in a positive direction in each area of hypothesis testing, it is reasonable to conclude that the D2 Cuing Method assisted teachers in their efforts to improve student achievement. Students' mean post-tests scores were higher than mean pre-test scores.

The following section will discuss some of the factors that may have limited the results of this study. The lack of statistical significance between test scores for the experimental group versus the control group in reading, science, mathematics, and social studies; between gifted and talented education (GATE) and Free and Reduced Lunch status subgroups; between fourth and fifth grade mathematics and social studies scores; and in growth scores in any one subject is explained by a variety of factors.

The assumption that teachers in the experimental group used the D2 Cuing Method appropriately and with fidelity was accepted. Weekly observation sessions monitored use of the D2 Cuing Method during large group instruction. Still it was possible that teachers in the experimental group did not use the D2 Cuing Method regularly or as successfully as qualitative data indicated.

Professional development in the D2 Cuing Method was one hour in length, with additional feedback and modeling conducted during weekly 45-minute and 15-minute observations. Additional professional development would have benefited teacher understanding and use of the D2 Cuing Method. Teachers in the experimental group stated they could have used an entire course on cuing strategies to better enhance their understanding and use of the D2 Cuing Method. Experimental group teachers stated the feedback and modeling provided by this researcher was most helpful to their learning and implementation of the D2 Cuing Method. Provision for more frequent monitoring would have further increased a teacher's mastery of the D2 Cuing Method.

In addition to limited professional development the number of students who qualified for Gifted and Talented Education (GATE) and Free and Reduced Lunch status was limited. Seven students in the study qualified for GATE. Thirty-six students qualified for Free and Reduced Lunch. Larger population samples are required to accurately represent these sub-groups. Teacher perception, however, suggested the D2 Cuing Method was particularly helpful in enhancing the thought processes of highest performing students.

The timeline of this study was determined to be a factor. This study was conducted during the first semester of school which lasted approximately sixteen weeks. Had this study been conducted for an entire school year there would have been more opportunities for use of the D2 Cuing Method and more opportunities to collect data points (test scores). These opportunities may have provided a more accurate investigation of the effects of the D2 Cuing Method in large group classroom question-answer periods. GLE's and Missouri Show Me Standards are only common between fourth and fifth grade classes during the first semester of the school year. Consequently, it was judged appropriate to limit the time-line of the study to allow for comparisons between the grade levels.

The method used in this study to assess student achievement and growth in test scores was limited to one set of pre- and post-tests per subject. Pre- and Post-assessments consisted of ten multiple-choice questions. Open-ended and constructed response questions would have provided greater opportunity to explore the impact of the D2 Cuing Method on student learning. If multiple-choice formats were to be used in future studies a longer test consisting of 20 or 25 questions would provide more diverse and accurate information.

Findings suggested the D2 Cuing Method made a positive impact on student achievement under specific conditions. Teacher perception of the effect of the D2 Cuing Method on student achievement was also analyzed. Teachers in both the control and experimental groups were interviewed. While the experimental group focused on the D2 Cuing Method, the control group was asked to discuss instructional strategies that they currently employed during large group instruction.

Qualitative analysis suggested that the D2 Cuing Method was a practical and useful instructional strategy when applied to large group instruction with all students, and in all subjects. Experimental group teachers reported continued use of this strategy after the conclusion of the study, suggesting they found the D2 Cuing Method to be a useful teaching strategy and method of instruction.

Teachers perceived the D2 Cuing Method to be valuable because it enabled the *teachable moment*, the moment in which the teacher discovered a need to assist the student, through increased engaged instruction. The positive impact on student achievement and enhancement of instructional effectiveness became self-evident. Qualitative analysis revealed that students who did not generally participate in large class discussion enhanced their engagement by increased participation in question and answer exchanges. Students were observed to respond positively to specific feedback and the cuing process when they gave a correct answer. Increase in student engagement and success promoted improved self-esteem and a positive classroom culture as reported in the qualitative data. Experimental and control group teachers reported they commonly sought peer assistance (i.e., call on another student) when a student provided an incorrect answer. Teachers in the experimental group reported using peer assistance methods less frequently once they learned the D2 Cuing Method.

Experimental group teachers commented they could assess a student's level of understanding based on the level of cuing required to elicit a correct answer. Experimental group teachers reported that use of the D2 Cuing Method sent the student a message; I will work with you till you get it right. Experimental group teachers found this message had a positive impact on students and classroom culture.

Control group teachers could not state a specific instructional strategy they used in the classroom, making it difficult for them to elaborate on how an instructional strategy was employed during large group instruction. Use of guided practice was discussed, but control group teachers could not clearly describe what it was or how it was best utilized. It was evident the experimental group teachers had a greater understanding compared to the control group teachers of instructional strategies and how to utilize them in the classroom.

In summary, experimental group teachers suggested that the D2 Cuing Method was useful in eliciting an answer that required specific information. The D2 Cuing Method was less helpful when questions were open-ended and required an opinion or explanation. The D2 Cuing Method provided opportunity for observational student learning (watching another student). Observational student learning style was evidenced when students attended to the cues being given, even though the teacher was interacting with another student, allowing all students in the class to cycle through the process and arrive at a correct answer. Although not formally measured, experimental group teachers observed a gradual increase in the number of students who would raise their hand to offer an answer. Experimental group teachers perceived that students were more focused and engaged in learning during large group instruction. Experimental group teachers commented the D2 Cuing Method, more often than not, elicited a correct answer. Hence the D2 Cuing Method was seen as a successful scaffolding/cuing method.

In an attempt to substantiate these aforementioned findings the following section of chapter five will link these findings to the literature discussed in chapter two. While the results of this study were not causal, the impact of the D2 Cuing Method is explained and better understood when related to the neuro-science, speech-language pathology, and educational literature.

Findings Related to the Literature

This section of chapter five will connect the literature discussed in chapter two with the hypothesis testing and results of the study presented in chapters four and five. Because the D2 Cuing Method has not been previously studied, the elements fundamental to the D2 Cuing Method were evaluated based on the overall success of implementation in the classroom and impact on student achievement. This discussion will follow the same order as the information presented in chapter two: brain-based learning, memory, rehearsal, storage, and recall; emotion and learning; storage and retrieval of words; cuing strategies and hierarchies; feedback; scaffolding; wait time; verbal praise; response to intervention (RTI); and the role of the teacher.

The literature-review in chapter two discussed brain-based learning stemming from the notion that the supportive nature of the classroom could impede or enhance learning. It was concluded instruction should be "brain-compatible" (Hart, 1983). The qualitative feedback collected from the experimental group teachers showed the D2 Cuing Method worked with all students and more often than not elicited a correct answer from a student. Qualitative evidence suggests the D2 Cuing Method is a flexible strategy that meets the needs of students with varying levels of competence.

Caine and Caine (1997) developed the Twelve Brain/Mind Learning Principles in which three of the twelve elements of learning related to the D2 Cuing Method. These elements include: learning involves focused attention and peripheral perception; emotions are critical to patterning; and complex learning is enhanced by challenge and inhibited by threat. Experimental group teachers reported that the D2 Cuing Method worked with all of their students. But teachers noted the most positive effect occurred among their highest performing students. Higher performing students were reported to be more engaged and focused on the teacher who was guiding them through the D2 Cuing Method, allowing students to learn through unscripted cuing. Students who historically would not volunteer answers to questions during large group instruction were noted to be more engaged in attempting to provide answers. Students could attempt to answer without fear of failure as students learned that they would be guided to a correct answer.

The D2 Cuing Method aligns to brain-based learning theory because it provides a pro-active, non-threatening way to support students. Brain-based learning theory holds that when the amygdala, an area of the brain that processes emotion, is in a calm state it can move information into the learning and thinking network of the brain where memory systems are activated (Sousa & Tomlinson, 2011; Wolfe, 2010). The more pleasurable and less threatening an event, the further information is allowed to travel into the brain (Jenson, 2005; Willis, 2008). The D2 Cuing Method is designed to be a non-threatening approach to learning intended to enhance attention, focus, and memory formation. Teachers in the experimental group of the D2 Cuing Method study reported students feel less threatened when attempting to answer questions and are willing to take more risks in the form of increased participation in classroom question and answer activities.

Experimental group teachers reported the D2 Cuing Method was most easily applied to mathematics and situations that required a specific answer. The D2 Cuing Method was not as useful when questions were open-ended or required an opinion or explanation. Thus differences among mean mathematics scores, while not statistically significant, demonstrated positive trends and greater growth in the experimental group when compared to the control group. Despite the mixed results of the hypothesis testing, some subject areas and sub-sets of student groups experienced the D2 Cuing Method's impacted on student achievement in a positive way as measured by improved student test scores. Those test results suggested the cues utilized in the D2 Cuing Method were successful in supporting the retrieval of information.

While the D2 Cuing Method contained cuing strategies discussed by Linebaugh and Lehner (1977) and Love and Webb (1977), it utilized fewer cues and only verbal cues. Gestural and written cues were not provided. Research studies suggested providing cues with the least amount of support to elicit a correct answer and then fading the cues over time enhanced the learning of the student. Based on these strategies, the D2 Cuing Method instructed teachers to provide the least amount of support required to elicit a correct answer and then to work up or down the hierarchy depending on the student's response.

Cuing used in this way could help explain the teachers' perception that it worked with all students, including those who required special education support and those who qualified for gifted programming. The D2 Cuing Method was applied during large group instruction and had to be flexible to accommodate all student needs. Experimental group teachers agreed that the D2 Cuing Method accommodated their students' need for support and could be effectively used in large group instruction. No teacher reported a negative outcome using the D2 Cuing Method. Qualitative data provided evidence that more often than not the D2 Cuing Method elicited a correct response. These results could be explained by the fact that imitating the answer was the most potent cue provided. If the student could not imitate the answer provided by the teacher, it was the only time the D2 Cuing Method would not elicit a correct response.

The D2 Cuing Method provided feedback to students and teachers. The cuing hierarchy helped track the amount of support required by a student. By using the hierarchy, a teacher had a viable next step to guide a student to a correct answer.

The D2 Cuing Method provided guidance for a teacher to readily provide direct and specific information to a student when the student responded to a question incorrectly. Frey and Fisher's (2010) research suggested that because teachers followed through with students only 20% of the time to attain a correct answer during question-answer interactions, 80% of the time errors were left uncorrected. Yet the need to correct students when they are incorrect is essential to the learning process. By giving teachers a systematic method to scaffold students, teachers become more effective in promoting learning. Use of this reasoning explains why the D2 Cuing Method provided a positive impact on student achievement. This reasoning is supported by the research of Winne and Butler (1995), Hattie and Timperley (2007), and Hattie (2009, 2012). Hattie and Timperley (2007) determined that cues and feedback had the greatest effect-size when determining activities that promoted student achievement.

The D2 Cuing Method allows a framework for feedback and guides a student to a correct answer through scaffolding. Through student interactions, teachers provide cues that assist a student in generating a correct answer to a question. Support is faded over time as the teacher moves through the steps in the hierarchy moving from the most to least amount of cuing support. When the question is repeated and the student must answer the question independent of a cue, transference of responsibility is established from teacher to student.

Stone (1993) stressed the idea that scaffolding is not a teaching method in which the student is passive. Both the teacher and student learn from each other, creating an interactive dialogue in which both parties are actively engaged. This is the framework upon which the D2 Cuing Method is built. Stone (1998a, b) cautions that scaffolding must involve the student-teacher interaction to be successful. Scaffolding can not be a teacher-directed instructional strategy. Ruiz-Primo and Frutak (2006, 2007) along with Nathan and Kim (2009) reported teachers in their study demonstrated difficulty in applying diagnostic information to the intervention strategies required to offer adequate support. When no adjustment in instruction was made, the feedback information lost its power.

Another variable in the study of the D2 Cuing Method was wait time. Wait time is an instructional strategy that is defined as allowing students several seconds to formulate an answer to a question before being called upon to answer. Rowe (1974, 1987) determined a wait time of at least 3 seconds between the asking of a question and the calling for an answer was required to make a significant difference in student engagement.

The D2 Cuing Method incorporated wait time as a means to increase student participation and allow the student sufficient processing time. Teachers in the experimental group reported slowing down their teaching pace and stated it made a noticeable difference in the number of students who volunteered to answer questions. Based on teacher interviews, wait time was successfully implemented during cuing and had a positive outcome. No negative effects were reported as a result of increased wait time.

Unlike wait time, praise was a commonly used classroom strategy that produced inconsistent results in the research literature (Hattie, 2009, 2012). Hattie (2009, 2012) and Hattie and Timperley (2007) warned that when praise is offered as an empty comment containing no specific feedback it can have little effect and at times negative effect on student learning. However, Merrett and Thorpe (1996) suggested praise was an important component of learning as it enhanced student learning in reading instruction. Although the literature does not generally support the use of praise for the purpose of enhancing student achievement praise does help to create positive student-teacher relationships (Hattie, 2012).

Praise offered to students by the experimental group teachers potentially had a limited and even negative effect on student achievement. At no time in the D2 Cuing Method professional development did experimental group teachers receive instruction or information on how to provide praise. While praise may have improved student-teacher rapport and promoted a positive classroom culture, it may have also limited student achievement by diluting the instruction.

Positive student-teacher rapport is an essential component in a successful classroom environment that is conducive to learning. Rapport aids in a teacher's ability to understand and meet the needs of all students. Large group instruction is a common configuration of students for teaching in which one teacher is responsible for differentiating instruction to a large group of students. Schools now commonly use RTI as a framework in which tiered support is offered to students who require varying degrees of intensive training (Whitten, et al., 2009).

The D2 Cuing Method was applied to Tier I large group instruction. Four out of four experimental group teachers reported continued use of the D2 Cuing Method in their classrooms even after the data collection portion of the study was completed and classroom observations for this study were discontinued. Experimental group teachers reported the D2 Cuing Method promoted differentiated instruction because it could be used with every student in the class. Teachers reported that their perception improved of students who did not typically participate in question and answer exchanges because the D2 Cuing Method elicited a willingness on the part of many such students to engage more frequently in classroom discussion.

With use of the D2 Cuing Method teachers tended to evaluate more highly students who normally limited their class participation because of the subsequent increased level of participation. By reducing self-limiting opinions of student abilities, student expectations were increased. The observed increase of participation and change of teacher expectations in the experimental group paralleled Rowe's (1974) findings. Rowe reported teachers inherently called on the highest performing students in the class more frequently than the lowest performing students. Thus teachers set a precedent for limited participation by lower performing students.

Teachers in the experimental group were willing to adopt and continue to use the D2 Cuing Method further suggesting the D2 Cuing Method provided support and made a positive impact in the classroom and in student achievement. Literature and research suggest that teachers have the most powerful influence on student achievement (Hattie, 2009; Marzano, et al., 2001). Hattie (2009) warned, however, that not all teachers are equally effective and the quality of instruction they offer varies. Hattie's warnings were evident in this study. Fourth grade students in the experimental group did better in reading than fifth grade students. Conversely, fifth grade students in the experimental group did better in science than fourth grade students. It could be concluded that differences between fourth and fifth grade classrooms were more teacher-specific. The teacher was the critical factor in the outcome. As well, it is possible that some teachers utilized the D2 Cuing Method in a more effective manner than others.

Conclusions

The D2 Cuing Method was developed using specific elements of teaching and learning theory and practice from the fields of education, speech-language pathology, and neuro-cognitive science. This study's objective was to determine if a systematic hierarchy of cuing could be applied to large group instructional settings and yielded positive impact for student achievement. Although results were mixed the quantitative research suggested potential for positively impacting student achievement in reading, mathematics, science, and social studies. The qualitative research suggested a positive impact on student learning and teacher ability to successfully use scaffolding and cuing methods in the classroom.

Implications for Action.

Frey and Fisher (2010) suggested that while researchers have attempted to describe what scaffolding looks like, a systematic method of how to implement scaffolding has not been defined in the literature. In alignment, researchers have reported that teachers have difficulty using feedback they receive from their students to scaffold instruction (Ruiz-Primo & Frutak, 2006, 2007). Nathan and Kim (2009) reported little demonstration of adjustment in instruction to the level of their student whether in whole-class, small-group, or one-to-one settings.

The D2 Cuing Method attempted to provide a "how to" model for teachers that would incorporate the instructional strategies of cuing, scaffolding, feedback, wait time, and praise. The objective was to enhance student achievement and promote positive learning during teachable moments that would encourage effective student support, feedback, and educational risk taking. The D2 Cuing Method attempted to answer a call to action by Jensen (2005) to complete action-research that incorporated brain-based learning with teaching strategies for classroom use. This study provided evidence that the D2 Cuing Method was more likely than not to have a positive impact on student achievement.

Recommendations for Future Research.

Because there is no research in the literature that addresses all the elements contained in the D2 Cuing Method, this research was designed to be a pilot study to establish whether or not there was value in implementing the method on a large-scale basis and to conduct additional research. Recommendations for future research are:

1. Replication of this study should be completed to compare results and findings;
2. The D2 Cuing Method should be tested in other grade levels and schools to better understand its general effect in the classroom;
3. Multiple data points (test scores) should be collected in each subject area to better represent growth scores and understand the effect on student achievement of the D2 Cuing Method;
4. This study should be conducted over the course of a complete school year to better assess the cumulative effects of the D2 Cuing Method;
5. Classroom culture surveys could be completed prior to the implementation of the D2 Cuing Method and again at the end of the study to objectively determine student and teacher perception of classroom culture and any change effects the D2 Cuing Method may have caused;
6. Teacher professional development should include specific instruction on praise and feedback to limit the negative effects of empty praise comments;
7. Subgroup subject numbers should be larger to provide a more representative sample of students in various subgroups;

8. The D2 Cuing Method should be tested in RTI Tier II and Tier III instructional settings to determine generalization of effect in small group and one-to-one instructional settings; and
9. Methods of measuring student achievement in pre- and post-tests should vary to allow for multiple methods of data collection and better representation of student learning.

Concluding Remarks

The D2 Cuing Method was designed to offer teachers another tool in their arsenal of instructional strategies with which to enhance learning and promote a positive classroom culture. This study was an attempt to operationalize differentiated instruction through a hierarchical cuing method that intuitively makes sense while incorporating elements of evidence-based teaching methods. While there is no claim that the D2 Cuing Method will work in all classrooms with every child, the results of this study suggested that a skilled teacher could apply the D2 Cuing Method across various subject areas to capitalize on a teachable moment when a student answers a question incorrectly.

DuFour and Marzano (2011) stated,

> No single instructional strategy is guaranteed to result in high levels of student learning. Even strategies that have a solid research base supporting their effectiveness are likely to be found ineffective by a substantial number of other studies assessing the impact of those same strategies. (pp. 141-142)

With DuFour and Marzano's words in mind, it is the intention of this researcher that the D2 Cuing Method continue to be tested, refined, and better understood so that the method and strategy will evolve into a viable and effective method of instructional support for students in the classroom.

References

Abdeleal, A. (2008). *Neurocognitive processes of learning and evidence-based strategies for improving information processing*. Paper presented at American Speech Language Hearing Association National Convention, Chicago, IL.

Abercrombie, H. C., Kalin, N. H., Thurow, M. E., Rosenkranz, M. A., & Davidson, R. J. (2003). Cortisol variation in humans affects memory for emotionally laden and neutral information. *Behavioral Neuroscience*, *117*(3), 505-516.

Anderson, J. R. (1995). *Learning and memory: An integrated approach*. New York, NY: Wiley.

Atwood, V., & Wilen, W. (March 1991). Wait time and effective social studies instruction: what can research in science education tell us? *Social Education*, *55*, 179-181.

Bandur, D. L. & Shewan, C. M. (2008). Language-oriented treatment: a psycholinguistic approach to aphasia. In R. Chapey (Ed). *Language intervention strategies in aphasia and related neurogenic communication disorders* (5th ed.), (pp.756-799). Baltimore: MD: Lippincott, Williams, & Wilkins.

Bandura, A. (1965). Influence of models' reinforcement contingencies on the acquisition of imitative responses. *Journal of Personality and Social Psychology*, *1*, 589-595.

Bandura, A. (1977). *Social learning theory*. Englewood Cliffs, NJ: Prentice-Hall.

Batsche, G., Elliott, J., Graden, J.L., Grimes, J., Kovaleski, J. F., Prasse, D., Reschly, D.J., Schrag, J., & Tilly III, W. D. (2005). *Response to intervention: Policy consideration and implementation.* Alexandria, VA: National Association of State Directors of Special Education, Inc.

Bender W. N. & Shores, C. (2007). *Response to intervention: a practical guide for every teacher*. Thousand Oaks, CA: Corwin Press.

Berman, M., & Peele, L. M. (1967). Self-generated cues: A method for aiding aphasic and apractic patients. *Journal of Speech and Hearing Disorders*, *32*, 372-376.

Bjork, R., & Bjork, L. (1992). A new theory of disuse and an old theory of stimulus fluctuation. In A. F. Healy, S. M. Kosslyn, & R. M. Shiffrin (Eds.), *From learning processes to cognitive processes: Essays in honor of William K. Estes, 2*, 35–67, Hillsdale, NJ: Erlbaum.

Black, P. & Wiliam, D. (October 1998). Inside the black box: Raising standards through classroom assessment. *Phi Delta Kappan, 80*(2), 139-148.

Black, P. & Wiliam, D. (2009). Developing the theory of formative assessment. *Educational Assessment, Evaluation and Accountability, 21*(1), 5-31.

Bloom B. S. (1956). *Taxonomy of educational objectives, Handbook I: The cognitive domain.* New York: David McKay Co Inc.

Bloom, B. S. (1976). *Human characteristics and school learning*. New York, NY: McGraw-Hill.

Brookhart, S.M. (2008). *How to give effective feedback to your students*. Alexandria, VA: Association for Supervision and Curriculum Development.

Brophy, J. E., (1981). Teacher praise: A functional analysis. *Review of Educational Research, 51*, 5-32.

Buffum, A., Mattos, M., & Weber, C. (October, 2010). The why behind RTI: Response to intervention flourishes when educators implement the right practices for the right reasons. *Educational Leadership*, *68*(2), 10-16.

Butler, D. L., & Winne, P. H. (1995). Feedback and self-regulated learning: A Theoretical Synthesis. *Review of Educational Research*, *65*(3), 245 -281.

Burns, M. K., Appleton, J. J., & Stehouwer, J. D. (2005). Meta-analysis of response-to-intervention research: Examining field-based and research-implemented models. *Journal of Psychoeducational Assessment, 23,* 381–394.

Buzan, T. (1974). *Use both sides of your brain*. New York, NY: E. P. Dutton.

Chetty, R., Friedman, J., & Rockoff, J. (December 2011). The long-term impacts of teachers: Teacher value-added and student outcomes in adulthood. Retrieved from *obs.rc.fas.harvard.edu/chetty/value_added.pdf*

Cahill, L., Gorski, L., & Le, K. (July-August 2003). Enhanced human memory consolidation with post-learning stress: Interaction with the degree of arousal at encoding. *Learning & Memory, 10*(4), 270-274.

Cahill, L., Prins, B., Weber, M., & McGaugh, J. (1994, October 20). Adrenergic activation and memory for emotional events. *Nature, 371*(6499), 702-704.

Caine, G., & Caine, R. (1991). *Making connections: Teaching and the human brain*. Alexandria, VA: Association for Supervision and Curriculum Development.

Caine, R., and Caine, G. (1994). *Making connections: Teaching and the human brain,* (2nd ed.). Alexandria, VA: The Association for Supervision and Curriculum Development.

Caine, R., & Caine, G. (1997). *Education on the edge of possibility*. Alexandria, VA: The Association for Supervision and Curriculum Development.

Cole, A. D. (2006). Scaffolding beginning readers: Micro and macro cues teachers use during student oral reading. *Reading Teacher*, *59*, 450–459.

Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches*, (3rd ed.). Thousand Oaks, CA: SAGE Publications, Inc.

Davis, O. L., & Tinsley, D. (1967). Cognitive objective revealed by classroom questions asked by social studies teachers and their pupils. *Peabody Journal of Education, 44*, 21-26.

Dean, C. B.; Hubbell E. R., Pitler, H., & Stone, B. (2012). *Classroom instruction that works* (2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development.

Department of Elementary and Secondary Education (2011). Grade Level Expectations. Retrieved from http://www.dese.mo.gov/divimprove/curriculum/GLE/.

Department of Elementary and Secondary Education (2011). Show Me Standards. Retrieved from http://www.dese.mo.gov/standards/.

DuFour, R., DuFour, R., Eaker, R., & Many, T. (2006). *Learning by doing*. Bloomington, IN: Solution Tree Press.

DuFour, R., & Marzano, R. J. (2011). *Leaders of learning: how district, school, and classroom leaders improve student achievement*. Bloomington, IN: Solution Tree Press.

Edwards, B. (1979). *Drawing on the right side of the brain*. Los Angeles, CA: J. P. Teacher.

Fillippone, M. (1998). Questioning at the elementary level. Master's thesis, Kean University. (ERIC Document Reproduction Service No. ED 417431).

Fisher, D. & Frey, N. (2010a). *Enhancing RTI: How to ensure success with effective classroom instruction & intervention.* Alexandria, VA: Association for Supervision and Curriculum Development.

Fisher, D. & Frey, N. (2010b). *Guided instruction: How to develop confident and successful learners.* Alexandria, VA: Association for Development and Curriculum Development.

Frey, N. & Fisher, D. (2010, October). Identifying instructional moves during guided learning. *The Communication Arts Teacher,* 64(*2*), 84-95.

Fuchs, D. & Fuchs, L. (Jan/Feb/Mar 2006). Introduction to response to intervention: What, why, & how is it valid? *Reading Research Quarterly*, *41*(1), 93-99.

Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences*. New York, NY: Basic Books.

German, D. J. (2002). A phonologically based strategy to improve word-finding abilities in children. *Communication Disorders Quarterly, 23*, 179–192.

German, D. (2009, February). Child word finding: Student voices enlighten us. *The ASHA Leader,* retrieved from *http://www.asha.org/Publications/leader/2009/090210/f090210a/*.

Glass, G. V. (1976). Primary, secondary, and meta-analysis of research. *Educational Researcher, 5* (10), 3-8.

Glynn, T. & McNaughton, S. (1985). The Mangere home and school remedial reading procedures: Continuing research on their effectiveness. *New Zealand Journal of Psychology, 14*, 66-77.

Glynn, T., McNaughton S., Robinson, V., & Quinn, M. (1979). *Remedial reading at home helping you to help your child*. Education Department University of Auckland, New Zealand Council for Educational Research, Wellington. ERIC Document ED184081.

Ham, J. (Ed.). (2008). *Buckle Down Missouri communication arts level 4*. Iowa City, IA: Buckle Down Publishing.

Hamer, T. (Ed.). (2007). *Buckle Down science level 3-4*. Iowa City, IA: Buckle Down Publishing.

Hamer, T. (Ed.). (2008). *Buckle Down Missouri science level 5*. Iowa City, IA: Buckle Down Publishing.

Hardiman, M. M. (2010). The creative-artistic brain. In D. A. Sousa (Ed.), *Mind, brain, & education: Neuroscience implications for the classroom*. (pp. 227-246). Solution Tree Press, Bloomington, IN.

Hart, L. (1983). *Human brain and human learning*. New York, NY: Longman.

Harvard (2012). Harvard university website: Academic Programs through the Graduate School of Education. Retrieved from: http://www.gse.harvard.edu/academics/index.html.

Hattie, J.A.C. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement.* London, England: Routledge.

Hattie, J.A.C. (2012). *Visible learning for teachers: Maximizing impact on learning.* London, England: Routledge.

Hattie, J.A.C. & Timperley, H. (2007). The power of feedback. *Review of Educational Research*, *77*(1) p. 81-112.

Hogan, K., & Pressley, M. (1997). *Scaffolding student learning: Instructional approaches and issues*. Cambridge, MA: Brookline.

Hughes, C., & Dexter, D. D. Response to intervention: A research review. Retrieved from http://www.rtinetwork.org/learn/research/researchreview.

Healthy and Hunger-Free Kids Act of 2010 (Public Law 111-296). Retrieved from http://www.gpo.gov/fdsys/pkg/PLAW-111publ296/pdf/PLAW-111publ296.pdf.

Individuals with Disabilities Education Improvement Act of 2004 (Public Law 108-446). Retrieved from http://idea.ed.gov/.

Jancke, L. (2000). Cortical activations in primary and secondary motor areas for complex bimanual movements in professional pianists. *Cognitive Brain Research, 10*(1-2), 177-183.

Jensen, E. (2005). *Teaching with the brain in mind*. (2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development.

Jensen, E. (2008). *Brain-based learning: The new paradigm of teaching.* (2nd ed.). Thousand Oaks, CA: Corwin Press.

Kamins, M. L. & Dweck, C. S. (1999). Person versus process praise and criticism: Implications for contingent self-worth and coping. *Developmental Psychology, 35*(3), 835-847.

Kandel, E. R., Schwartz, J. H., & Jessell, T. M. (2000). *Principles of neural science*. New York, NY: McGraw-Hill.

King, D. (2009). Building assessment expertise through twenty-first-century professional development. In T. R. Guskey (Ed), *The principal as assessment leader* (pp. 73-91). Bloomington, IN: Solution Tree Press.

Kluger, A. N., & DeNisi, A. (1996). The effects of feedback interventions on performance: A historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychological Bulletin, 119*(2), 254.

Larkin, M. (2002). Using scaffolded instruction to optimize learning. Arlington, VA: ERIC Clearinghouse on Disabilities and Gifted Education. (ERIC Document Reproduction Service No. ED474301).

Lesley, M.K., Hamman, D., Olivarez, A., Button, K., & Griffith, R. (2009). "I'm prepared for anything now." Student teacher and cooperating teacher interaction as a critical factor in determining the preparation of "quality" elementary reading teachers. *The Teacher Educator, 44*(1), 44-55.

Levelt, W. J. M., Roelofs, A., & Myers, A. S. (1999). A theory of lexical access in speech production. *Behavioral and Brain Sciences, 22*(1), 1-75.

Linebaugh, C. W. & Lehner, L. H. (1977). Cueing hierarchies and word retrieval: A therapy program. In R. H. Brookshire (Ed.), *Proceedings of the clinical aphasiology conference* (pp. 19–31). Minneapolis: BRK Publishers.

Linebaugh , C. W., Shisler, R. J., Lehner, L. (2003). Cueing hierarchies and word retrieval: A therapy program. *Aphasiology*, *19*(1), 77-92.

Lipcomb, L., Swanson, J., & West, A. (2004). Scaffolding. In M. Orey (Ed.), *Emerging perspectives on learning, teaching, and technology*. Retrieved from http://projects.coe.uga.edu/epltt/.

Love, R. J. & Webb, W. G. (1977). The efficacy of cueing techniques in broca's aphasia. *Journal of Speech and Hearing Disorders, XLII*, 170-178.

Lowell, S., Beeson, P. M., & Holland, A. L. (1995). The efficacy of a semantic cueing procedure on naming performance of adults with aphasia. *American Journal of Speech-Language Pathology, 4,* 109-114.

Lunenburg, F. & Irby, B. (2008). *Writing a successful thesis or dissertation*. Thousand Oaks, CA: Corwin Press.

Many, J. E., Dewberry, D., Taylor, D. L., & Coady, K. (2009). Profiles of three preservice ESOL teachers' development of instructional scaffolding. *Reading Psychology, 30*, 148-174.

Marshall, R. C., Freed, D. B., & Phillips, D. S. (1994). Labeling of novel stimuli by aphasic subjects: Effects of phonologic and self-cueing procedures. *Clinical Aphasiology, 22*, 335-343.

Marzano, R. J. (2000). *Designing a new taxonomy of educational objectives*. Thousand Oaks, CA: Corwin Press.

Marzano, R. J. (2003). *What works in schools: Translating research into action in schools.* Alexandria, VA: Association for Supervision and Curriculum Development.

Marzano, R. J. (2007). *The art and science of teaching: A comprehensive framework for effective instruction*. Alexandria, VA: Association for Supervision and Curriculum Development.

Marzano, R., Pickering, D., & Pollock, J. (2001). *Classroom instruction that works: Research based strategies for increasing student achievement.* Alexandria, VA: Association for Supervision and Curriculum Development.

McGee, M. G. & Wilson, D. W. (1984). *Psychology: Science and application.* New York, NY: West Publishing Company.

McGeehan, J. (2001). Brain-compatible learning. *Green Teacher*, *64*, 7-13.

McGregor, K. K. (1994). Use of phonological information in a word-finding treatment for children. *Journal of Speech and Hearing Research, 37,* 1381-1393.

McNaughton, S., Glynn, T., & Robinson, V. (1987). *Pause, prompt and praise: Effective remedial reading tutoring.* Birmingham: Positive Products.

Merrett, F., & Thorpe, S. (1996). How important is the praise element in the pause, prompt, and praise tutoring procedures for older, low-progress readers? *Educational Psychology, 16*(2), 193-206.

Meyer, M. S. (2000). The ability-achievement discrepancy: Does it contribute to an understanding of learning disabilities?. *Educational Psychology Review, 12*(3), 315-337.

Meyers, P. (Ed.). (2008a). *Buckle down Missouri mathematics level 4*. Iowa City, IA: Buckle Down Publishing.

Meyers, P. (Ed.). (2008b). *Buckle down Missouri mathematics level 5*. Iowa City, IA: Buckle Down Publishing.

Miller, B. J., Effeney, D. J., & Gough, I. R. (1993). Do medical students remember multiple choice questions? *The Australian and New Zealand Journal of Surgery*, *63*(11), 897-900.

Murphy, N., & Messer, D. (2000). Differential benefits from scaffolding and children working alone. *Educational Psychology*, *20*, 17–31.

Myhill, D., & Warren, P. (2005). Scaffolds or straitjackets? Critical moments in classroom discourse. *Educational Review*, *57*, 55–69.

Nathan, M., & Kim, S. (2009). Regulation of teacher elicitations in the mathematics classroom. *Cognition and Instruction*, *27*, 91–120.

New faculty newsletter #7. (August 2006). Informally published manuscript, Office of Educational Development, University of California, Berkeley, CA. Retrieved from http://teaching.berkeley.edu/newsletters0910/correctingwronganswers.html

Newell, A. & Rosenbloom, P. S. (1981). Mechanisms of skill acquisition and the law of practice. In J. R. Anderson (Ed.), *Cognitive skills and their acquisition*. Hillsdale, NJ: Erlbaum.

No Child Left Behind Act of 2001 (Public Law 107-110). Retrieved from http://www.ed.gov/nclb/landing.jhtml.

Nickels, L. (2002). Improving word finding: Practice makes (closer to) perfect? *Aphasiology*, *16*(10/11), 1047-1060.

Nickels, L. (2010). Therapy for naming disorders: Revisiting, revising, and reviewing. *Aphasiology*, *16*(10/11), 935-979.

Nicol, D. J. & Macfarlane-Dick, D. (2006). Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. *Studies in Higher Education*, *31*(2), 199-218.

Nuthall, G. A. (2005). The cultural myths and realities of classroom teaching and learning: A personal journey. *Teachers College Record, (107)*5, 895-934.

Nuthall, G. A. (2007). *The hidden lives of learners*. Wellington, New Zealand: New Zealand Council for Educational Research.

Oh, P. S. (2005). Discursive roles of the teacher during class sessions for students presenting their science investigations. *International Journal of Science Education*, *27*, 1825–1851.

Puntambekar, S., & Hubscher, R. (2005). Tools for scaffolding students in a complex learning environment: what have we gained and what have we missed? *Educational Psychologist*, *40*, 1-12.

Pawan, F. (2008). Content-area teachers and scaffolded instruction for English language learners. *Teaching and Teacher Education*, *24*, 1450–1462.

Pea, R. D. (2004). The social and technological dimensions of scaffolding and related theoretical concepts for learning, education, and human activity. *Journal of the Learning Sciences*, *13*, 423–451.

Pearson, P. D., & Gallagher, M. C. (1983). The instruction of reading comprehension. *Contemporary Educational Psychology*, *8*, 317–344.

Petrelli, M. (2007). Is no child left behind's birthday worth celebrating? *Education Gadfly*, *7*(1). Retrieved from www.fordhamfoundation.org/foundation/gadfly/issue.cfm?edition=&id=271#3173.

Piaget, J. (1952). *The origins of intelligence in children*. New York, NY: W. W. Norton.

Pool, C. R. (March 1997). Maximizing learning: a conversation with renate nummela cain. *Educational Leadership*, *54*(6), 11-15.

Pratt, M. W., & Savoy-Levine, K. M. (1998). Contingent tutoring of long-division skills in fourth and fifth graders: Experimental tests of some hypotheses about scaffolding. *Journal of Applied Developmental Psychology*, *19*, 287–304.

Pressley, M., Hogan, K., Wharton-McDonald, R., Mistretta, J., & Ettenberger, S. (1996). The challenges of instructional scaffolding: The challenges of instruction that supports student thinking. *Learning Disabilities Research & Practice, 11*(3), 138-146.

Puntambekar, S., & Hübscher, R. (2005). Tools for scaffolding students in a complex learning environment: What have we gained and what have we missed? *Educational Psychologist*, *40*, 1–12.

Reeves, D. (2009). Level-five networks: Making significant changes in complex organizations. In A. Hargreaves & M. Fullan (Eds.), *Change wars* (pp. 185-200). Bloomington, IN: Solution Tree Press.

Rochford, G., & Williams, M., (August 1962). M. Studies in the development and breakdown of the use of names. *Journal of Neurology, Neurosurgery, & Psychiatry*, *25*, 222–233.

Rosenshine, B. (2002). Converging findings in classroom instruction. In A. Molnar (Ed.), *School reform proposals: The research evidence*. (pp. 9.0-9.30). Retrieved from nepc.colorado.edu/files/Chapter09-Rosenshine-Final.pdf.

Rothstein, D., & Santana, L. (2011). *Make just one change: Teach students to ask their own questions.* Cambridge: MA, Harvard University Press.

Rowe, M.B. (1972) *Wait-time and rewards as instructional variables, their influence in language, logic, and fate control.* Paper presented at the National Association for Research in Science Teaching, Chicago, IL.

Rowe, M. B. (1974). Wait time and rewards as instructional variables, their influence on language, logic and fate control. *Journal of Research in Science Teaching, 11,* 81-94.

Rowe, M. B. (Spring 1987). Wait time: Slowing down may be a way of speeding up. *American Educator, 11*, 38-43.

Ruiz-Primo, M. A., & Frutak, E. M. (2006). Informal formative assessment and scientific inquiry: Exploring teachers' practices and student learning. *Educational Assessment*, *11*, 237-263.

Ruiz-Primo, M. A., & Frutak, E. M. (2007). Exploring teachers' informal formative assessment practices and students' understanding in the context of scientific inquiry. *Journal of Research in Science Teaching*, *44*, 57-84.

Sadler, D. R. (1989). Formative assessment and the design of instructional systems. *Instructional Science*, *18*(2), 119-144.

Sadler, D. R. (2008). Beyond feedback: Developing student capability in complex appraisal. *Assessment and Evaluation in Higher Education*, *35*(5), 535-50.

Section 504 of the Rehabilitation Act (1973). Retrieved from http://www.ada.gov/cguide.htm.

Shepard, L. A. (2005). Linking formative assessment to scaffolding. *Educational Leadership*, *63*, 66–70.

Skipper, Y. & Douglas, K. (April 2011). Is no praise good praise? Effects of positive feedback on children's and university students' responses to subsequent failures. *British Journal of Educational Psychology*.

Smith, D. (Ed.). (2009). *Skillbridge: Missouri 4 reading*. Iowa City, IA: Buckle Down Publishing.

Sousa, D. A. (2009). *How the brain influences behavior: Management strategies for every classroom*. Thousand Oaks, CA: Corwin Press.

Sousa, D. A. (2010). How science met pedagogy. In D. A. Sousa (Ed.), *Mind, brain, & education* (pp. 9-24). Bloomington, IN: Solution Tree Press.

Sousa, D. A. & Tomlinson, C.A. (2011). *Differentiation and the brain: How neuroscience supports the learner-friendly classroom*. Bloomington, IN: Solution Tree.

Stahl, R. J. (1990). *Using think time behaviors to promote students' information processing, learning and on-task participation: An instructional module*. Tempe, Arizona: Arizona State University.

Stahl, R. J. (1994). *Using "think-time" and "wait-time" skillfully in the classroom* (ERIC Digest). Bloomington, IN: ERIC Clearinghouse for Social Studies/Social Science Education. (ERIC Reproduction Service No. ED 370885).

Steinberg, W. (2008). *Statistics alive!* Thousand Oaks, CA: Sage Publications, Inc.

Stevens, J. (1999). *Post hoc tests in ANOVA*. Retrieved from pages.uoregon.edu/stevensj/posthoc.pdf.

Stiggins, R. (2009). Assessment FOR learning in upper elementary grades. *Phi Delta Kappan, 90*(6), 419-421.

Stone, C. A. (1993). What is missing in the metaphor of scaffolding? In E. A. Forman, N.M. Minick, & C. A. Stone (Eds.), *Contexts for learning. Sociocultural dynamics in children's development* (pp. 169-183). New York, NY: Oxford University Press.

Stone, C. A. (1998a). The metaphor of scaffolding: Its utility for the field of learning disabilities. *Journal of Learning Disabilities*, *31*, 344–364.

Stone, C. A. (1998b). Should we salvage the scaffolding metaphor? *Journal of Learning Disabilities*, *31*, 409–413.

Sylwester, R. (February, 1997). The neurobiology of self-esteem and aggression. *Educational Leadership*, *54*(5), 75-79.

Tate, M.L. (2003). *Worksheets don't grow dendrites: 20 instructional strategies that engage the brain*. Thousand Oaks, CA: Corwin Press.

Tobin, K. (Spring 1987). The role of wait time in higher cognitive level learning. *Review of Educational Research*, *57*, 69-95.

van de Pol, J., Volman, M., & Beishuizen, J. (2010, April). Scaffolding in teacher-student interaction: A decade of research. *Educational Psychology Review, 22*, 271-296.

van de Pol, J., Volman, M., Beishuizen, J. (2011). Patterns of contingent teaching in teacher–student interaction. *Learning and Instruction 21*(1), 46-57.

Van Honk, J., Kessels, R.P.C., Putman, P., Jager, G., Postma, A., & Koppeschaar, H.P.F. (2003). Attentionally modulated effects of cortisol and mood on memory for emotional faces in healthy young males. *Psychoneuroendocrinology*, *28*, 941-948.

Vygotsky, L.S. (1962). *Thought and Language*. Cambridge, MA: MIT Press.

Vygotsky, L.S. (1978). In M. Cole, V. John-Steiner, S. Scribner, and E. Souberman, (Eds.), *Mind in society— The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Westwater, A. & Wolfe, P. (November, 2000). The brain-compatible curriculum, *Educational Leadership, 58*(3), 49-52.

Whitten, E., Esteves, K. J., & Woodrow, A. (2009). *RTI success: Proven tools and strategies for schools and classrooms.* Minneapolis, MN: Free Spirit Publishing Inc.

Wiig, E. H. & Semel, E. (1984). *Language assessment & intervention for the learning disabled* (2nd ed.). Columbus, OH: Charles E. Merrill Publishing Company.

Wilkinson, S. S. (1981). The relationship between teacher praise and student achievement: A meta-analysis of selected research. *Dissertation Abstracts International, 41*, 3998A.

Willis, J. (2006). *Research-based strategies to ignite student learning: Insights from a neurologist and classroom teacher*. Alexandria, VA: Association for Supervision and Curriculum Development.

Willis, J. (2007). *Brain-friendly strategies for the inclusion classroom: Insights from a neurologist and classroom teacher.* Alexandria, VA: Association for Supervision and Curriculum Development.

Willis, J. (2008). *How your child learns best: Brain-friendly strategies you can use to ignite your child's learning and increase school success*. Naperville, IL: Sourcebooks, Inc.

Wisenburn, B. & Mahoney, K. (2009). A meta-analysis of word-finding treatments for aphasia. *Aphasiology*, *23*(11) 1338-1352.

Wolfe, B. (Ed.). (2007). *Buckle down reading 5*. (2nd ed.). Iowa City, IA: Buckle Down Publishing.

Wolfe, P. (2010). *Brain matters: Translating research into classroom practice*. (2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development.

Wood, D., Wood, H., & Middleton, D. (1978). An experimental evaluation of four face-to-face teaching strategies. *International Journal of Behavioral Development*, *1*, 131–147.

Wright, S. P., Horn, S. P., & Sanders, W. L. (1997). Teacher & classroom context effects on student achievement: Implications for teacher evaluation. *Journal of Personnel Evaluation in Education*, *11*, 57-67.

Appendix A: Pre-Test and Post Test Components

Pre-test and Post-test components

Subject/Grade Level Expectation (GLE) or MO Strand Standard	Task for Assessment	Time Line for Assessment	Example Question
Reading: Fictional Reading GLE: R2C4 andR2C5 Develop and apply skills and strategies to comprehend, analyze, and evaluate fiction, poetry, and drama from a variety of cultures and times.	10 question multiple choice test derived from published curriculum materials	Pre-test: Week 2-Sept. Post-test: Week 4-Oct.	A writer would use which form of literature to convince you of his/her position: A. Poetry B. persuasive letter C. journal entry D. short story
Mathematics: Number and Operations and Algebraic Relationships GLE: N1C 4 and N1C5 Recognize equivalent representation for the same number and generate them by decomposing and composing numbers.	10 question multiple choice test derived from published curriculum materials	Pre-test: Week 3-August Post-test: Week 4 – Sept.	525 n also be written as: A. 500+2+5 B. 500+50+20 C. 5+2+5 D. 500+20+5

Subject/Grade Level Expectation (GLE) or MO Strand Standard	Task for Assessment	Time Line for Assessment	Example Question
Social Studies: Non-fiction Reading GLE: R3C4 and R3C5 Develop and apply skills and strategies to comprehend, analyze and evaluate nonfiction from a variety of cultures and times	10 question multiple choice test derived from published curriculum materials	Pre-test: Week 4- August Post-test: Grade 4: Week 3 – Sept. Grade 5: Week 2- Oct.	New England was founded in: A. North America B. South America C. England D. Asia
Science: Scientific Inquiry – MO Strand 7 Science understanding is developed through the use of science process skills, scientific knowledge, scientific investigation, reasoning, and critical thinking.	10 question multiple choice test derived from published curriculum materials	Pre-test: Week 1- Sept. Post-test: Week 2 – Oct.	Which unit of measurement would be most helpful to measure the length of your shoelace: A. miles B. liters C. inches D. yards

Appendix B: Validity Testing of Qualitative Research

Validity Testing of Qualitative Research

The following purpose statement was presented to five elementary teachers employed at the district in which this study was conducted. These teachers were not included in the experimental or control groups of the study. Feedback was requested from them regarding the validity and quality of the interview questions. This feedback was reviewed and improvements to the questions were made accordingly.

Validity Test

The purpose of this validity test is to determine if the following interview questions effectively and adequately requested information of study participants as they align to the research study. The following information reviews the study and interview format. Please read this information and review the interview questions, then answer the three questions to assess validity.

The purpose of this research is to investigate the effectiveness of the D2 Cuing Method in fourth and fifth grade classrooms on student outcomes in the areas of reading, mathematics, social studies, and science. The effect of this cuing method specific to the subgroups of children qualifying for free and reduced lunch, special education services, and gifted programming is also assessed. In addition, this study attempts to determine if this cuing method is more effective in the fourth or fifth grade and if it has greater effect in one subject area versus another. The final purpose of this study is to document teacher perception regarding cuing methods and teaching strategies in the classroom. Specifically, the teachers in the experimental group were asked to comment on the degree of ease and effectiveness this method had in his/her classroom across various curriculum subjects. Those teachers who were not trained in the D2 Cuing Method were asked to comment on teaching and cuing strategies in general. This qualitative data was collected to determine if teachers' self-perception of the implementation of the D2 Cuing Method (or lack of implementation) aligned to the outcomes associated with the quantitative data (pre- and post-test scores).

To clarify, the D2 Cuing Method is a systematic, hierarchical cuing strategy used to scaffold student learning in order to elicit a correct answer to a question. This instructional strategy utilizes a five-tiered series of cues, placed in hierarchical order, which can be used by the classroom teacher the moment a child responds incorrectly to a question. In this regard, a teachable moment is not lost, as would be the case if the teacher moved to another student to seek the correct answer. This allows real-time, interactive learning between the student and teacher to be incorporated into large group instruction.

The following interview questions will be asked of the teachers who participate in the study.

Guiding Questions for Teacher Interview with the Experimental Group

1. Describe your training in the D2 Cue Method and whether or not you felt it was effective.
2. What are five words you would use to describe the D2 Cue Method?
3. How easy was the D2 Cue Method to implement during large group instruction?
4. To what degree did the D2 Cue Method help elicit correct student answers in comparison to other methods you have used?

5. How have you elicited correct student answers in the past? Describe your procedure.
6. To what degree was the D2 Cue Method effective for all students in your classroom, including gifted students, those with special education needs, and those receiving free and reduced lunch?
7. Describe the student participation/engagement when you used this method.
8. Describe the correctness of response from your students when you implemented the D2 Cue Method.
9. What makes you feel empowered as a teacher?

Guiding Questions for Teacher Interview with the Control Group

1. Describe any training you have received in instructional strategies and whether or not you felt it was effective.
2. What are five words that describe the instructional strategy(ies) you use when a student answers a question incorrectly during a question-answer interaction?
3. How easy is this strategy to implement during large group instruction?
4. To what degree does this method help elicit correct student answers?
5. How have you elicited correct student answers in the past? Describe your procedure.
6. To what degree is this method effective for all students in your classroom, including gifted students, those with special education needs, and those receiving free and reduced lunch?
7. Describe the student participation/engagement when you used this method.

8. Describe the correctness of response from your students when you implemented this method.
9. What makes you feel empowered as a teacher?

Please answer the following questions:

1. Were these questions easy to read and understand? If not, why?
2. Do you think a 4th and 5th grade teacher could answer these questions effectively? If not, why?
3. Do these questions align with your understanding of the research study? If not, why?
4. Do you believe these questions will help the researcher obtain useful information to explain the quantitative study results (i.e.: effectiveness of the D2 Cuing Method)?
5. Would you change anything about the questions? If so, what?
6. Are there any questions you would add? If so, what, what?

Appendix C: Baker University Proposal For Research

BAKER UNIVERSITY

SCHOOL OF EDUCATION

Date:__8-2-11__________
IRB PROTOCOL NUMBER

____
GRADUATE DEPARTMENT
(IRB USE ONLY)

IRB REQUEST
Proposal for Research
Submitted to the Baker University Institutional Review Board

I. Research Investigator(s) (Students must list faculty sponsor first)

Department(s) **School of Education Graduate Department**

Name	Signature	
1. Dennis King, EdD	[signature]	Major Advisor
2. Margaret Waterman	[signature]	Research Analyst
3.		University Committee Member
4.		External Committee Member

Principal Investigator: Dawn M. Dennis
Phone: 816-689-1222 (H) 816-341-0104 (C)
Email: slpdawndennis@aol.com
Mailing address: 521 Raintree Drive St. Joseph, MO 64506

Faculty sponsor: Dennis King, EdD
Phone: 913-341-1231
Email: dennis.king@bakeru.edu
Expected Category of Review: ____Exempt ___X_Expedited ____Full

II: Protocol Title D2 Cue: Use of a Systematic Cuing Method in the Elementary Classroom

---

Summary
The following summary must accompany the proposal. Be specific about exactly what participants will experience, and about the protections that have been included to safeguard participants from harm. Careful attention to the following may help facilitate the review process:

In a sentence or two, please describe the background and purpose of the research.
This study sought to determine if use of the D2 Cuing Method would have a positive effect on reading, mathematics, social studies, and science test scores in fourth and fifth grade classrooms. This study will attempt to add to the limited body of literature that addresses cuing and scaffolding teaching strategies within the classroom.

Briefly describe each condition or manipulation to be included within the study.
The setting for this study will be regular education classrooms within the context of large group instruction for the subjects of reading, mathematics, social studies, and science. Students involved in the experimental group will experience the use of the D2 Cuing Method to elicit correct answers during question-answer interactions between students and teachers. Those students involved in the control group will not experience the use of the D2 Cuing Method during question-answer interactions.

What measures or observations will be taken in the study? If any questionnaire or other instruments are used, provide a brief description and attach a copy.
Teachers will be observed teaching in their classrooms for both the control and experimental groups to determine if they use any teaching strategies that mirror the D2 Cuing Method. Teachers in the experimental groups will continue to be observed weekly to determine fidelity of implementation of the D2 Cuing Method.

For the quantitative portion of this study pre- and post-test measures will be obtained from students in both the experimental and control groups. Pre- and post-tests will be 10 question multiple-choice tests derived from published curriculum materials. These tests will be administered for the curriculum subjects of reading, mathematics, social studies, and science. These tests are derived from teaching materials that can but utilized as practice work or formative assessments that teachers could use to assess student achievement and growth. All test content aligns to selected MO Show-Me Standard or Grade Level Expectation (GLE) as it occurs in the curriculum. All test content is presented in Missouri Assessment Program (MAP) format.

For the qualitative portion of the study, teachers in both the experimental and control groups will be interviewed to assess their views on cuing and scaffolding strategies used in large group instruction. Teachers in the control group will be asked to discuss their perceptions and experience using cuing methods in the classroom, amongst other strategies. For the teachers in the experimental group who were taught the D2 Cuing Method, questions will also focus on their opinions and thoughts about the D2 Cuing Method. Guiding Questions for the interviews will be as follows:

Guiding Questions for Teacher Interview with the Experimental Group

1. What are five words you would use to describe the D2 Cue Method?
2. How easy was the D2 Cue Method to implement during large group instruction?
3. To what degree did the D2 Cue Method help elicit correct student answers in comparison to other methods you have used?
4. How have you elicited correct student answers in the past? Describe your procedure.
5. To what degree was the D2 Cue Method effective for all students in your classroom, including gifted students, those with special education needs, and those receiving free and reduced lunch?
6. How did the students generally respond when you used this method?
7. Describe the response from your students when you implemented the D2 Cue Method.
8. What makes you feel empowered as a teacher?
9. Describe your training in the D2 Cue Method and whether or not you felt it was effective?

Guiding Questions for Teacher Interview with the Control Group

1. What are five words that describe the instructional strategy(ies) you use when a student answers a question incorrectly during a question-answer interaction?
2. How easy is this strategy to implement during large group instruction?
3. To what degree does this method help elicit correct student answers?
4. How have you elicited correct student answers in the past? Describe your procedure.
5. To what degree is this method effective for all students in your classroom, including gifted students, those with special education needs, and those receiving free and reduced lunch?
6. How did the students generally respond when you used this method?
7. Describe the response from your students when you implemented this method.
8. What makes you feel empowered as a teacher?
9. Describe your training you received in this method and whether or not you felt it was effective?

Will the subjects encounter the risk of psychological, social, physical, or legal risk? If so, please describe the nature of the risk and any measures designed to mitigate that risk.
Subjects will not encounter the risk of psychological, social, physical, or legal risk.

Will any stress to subjects be involved? If so, please describe.
Subjects will not experience stress in this study.

Will the subjects be deceived or misled in any way? If so, include an outline or script of the debriefing.
Subjects will not be deceived or misled in any way.

Will there be a request for information that subjects might consider to be personal or sensitive? If so, please include a description.
Subjects will not be asked to provide information that might be considered personal or sensitive.

Will the subjects be presented with materials that might be considered to be offensive, threatening, or degrading? If so, please describe.
Subjects will not be presented with materials that might be considered to be offensive, threatening, or degrading.

Approximately how much time will be demanded of each subject?
The subjects are 8 elementary school teachers; 4 in the control group and 4 in the experimental group. Subjects also include the students in each of these classrooms, for an anticipated total of approximately 200 students.
Teachers involved in this study will go through the following process:
Control Group:
1. Teachers are given an overview of the study and sign consent to participate in study. (30 min)
2. Teachers are observed for 20 minutes to ensure they are not using techniques that mimic the D2 Cuing Method in the classroom.
3. Teachers teach as they always have.
4. Teachers administer the pre- and post-test measures according to the timeline. (20 min/test)
5. Teachers are interviewed to assess their thoughts about strategies they use in the classroom. (45 min.)

Experimental Group:
1. Teachers are given an overview of the study and sign consent to participate in study. (30 min)
2. Teachers are observed 20 minutes to ensure they are not using techniques that mimic the D2 Cuing Method in the classroom.
3. Teachers undergo a 60-minute training outside of the classroom to learn the D2 Cuing Method.
4. Teachers implement the D2 Cuing Method during large group instruction.
5. Teachers are observed 15 minutes three times the first week and then 15 minutes per week thereafter to ensure the D2 Cuing Method is implemented correctly. Feedback is provided.
6. Teachers administer the pre- and post-test measures according to the timeline. (20 min/test)
7. Teachers are interviewed to assess their thoughts about use of the D2 Cuing Method. (45 min.)

Students involved in this study will not be required to participate in activities outside of the school day. The D2 Cuing Method will be included as a strategy a teacher can use in the experimental group. Students will not be aware of this change. For both the experimental and control groups, the pre- and post-test measures are ten question multiple-choice tests that should take no longer than 15-20 minutes to administer. These tests will be administered during appropriate times in the school day, as determined by the classroom teacher.

Who will be the subjects in this study?
Fourth and Fifth grade students in an urban Missouri public school district at 2 pre-determined elementary schools will be the subjects of this study. The teachers in each of these classrooms are considered subjects, as well.
How will they be solicited or contacted?
Teachers will be informed by this investigator and the building principal that the study has been approved and they were selected to participate in the study. Students will not be specifically informed, as there will be no change in the instruction of the curriculum. Teachers will maintain all curriculum activities. The D2 Cuing Method is a teacher strategy. Students will not be aware that there is a study being conducted.

Provide an outline or script of the information which will be provided to subjects prior to their volunteering to participate. Include a copy of any written solicitation as well as an outline of any oral solicitation.
Teachers will be informed in an informational meeting prior to the start of school. The following will be discussed:
1. Overview of the study. (Highlighted in Chapter 3- Methodology section of dissertation)
2. Requirements of the teacher. (Highlighted in Chapter 3 of dissertation)
3. Scheduling of initial classroom observation.
4. Scheduling of the training session for those in the experimental group.

What steps will be taken to ensure that each subject's participation is voluntary?
For teachers, the consent form included below states participation is voluntary.
Students will be participating in large group instruction and complete pre- and post-test measures that are part of the curriculum. A student's participation in the study is by participating in the school day, which will not differ. Students will not be aware they are a part of a study.

What if any inducements will be offered to the subjects for their participation?
Teachers will be asked to voluntarily participate in the study. No inducements will be offered.
Students will be participating in large group instruction and complete pre- and post-test measures that are part of the curriculum. No inducements will be offered.

How will you ensure that the subjects give their consent prior to participating? Will a written consent form be used? If so, include the form. If not, explain why not.
Students will not be required to give consent, as they will not be aware of the study.

Written consent of teachers will be used with the following form:

I, ______________________________________, voluntarily agree to participate in the dissertation study, *D2 Cue: The Use of a Systematic Cuing Method in the Classroom,* conducted by Dawn M. Dennis, doctoral candidate at Baker University. I understand that this study will require Mrs. Dennis to observe my teaching in the classroom and I will be required to administer pre- and post- tests to my students. I also understand I may involve learning a new teaching strategy. This study will also required me to be interviewed by Mrs. Dennis after all quantitative data is collected.

_______________________________ _________________________________

Participant Dawn M. Dennis- researcher

Will any aspect of the data be made a part of any permanent record that can be identified with the subject? If so, please explain the necessity.
No. Schools, teachers, and students will not be identified by name. Schools will be labeled A and B. Teachers will be assigned a letter-number combination based on school and grade (i.e.: A-4-1; A-4-2). Students will be given a number id. This will be assigned by the classroom teacher. Names will not be made known to the researcher. Classroom teachers will indicate if the child receives special education services or gifted services. The school secretary will indicate if a child qualified for free and reduced lunch.

Will the fact that a subject did or did not participate in a specific experiment or study be made part of any permanent record available to a supervisor, teacher or employer? If so, explain.
Failure for a subject (teachers and students) to participate in the study will not be made part of their permanent record available to a supervisor, teacher, or employer.

What steps will be taken to ensure the confidentiality of the data?
Investigators will not identify participants by name on the pre- and post- tests nor share that information with anyone not involved in the study. Participants will only be identified by number.

If there are any risks involved in the study, are there any offsetting benefits that might accrue to either the subjects or society?
There are no risks involved in the study.

Will any data from files or archival data be used? If so, please describe.
Yes. Teachers will need to use data from the students' cumulative academic files to indicate if the student participates in special education services or gifted programming. However, specifics from the file will not be made available to the researcher. The school secretary will need to review her files to indicate if a child is eligible for free and reduced lunch. Again, none of the specific information (child's name) will be revealed to the researcher.

Appendix D: Baker University IRB Approval Letter

September 21, 2011

Dawn M. Dennis
521 Raintree Drive
St. Joseph, MO 64506

Dear Ms. Dennis:

The Baker University IRB has reviewed your research project application (E-0119-0912-0921-G) and approved this project under Expedited Review. As described, the project complies with all the requirements and policies established by the University for protection of human subjects in research. Unless renewed, approval lapses one year after approval date.

The Baker University IRB requires that your consent form must include the date of approval and expiration date (one year from today). Please be aware of the following:

1. At designated intervals (usually annually) until the project is completed, a Project Status Report must be returned to the IRB.
2. Any significant change in the research protocol as described should be reviewed by this Committee prior to altering the project.
3. Notify the OIR about any new investigators not named in original application.
4. Any injury to a subject because of the research procedure must be reported to the IRB Chair or representative immediately.
5. When signed consent documents are required, the primary investigator must retain the signed consent documents for at least three years past completion of the research activity. If you use a signed consent form, provide a copy of the consent form to subjects at the time of consent.
6. If this is a funded project, keep a copy of this approval letter with your proposal/grant file.

Please inform Office of Institutional Research (OIR) or myself when this project is terminated. As noted above, you must also provide OIR with an annual status report and receive approval for maintaining your status. If your project receives funding which requests an annual update approval, you must request this from the IRB one month prior to the annual update. Thanks for your cooperation. If you have any questions, please contact me.

Sincerely,

Appendix E: School District X IRB Proposal and Approval

Institutional Review Board

Doctoral: Full Application Educational Specialist: Modified *

*Name _______Dawn M. Dennis________*Date Applied __June 26, 2011______

*Title of Study: D2 Cue: Use of a Systematic Cuing Method in the Elementary Classroom

*Dates for Collection of Data: August 2011 – October 2011

*Type of Data: Qualitative and Quantitative

*Research Design:

A mixed-method research design was utilized for this study. The quantitative component of this study consisted of a quasi-experimental research methodology pre-test - post-test design using a control group and experimental group. Hypothesis testing was completed to determine if the difference between the pre-test and post-test scores was statistically significant ($\alpha = 0.05$).

The qualitative component of this study consisted of a post-study interview of the four teachers who were trained in and implemented the D2 Cuing Method and the four teachers who were not trained in the D2 Cuing Method.

*Data Collection and Methodology:

In this study, both quantitative and qualitative data was collected. Three phases of implementation existed. They included the following: 1. Pre-Implementation Phase, 2. Implementation Phase, and 3. Post-Implementation Phase. The Pre-Implementation Phase and the Implementation Phase allowed for collection of quantitative data. The Post-Implementation Phase allowed for collection of qualitative data. The procedures completed for each of these phases were as follows:

Pre-Implementation Phase:

Prior to the start of school, participating teachers signed an agreement (see attached) indicating his/her intent to participate in the study and complete the tasks required of them accordingly. To protect confidentiality, the classroom teacher assigned students a number. This number system was used throughout the study to refer to specific students. During the first week of school, participating teachers, both in the experimental and control groups, were observed for a total of 30 minutes during large group instruction to ensure they were not using a cuing and scaffolding style of teaching that was identical to the D2 Cuing Method. If they were, they were removed from the study.

Implementation Phase:

An experimental group and a control group were established. School A contained those students who received the D2 Cuing Method, known as the experimental group. School B contained the students who did not receive the D2 Cuing Method, known as the control group.

The teachers of the experimental group underwent a 60-minute training session in which the D2 Cuing Method was described, demonstrated, and practiced. Training materials provided included a 4x6 note card of the five levels of cuing, as well as a guide that gave a detailed description of each level. Teachers were then required to use this cuing method in the classroom during all large group instruction. Use of the 4x6 note card as a guide was encouraged. The researcher observed three 15-minute instruction times during the first week of implementation. Feedback was given as to the use of the D2 Cuing Method and what, if any, improvements should be made. Fifteen-minute observations to ensure usage of the strategy were made every week, thereafter. Written and verbal feedback was provided after each observation. This feedback was specific as to if they were correctly using the D2 Cuing Method, and if not, what changes should be made.

To determine student growth and learning, pre- and post-tests were administered to students in both the control and experimental classes in the subjects of Reading, Mathematics, Social Studies, and Science. Prior to the instruction of an identified unit, the pre-test was administered. Teachers used the school curriculum as assigned. When a classroom teacher indicated completion of teaching a particular concept or unit in the curriculum that was being targeted by this study, the post-test was administered to the students. This researcher corrected all of the student tests.

Post-Implementation Phase:

The Post-Implementation Phase of the study was initiated once all of the post-tests were completed by the control and experimental groups. A qualitative interview was conducted with all of the teachers who participated in this study. The experimental group teachers' answers were recorded and reviewed to provide this researcher with teacher perception of the effectiveness and ease of utilizing the D2 Cuing Method in large group, general education classroom instruction.

The interview data was recorded and reviewed from the four teachers who participated in the control group. This data was collected to provide this researcher with teacher understanding of methods currently used in the classroom and if there exists a need for a method to be made available to them, such as the D2 Cuing Method. Guiding questions were used in each interview.

*What data will you be collecting and reporting about the ?

has only been described, not specifically named, in this research document.

Schools, teachers, and students will not be identified by name. Schools will be labeled A and B. Teachers will be assigned a letter-number combination based on school and grade (i.e.: A-4-1; A-4-2). Students will be given a number id. This will be assigned by the classroom teacher. Names will not be made known to the researcher. Classroom teachers will indicate if the child receives special education services or gifted services. The school secretary will indicate if a child qualified for free and reduced lunch.

Teachers will need to use data from the students' cum files to indicate if the student participates in special education services or gifted programming. However, specifics from the file will not be made available to the researcher. The school secretary will need to review her files to indicate if a child is eligible for free and reduced lunch. Again, none of the specific information (child's name) will be revealed to the researcher.

*University IRB Approval attached __This is still in process_

Chapter 3 attached ✓

IRB Interview completed ✓

*Report of findings/Executive Summary appointment to be completed upon final data collection

Institutional Review Board Approval (Yes) No

Signatures Date

1. July 14, 2011
2. 7/14/2011
3.
4.

Appendix F: Subject Agreement Form

Subject Agreement Form

I, ______________________________________, voluntarily agree to participate in the dissertation study, *D2 Cue: The Use of a Systematic Cuing Method in the Classroom,* conducted by Dawn M. Dennis, doctoral candidate at Baker University. I understand that this study will require Mrs. Dennis to observe my teaching in the classroom and I will be required to administer pre- and post- tests to my students. I also understand I may be required to learn a new teaching strategy. This study will also required me to be interviewed by Mrs. Dennis after all quantitative data is collected.

Participant: _______________________________________Date: __________

Researcher:____Date:___________

Dawn M. Dennis

Appendix G: Professional Development Materials: Notecard

Professional Development Materials

(Printed on 4x6 Note Card)

D2 Cuing Method

Following classroom instruction complete the following steps:

A. Ask question, wait three seconds for an answer.

B. If answer is correct, offer praise.

C. If answer is incorrect, use the following hierarchical cues:

1. semantic cues
2. sentence completion
3. phonemic cue
4. choice of 2 or 3 answers
5. imitation of the answer

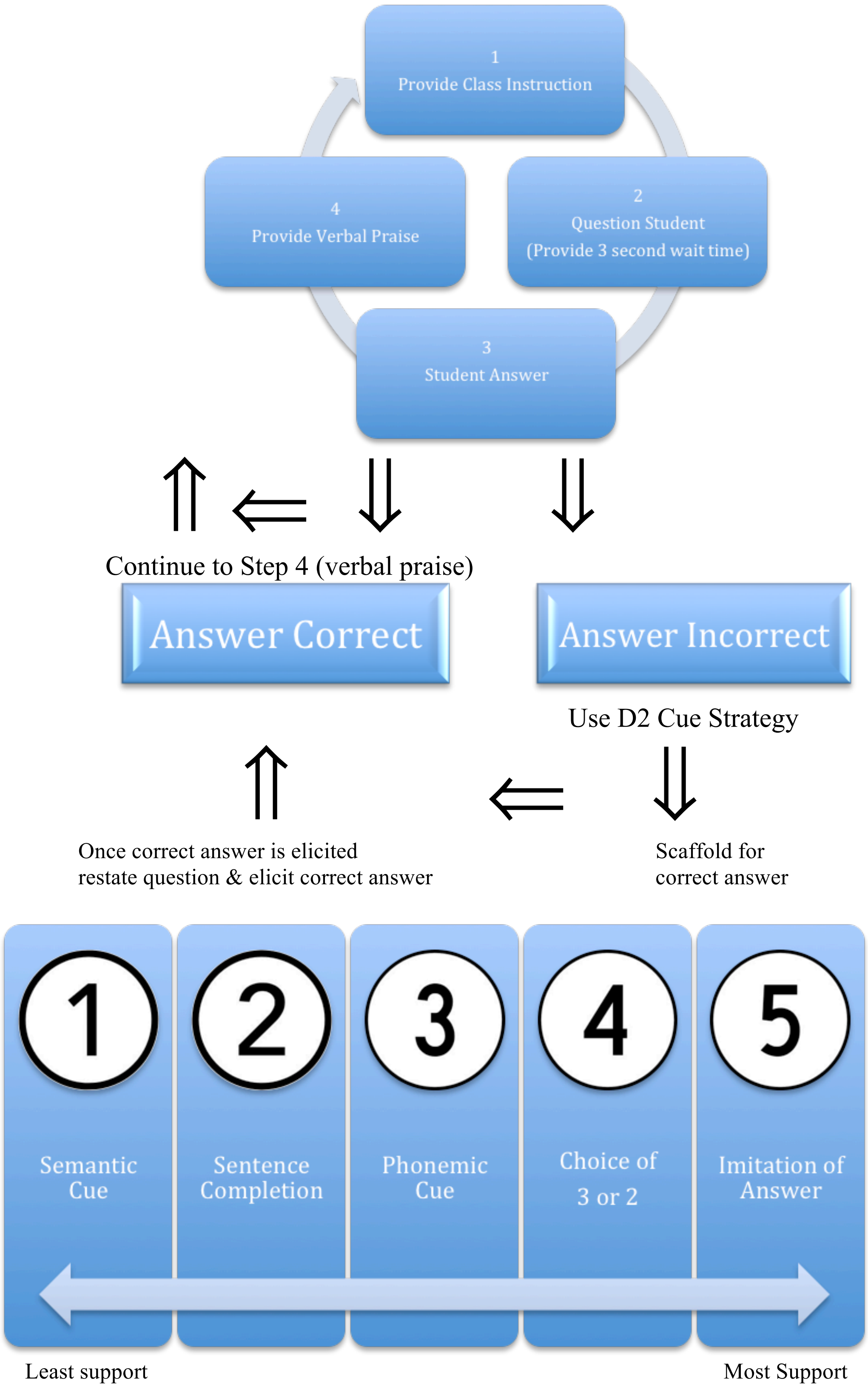
The teacher may start at any level and move up and down the hierarchy as deemed appropriate. (Level 1 least amount of support/Level 5 greatest amount of support).

D. Elicit a correct answer, restate the question, and wait at least three seconds for a spontaneous answer.

E. Offer praise for the correct answer.

F. If answer is again incorrect return to Step C and begin procedure again.

D2 Cuing Method



Appendix H: Professional Development Materials: D2 Cuing Method Guide

Professional Development Materials

D2 Cuing Method Guide:

Level 5: Imitation of the answer: (Greatest amount of support) The child is required to only use short-term memory and repeat information. This strategy can be modified from requesting a single word to a few sentences (Cue: "Say, 'wrench.'" vs. Cue: "Say, 'The mechanic is holding a wrench.'"). The child then repeats the answer.

Level 4: Choice of Two or Three Answers: The child hears the target answer and then one or two incorrect answers (foil). The child is therefore offered a model but will need to compare it to another choice. It is useful to make the non-targeted item one that pre-exists in the child's fund of knowledge. This strategy can be modified by making the choices similar (Cue: "Is it a wrench or a hammer?"). Increasing choices also decreases the percentage of a random guess (Cue: "Is it a wrench, hammer or screwdriver?"). The child then chooses an answer.

Level 3: Phonemic Cuing: The child hears the initial phoneme of the target word to help in his word finding skills. This can be modified by giving the initial sound, syllable or a few syllables in a multisyllabic word (Cue: "This is a wr____/wren____."). The child then generates the correct word.

Level 2: Sentence Completion: The child hears the sentence prompt which removes the need for the child to generate a sentence himself/herself, thus reducing the language demands of the child. The child then answers the question with a one to two word answer. Depending on how the sentence cue is structured, information from the original question can be repeated, helping the child hear specific information a second time (Cue: "This is a picture of a _________." Or "The tool that is used with a nut and bolt is called a _____.").

Level 1: Semantic Cues: (Least amount of support) The child is given attributes and categorical information of the targeted answer to help organize his thoughts and generate a correct answer. This cuing strategy is modified by how much information is given (Cue: "This is a metal tool that you use to fasten a nut and bolt. A mechanic would use it. You find it in a tool box."). The child then generates an answer.

Appendix I: Data Collection Table

Data Collection Table:

School: A or B **Grade: 4 or 5** **Teacher: 1 or 2**

Student #	SpEd	GATE	F&R	Reading		Math		Science		Social Studies	
				Pre/Post		Pre/Post		Pre/Post		Pre/Post	
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											

SpEd: Special Education Services GATE: Gifted and Talented Education
F&R: Free and Reduced Lunch

Appendix J: Guiding Questions For Teacher Interviews

Guiding Questions For Teacher Interviews

Guiding Questions for Teacher Interview with the Experimental Group

1. Describe your training in the D2 Cuing Method and whether or not you felt it was effective.
2. What are five words you would use to describe the D2 Cuing Method?
3. How easy was the D2 Cuing Method to implement during large group instruction?
4. To what degree did the D2 Cuing Method help elicit correct student answers in comparison to other methods you have used?
5. How have you elicited correct student answers in the past? Describe your procedure.
6. To what degree was the D2 Cuing Method effective for all students in your classroom, including gifted students, those with special education needs, and those receiving free and reduced lunch?
7. Describe the student participation/engagement when you used this method.
8. Describe the correctness of response from your students when you implemented the D2 Cuing Method.
9. What makes you feel empowered as a teacher?

Guiding Questions for Teacher Interview with the Control Group

1. Describe any training you have received in instructional strategies and whether or not you felt it was effective.
2. What are five words that describe the instructional strategy(ies) you use when a student answers a question incorrectly during a question-answer interaction?
3. How easy is this strategy to implement during large group instruction?
4. To what degree does this method help elicit correct student answers?
5. How have you elicited correct student answers in the past? Describe your procedure.
6. To what degree is this method effective for all students in your classroom, including gifted students, those with special education needs, and those receiving free and reduced lunch?
7. Describe the student participation/engagement when you used this method.
8. Describe the correctness of response from your students when you implemented this method.
9. What makes you feel empowered as a teacher?