

STUDENTS' LEARNING STYLE PREFERENCES AND TEACHERS'
INSTRUCTIONAL STRATEGIES: CORRELATIONS BETWEEN MATCHED
STYLES AND ACADEMIC ACHIEVEMENT

by

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Liberty University

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

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between matched styles and academic achievement

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ABSTRACT

Mary Lynne Wilson. STUDENTS' LEARNING STYLE PREFERENCES AND TEACHERS' INSTRUCTIONAL STRATEGIES: CORRELATIONS BETWEEN MATCHED STYLES AND ACADEMIC ACHIEVEMENT. (Under the direction of Dr. Leonard W. Parker) School of Education, November, 2011.

The purpose of the current study was to identify the extent to which learning styles influence the educational process as well as the outcome of students, particularly elementary-age students, in terms of academic achievement. This study examined the potential relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the academic achievement of fourth grade students as shown by Palmetto Assessment of State Standards scores in four academic content areas, namely English language arts, mathematics, science, and social studies. The researcher collected data from a sample of approximately 200 students from three schools in different northwestern South Carolina districts. A quantitative approach utilizing a correlational design was used to analyze the data and produced Pearson r values for each content area respectively. These results demonstrate a lack of significant correlation between variables.

Keywords: learning styles, achievement, instructional strategies, elementary

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TABLE OF CONTENTS

| | |
|--|------|
| Acknowledgements..... | ii |
| List of Tables | vi |
| List of Figures..... | vii |
| List of Abbreviations | viii |
| CHAPTER ONE: INTRODUCTION..... | 1 |
| Background..... | 1 |
| Problem Statement..... | 3 |
| Purpose Statement..... | 3 |
| Significance of the Study..... | 4 |
| Implications..... | 4 |
| Application..... | 4 |
| Research Questions and Hypotheses | 5 |
| Research Questions..... | 5 |
| Null Hypotheses..... | 6 |
| Identification of Variables | 7 |
| Operational Definitions..... | 7 |
| Conclusion | 9 |
| CHAPTER TWO: REVIEW OF THE LITERATURE..... | 11 |
| Purpose..... | 13 |
| Sources of Data..... | 13 |
| Diversity within the Learning Styles Field..... | 14 |
| Theoretical Foundations Underlying the Field of Learning Styles..... | 15 |
| Variations in Definitions and Exploration of Learning Styles..... | 17 |
| Implications of a Lack of Unity..... | 26 |
| Influence of Learning Styles on Education..... | 27 |
| Teachers | 27 |
| Students..... | 37 |
| The Question of Matching | 40 |
| Methodological Debate..... | 47 |
| Future Research | 48 |

| | |
|--|----|
| Theoretical Framework for the Current Study..... | 49 |
| Conclusion | 51 |
| CHAPTER THREE: METHODOLOGY | 53 |
| Introduction..... | 53 |
| Research Design..... | 53 |
| Research Questions..... | 54 |
| Null Hypotheses..... | 55 |
| Participants..... | 56 |
| Setting | 57 |
| Instrumentation | 58 |
| CAPSOL® Styles of Learning Inventory | 58 |
| Instructional Strategy Record Sheet and Compilation Checklist..... | 60 |
| Standardized Tests of Achievement..... | 61 |
| Procedures..... | 64 |
| Data Collection and Organization..... | 65 |
| Data Analysis | 68 |
| Summary of Methodology | 70 |
| CHAPTER FOUR: RESULTS | 71 |
| Restatement of Purpose..... | 71 |
| English Language Arts (ELA) | 71 |
| Research Question 1 | 72 |
| Null Hypothesis 1 | 72 |
| English Language Arts Results..... | 72 |
| Mathematics..... | 75 |
| Research Question 2 | 75 |
| Null Hypothesis 2 | 75 |
| Mathematics Results | 75 |
| Science | 77 |
| Research Question 3 | 78 |
| Null Hypothesis 3 | 78 |
| Science Results | 78 |
| Social Studies..... | 81 |
| Research Question 4 | 81 |
| Null Hypothesis 4 | 81 |

| | |
|---|-----|
| Social Studies Results..... | 81 |
| Conclusion | 84 |
| CHAPTER FIVE: DISCUSSION..... | 86 |
| Summary of Findings..... | 86 |
| Discussion..... | 87 |
| Implications..... | 89 |
| Delimitations and Limitations..... | 91 |
| Delimitations..... | 91 |
| Limitations in Design..... | 91 |
| Limitations in Data | 93 |
| Recommendations for Future Research..... | 96 |
| Conclusion | 98 |
| REFERENCES | 100 |
| APPENDIX A..... | 114 |
| School Administrative Official Letter/Consent Form..... | 114 |
| APPENDIX B..... | 118 |
| Teacher Letter/Consent Form | 118 |
| APPENDIX C..... | 121 |
| Parent/Guardian Consent Form..... | 121 |
| APPENDIX D..... | 124 |
| Child Assent Form | 124 |
| APPENDIX E..... | 125 |
| Instructions for Completing Instructional Strategy Record Sheet | 125 |
| APPENDIX F..... | 126 |
| Sample Instructional Strategy Record Sheet..... | 126 |
| APPENDIX G..... | 126 |
| Instructional Strategy Record Sheet..... | 127 |
| APPENDIX H..... | 131 |
| Compilation Checklist for Instructional Strategies..... | 131 |
| APPENDIX I..... | 131 |
| Cumulative Accommodation Data Sheet..... | 132 |

List of Tables

Table 1 – Cut Score Standards for PASS Test63

List of Figures

| | |
|---|----|
| Figure 1. Frequency Histogram of English Language Arts Degree of Match Scores (ELADOM) | 73 |
| Figure 2. Frequency Histogram of English Language Arts PASS Test Scores (ELAPASS) | 73 |
| Figure 3. Scatter Plot Displaying Relationship between English Language Arts Degree of Match (ELADOM) and PASS Test Scores (ELAPASS) | 74 |
| Figure 4. Frequency Histogram of Mathematics Degree of Match Scores (MATHDOM) | 76 |
| Figure 5. Frequency Histogram of Mathematics PASS Test Scores (MATHPASS) | 76 |
| Figure 6. Scatter Plot Displaying Relationship between Mathematics Degree of Match (MATHDOM) and PASS Test Scores (MATHPASS) | 77 |
| Figure 7. Frequency Histogram of Science Degree of Match Scores (SCIDOM) | 79 |
| Figure 8. Frequency Histogram of Science PASS Test Scores (SCIPASS) | 79 |
| Figure 9. Scatter Plot Displaying Relationship between Science Degree of Match (SCIDOM) and PASS Test Scores (SCIPASS) | 80 |
| Figure 10. Frequency Histogram of Social Studies Degree of Match Scores (SOCDOM) | 82 |
| Figure 11. Frequency Histogram of Social Studies PASS Test Scores (SOCPASS) | 83 |
| Figure 12. Scatter Plot Displaying Relationship between Social Studies Degree of Match (SOCDOM) and PASS Test Scores (SOCPASS) | 84 |

List of Abbreviations

Computerized Assessment Program - Styles of Learning (CAPSOL[®])

Differentiated Item Functioning (DIF)

English Language Arts (ELA)

Individualized Education Program (IEP)

Intelligence Quotient (IQ)

Myers-Briggs Type Indicator (MBTI)

Palmetto Assessment of State Standards (PASS)

Standard Error of Measurement (SEM)

CHAPTER ONE: INTRODUCTION

Background

An abundance of information exists concerning learning styles and their implications for learning and teaching. According to Zapalska and Dabb (2002), an understanding of the way students learn improves the selection of teaching strategies best suited to student learning. For students, this matching of instructional strategies to their individual learning styles has “consistently evidenced positive results” in empirical studies (Minotti, 2005, p. 84). Although some researchers deny there is a statistically significant correlation between learning style and performance, many of these researchers acknowledge there is likely an educational benefit from the use of varied modalities in instructional practice (Hall & Moseley, 2005; Karns, 2006; Kratzig & Arbuthnott, 2006; Pashler, McDaniel, Rohrer, & Bjork, 2009).

Educational and psychological theorists have identified several major types and categories of learning styles, and researchers have observed and recorded the effect of these various styles on student achievement in school (Reiff, 1992). Some prominent ways of identifying learning styles include learning modalities (Barbe, Swassing, & Milone, 1979), multiple intelligences (Gardner, 1999), and several distinct learning style models (Dunn & Burke, 2006; Felder, 1996). These varied conceptualizations of student learning preferences led to the review and development of numerous teaching styles. These include teacher-centered, experiential, and differentiated instruction, as well as various instructional model approaches and the incorporation of brain-based techniques (Caine, & Caine, 1991; Denig, 2004; Loo, 2004). Researchers have

conducted numerous studies concerning the influence of various learning styles and instructional methods on student learning and achievement (Collinson, 2000; Minotti, 2005).

Dunn et al. (2009) asserted that valid and reliable instruments are available for assessing the learning styles of students of all ages; additionally, they claimed educators can effectively utilize results gathered from such assessments to develop instructional lessons that are responsive to student needs. Meeting the needs of students is essential if educators are to make substantial progress toward the goal of developing lifelong learners (Williamson & Watson, 2007). Learning style theories have been cited as an effective means for helping teachers recognize the incredibly diverse needs students bring into the classroom (Dunn, Denig, & Lovelace, 2001; Felder & Brent, 2005; Hall & Mosely, 2005; Sternberg, Grigorenko, & Zhang, 2008; Williamson & Watson, 2007). In addition, Williamson and Watson claimed these theories provide a framework that enables teachers to knowledgably develop a variety of instructional methodologies to benefit all students. This certainly extends to students with identified special learning needs, and Guild (2001) even suggested that some identified students may simply be exhibiting difficulties associated with a mismatch between teaching and learning styles.

Although there is a broad theoretical foundation for the existence of learning styles, the need remains for further research concerning the relationship between learning styles and academic success (Cano-Garcia & Hughes, 2000; Romanelli, Bird, & Ryan, 2009). Indeed, significant debate still surrounds the issue of learning styles and its function in the instructional process (Sharp, Bowker, & Byrne, 2008). Particularly, researchers have not thoroughly explored the links between learning styles and achieved

outcomes of the learning process, thus hindering practical implementation of learning styles theory in instructional practice (Romanelli et al., 2009). Past research has predominately focused on identifying individuals' learning style preferences and patterns (Romanelli et al.). While this was purportedly beneficial for teachers in selecting and developing instructional practices, research along those lines often took the form of studies evaluating the implementation of specific learning or instructional style models (Goby & Lewis, 2000; Lovelace, 2005; Noble, 2004). Additionally, the majority of studies pertaining to learning styles involved participants in secondary or post-secondary education (Sharp et al., 2008); thus, the role learning styles may play in the achievement of primary grade students needs further investigation.

Problem Statement

It is essential, therefore, to conduct additional research identifying the extent to which learning styles influence the educational process as well as the outcome of students, particularly elementary-age students, in terms of academic achievement. Further, it is imperative that some of this research occur in authentic learning environments that do not appear sterile or contrived in an effort to maintain pure objectivity. In addition, a collective view of learning styles integrating several dominant components of various theories could make the application of potential findings more realistic and effective for use in the typical classroom.

Purpose Statement

Thus, the purpose of the study was to conduct an examination of student learning style preferences and teachers' instructional practices, exploring the extent to which these were matched in a typical classroom setting. The researcher then paired the observed

degree of match with students' academic achievement to detect potential relationships. The researcher recognized characteristics such as gender, ethnicity, and the presence or absence of special learning needs may affect the potential relationships between the level of matched learning and teaching strategies and student achievement; however, the current study did not consider these factors.

Significance of the Study

Implications

While, by nature, a correlational study cannot afford a statement of cause and effect, it is capable of providing researchers and educators alike with valuable information. This study aimed to assist teachers in understanding the various learning styles favored by themselves and their students. In addition, the researcher hoped to gather enough information to help teachers recognize the important relationship between the instructional strategies they utilize and the success their students may experience. If indeed significant relationships are exposed, further credibility is afforded the theory that learning styles play an important role in how well students achieve academically. The instruments utilized in the study could then become a means to assist teachers in continued self-reflection as they monitor their instructional strategies and attempt to incorporate a wider variety of methods in their teaching repertoire.

Application

The researcher was interested in obtaining the results and observing any potential patterns in teacher learning styles and instructional strategies in addition to the main query of this study. This could provide the basis for further research, as could any specific relationships between particular learning styles, instructional strategies, and

population subgroups. A wide range of prospective benefits may be obtained for teachers of all students if significant relationships are found for both students who have and have not been identified as having special educational needs. This could provide an impetus for increased differentiation in regular education classrooms, which would enable higher levels of success for all students as well as having the potential to ease the discomfort some teachers feel about inclusion. In addition, the results of the study may provide motivation and direction for an increased thrust in providing relevant teacher training concerning the concept of learning styles and matched instructional strategies.

Research Questions and Hypotheses

Prior research and theory as well as personal observations served as the foundation upon which the study was developed. In an attempt to expand the knowledge base in the field of education, the following research questions, with their related hypotheses, were developed and served as the guiding force of the study.

Research Questions

1. Is there a significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade English language arts students as shown by Palmetto Assessment of State Standards scores?
2. Is there a significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade mathematics students as shown by Palmetto Assessment of State Standards scores?
3. Is there a significant relationship between the degree of match (as determined

by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade science students as shown by Palmetto Assessment of State Standards scores?

4. Is there a significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade social studies students as shown by Palmetto Assessment of State Standards scores?

Null Hypotheses

1. There is no significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade English language arts students as shown by Palmetto Assessment of State Standards scores.
2. There is no significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade mathematics students as shown by Palmetto Assessment of State Standards scores.
3. There is no significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade science students as shown by Palmetto Assessment of State Standards scores.
4. There is no significant relationship between the degree of match (as

determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade social studies students as shown by Palmetto Assessment of State Standards scores.

Identification of Variables

The variables investigated in the current study included the academic achievement and the degree of match between students' learning style preferences and teachers' instructional strategies. These terms appear throughout the study and refer to specific ideas related to the research conducted. The following section provides operational definitions for these and other relevant terms in order to ensure accurate and consistent understanding in relation to the current study.

Operational Definitions

Academic achievement refers to the achievement levels of students in all academic content areas (English language arts, mathematics, science, and social studies,) as indicated by results of a standardized achievement test.

Degree of match illustrates the extent to which obtained indications of students' learning style preferences are similar to indications of teachers' instructional style accommodations for each of the learning style elements addressed in the study. Pairing students' high, moderate, or low learning style preference scores with teachers' high, moderate, or low accommodation scores produced degree of match scores of zero, one, or two. A complete match (e.g. high preference/high accommodation) received a score of zero, a complete mismatch (e.g. high preference/low accommodation) received a score of one, and a near match (e.g. high preference/moderate accommodation) received a score of one. Thus, pairwise comparison of these indications produced a degree of match

score ranging from zero to 18 for each student in each of the four academic content areas included in the study.

Instructional strategies are teaching methods and practices utilized to conduct a learning activity as reported by the teachers and paired in checklist form by the researcher and a panel of terminally degreed educators with the learning styles identified in the CAPSOL[®] (Computerized Assessment Program - Styles of Learning) Inventory.

Learning styles are approaches by which students prefer to learn as measured by the CAPSOL[®] Inventory. CAPSOL[®] defines the learning styles identified by the inventory as follows:

Auditory: The learner's preference for listening, understanding spoken directions, following logic that is explained verbally, and addressing background sounds-whether supportive or disruptive.

Visual: The learner's preference for visually gathering and comprehending information through reading, observing models, maps, graphic organizers, charts, and demonstrations, and to internalize their own perspective.

Bodily Kinesthetic: The learner's preference for understanding by actively touching, manipulating, arranging, acting, showing, and experimenting with various physical approaches by experiencing first-hand.

Individual: The learner's preference for addressing acquisition of knowledge from an individual perspective, comparing new information with previous experience and reflecting understanding through their own opinions and modes of perception.

Group: The learner's preference for collaboration with one or more other

students in planning, discussing, sharing responsibility, organizing, listening, and supporting a point of view leading to a product.

Oral Expressive: The learner's preference for expressing their understanding and insight through spoken description or through questioning of ideas, concepts or facts.

Written Expressive: The learner's preference for expressing their understanding and insight through written descriptions, questioning, word processing emphasizing cut/paste approaches, and drawing conclusions.

Sequential: The learner's preference for information and procedures that are based on logic, timeliness, ordering, prioritizing, and inferencing, including timelines, flo-charts [sic], diagrams, etc.

Global: The learner's preference for "big picture" understanding and addressing information whole to part, internalizing the "why", wanting to know what will this become, and if I learn this information, where can I apply it in the real world. (CAPSOL® Styles of Learning, n.d., Styles of Learning page)

Standardized achievement tests are any tests “with specific content, prescribed directions for administering and scoring, norms, and reliability and validity information derived from administration to representative samples” (Ary, Jacobs, Razavieh, & Sorensen, 2006, p. 639).

Conclusion

This chapter included an introduction to the problem addressed in the current study and provided the reader with an overview of the purpose of the research. In addition, the chapter delineated the research questions and related null hypotheses and

provided operational definitions for relevant terms. Chapter two will outline the review of the literature, covering the diversity within the learning styles field, the influence of learning styles on education, and the methodological debate surrounding learning styles research. The subsequent chapter concerning methodology details the research design and procedures for the current study. Chapter four presents the results and statistical analysis of the collected data, while the final chapter includes a discussion of the findings, implications for practice, and recommendations for future research.

CHAPTER TWO: REVIEW OF THE LITERATURE

The study of learning styles has received significant attention in recent years, and in a time when academic achievement is under scrutiny, it is vital that educators know and utilize the best possible methods for helping students learn successfully. When Koch (2007) questioned renowned learning styles expert, Rita Dunn, about the No Child Left Behind Act (2001), she responded by stating that no research has indicated that increased testing leads to increased achievement. Although she acknowledged that testing is an important aspect, she declared that only changes in instruction would produce higher levels of achievement. Fortunately, the educational world is opening up to the importance of understanding the various ways students learn and recognizing the vital role this plays in attaining widespread academic success (Collinson, 2000). In fact, results of a recent study indicated teachers benefit from developing an understanding of how they and others learn as well as the effect this has on their teaching (Evans & Waring, 2006).

This does not mean, however, that all educators have come to an agreement on the definition, descriptions, or implications of learning styles. Instead, there are an ever-increasing number of theories and models being developed to address this issue. Potentially causing further confusion is the fact that many of these models have a similar theoretical base and share foundational components while they maintain significant variations. According to Collinson (2000), researchers building upon previous ideas and methodologies develop unique terms and definitions, expand (or contract) the base of included factors, and broaden (or narrow) the horizons of instructional approaches, all of

which collectively conceal the overlapping qualities of their work. Perhaps one factor underlying this issue is the increasingly common view that learning styles are a combination of cognitive, affective, and physiological factors that merge to define each student's unique approach to effective learning (Collinson, 2000). Often, different researchers have chosen to focus exclusively on a certain set of factors, leaving educators with the need to study multiple theories and models in order to understand the needs and preferences of all the students they encounter in their classes.

An additional concern is that, while research and classroom experience confirms the existence of different learning styles, visits to schools throughout the world might convince one otherwise. Although Guild (2001) asserted that educators are cognizant of the diversity of the learners who populate their classrooms, he acknowledged that, regrettably, they typically maintain a singular approach to teaching. This uniformity in practice negates any benefits of the stated awareness (Guild, 2001). Moreover, educators who maintain a limited understanding of the differences among individual learners are likely to seek one paramount approach as the answer to all teaching and learning (Guild, 2001). Likewise, Evans and Waring (2006) discovered a majority of teachers involved in their study typically utilized an approach based upon transmitting information rather than one specifically geared toward the development of students' understanding. However, historical evidence has all but proven no single approach will ensure success for all learners. Thus, educators must abandon this singular mentality and realize the essential necessity of endeavoring to develop a true understanding of learning differences and striving to provide instruction that is intentionally diverse (Guild, 2001).

Purpose

The purpose of this literature review is to examine various approaches to understanding learning styles, looking at the models developed in an attempt to define learning styles and explain their influence on acquiring knowledge. In addition, this literature review explores multiple teaching styles designed to address the issue of learning styles in an effort to meet students' needs more effectively. Finally, this literature review intends to provide an investigation of prior and current research concerning the influence of having both unmatched and matched teaching and learning styles.

Sources of Data

In order to achieve the goals of the literature review, the researcher gathered information from various sources, including scholarly journal articles, books, and pertinent organizational websites. From sources reviewed, the researcher also examined the reference lists for citations identifying further sources that might be relevant to the current review. Conduction of the vast majority of research used the EBSCOhost platform to search multiple databases for relevant theoretical and research articles. These databases included, but were not limited to Academic Search Complete, Education Research Complete, and ERIC. Keyword searches facilitated the finding of articles pertaining to the following terms: learning styles, learning style preferences, instructional strategies, teaching strategies, and academic achievement. The researcher chose these terms in an attempt to target the search to those publications that were most relevant to the research question explored in this study, namely the effect of matched learning and teaching styles on students' academic achievement. Review of the attained results led to

an organization of information by topic.

Articles selected for inclusion in this review fell into two basic categories, which led to the general outline of this review. The first category was comprised of scholarly publications of historical or theoretical significance in regards to broad learning style theory and specific learning style models. The second category of articles selected were research publications disseminating empirical evidence concerning the effects of learning and teaching styles on academic achievement. Several research studies were not included because they explicitly focused on instructional approaches tied to a particular learning style model or because they studied only students in secondary or higher education. Omission of these articles from the review resulted from a focus deemed too narrow or not particularly generalizable to typical classroom-based instruction of elementary-aged students, which is the focus of this particular study.

Diversity within the Learning Styles Field

Although there is considerable interest in the subject of learning styles among educators and parents alike, there is a noted lack of unity within the field (Hall & Moseley, 2005; Pashler et al., 2009). Between 1902 and 2002, learning styles theory expanded significantly, with no fewer than 71 different models published during this 100-year period. While many of these models share some characteristics, each has a unique perspective, focusing uniquely on student preferences, abilities, and even preferences based on ability (Hall & Mosely). Researchers have made various attempts to classify the wide variety of learning style models and thereby bring greater unity to the field (Felder & Brent, 2005; Hall & Moseley; Sternberg et al. 2008). However, in order to understand fully the relationships between the diverse models, it is necessary to recognize

first the theoretical foundations underlying them. These include both Brain-Based Educational Theory and the Approaches to Learning Model.

Theoretical Foundations Underlying the Field of Learning Styles

Both the Brain-Based Educational Theory and The Approaches to Learning Model have relevance to the study of student achievement in relation to learning style preferences and instructional strategies. Further classification systems rely upon these basic theoretical differences as a basis for organizing the wide variety of specific models. For example, systems have been presented in which learning style models are classified as ability- or personality-based (Sternberg et al., 2008); as related to learning styles, approaches to learning, or intellectual development (Felder & Brent, 2005); and using a continuum from a focus on fixed traits to a greater emphasis on personal preferences and orientations (Hall & Moseley, 2005).

Brain-based educational theory. Brain-Based Educational Theory involves exploring the ways by which the brain works to facilitate learning. It takes into consideration the natural and physiological processes that occur during learning and uses this understanding to guide educational practice. Understanding the functions of the brain and incorporating this in designing learning experiences can significantly improve the effectiveness of student learning (Caine & Caine, 1991). Brain-Based Educational Theory is also exemplified by Howard Gardner's conceptualization of Multiple Intelligences. According to Dunn et al. (2001), Gardner's theory which includes nine intelligences (linguistic, logical-mathematical, spatial, kinesthetic, musical, interpersonal, intrapersonal, naturalistic, and existential) identifies intelligence as having much greater scope than what is measured in terms of test scores in language and mathematics; rather,

instead of demanding mastery of academic content, it encourages the development of each student's inherent potential.

Approaches to learning model. One may view the Approaches to Learning Model in terms of learning styles or learning approaches. While some proponents argue they are two distinct schools of thought, one can also conceptualize them as an integrated construct (Cuthbert, 2005). Learning styles, and the related cognitive styles, typically refer to individual preferences for responding to situations and data and for comprehending experiences and developing knowledge from them. Learning approaches, on the other hand, deal more with the intentions students have for different learning tasks, which then result in different learning outcomes (Cuthbert). Considering the inclusion of both learning styles and approaches to learning, this model has numerous proponents, each with a unique twist on the same basic concept that individuals have preferences for the ways in which they learn. One particularly well-known model is that of Dunn and Dunn, which defines learning style as “the way in which each person begins to concentrate on, process, internalize, and remember new and difficult academic content” (Dunn et al., 2001, Examining Learning Styles Section). Kolb’s Experiential Learning Theory and the Perceptual Learning Styles Theory are two additional examples of specific theories founded in the Approaches to Learning Model (Cuthbert, 2005; Davis, 2007; Kolb & Kolb, 2009). While they focus on different characteristics, with Kolb’s model focusing on grasping and transforming experiences (Kolb & Kolb) and the Perceptual Learning Style Theory dealing with multiple modality preferences for how individuals interact with information and conduct learning tasks (Davis, 2007), they both incorporate the concept that individual learning differences influence the learning process

and the effectiveness of various learning experiences.

Variations in Definitions and Exploration of Learning Styles

Much of the written work concerning learning styles is devoted to defining learning styles and providing evidence that differences exist in the inherited or preferred styles of individuals (Lovelace, 2005; Pashler et al., 2009). Some sources address specific approaches, identifying classification schemes and asserting the relevance of such for education (Collinson, 2000; Denig, 2004; Young, 2002). Others provide an overview of various models, attempting to provide a composite view of several approaches (Felder, 1996; Felder & Brent, 2005; Hall & Moseley, 2005). Not surprisingly, the multiplicity of learning style models is paralleled by an abundance of assessment instruments by which they may be identified (Dunn, Dunn, & Price, 1976; Keefe et al., 1986; Kolb, 1976).

Learning style models. The wide variety of learning style models makes it impractical to address each one in this context. However, a review of the significant models must include learning modalities, multiple intelligences, the Dunn and Dunn learning styles model, the Myers-Briggs Type Indicator, and Kolb's learning style model. The following paragraphs include descriptions and brief discussions of these models.

Learning modalities. Learning modalities can also be referred to as perceptual styles and include up to seven different pathways through which learners receive, store, and give information (Reiff, 1992). The Institute for Learning Styles Research (n.d.) includes print, interactive, and olfactory perceptual pathways in addition to the obvious visual, auditory, tactile (or haptic), and kinesthetic sensory channels. The foundation of perceptual learning style theory, which includes all seven modalities, is the idea that a

person's five senses act as the source of the majority of what is learned (Davis, 2007). The senses play a vital role in the storage of information in the sensory or immediate memory where it retains and combines this information with that which is newly gathered. Information from sensory or immediate memory then transfers into short-term, and eventually long-term, memory (Sprenger, 2003).

The Institute for Learning Styles Research (n.d.), reports that sensory pathways are unique to each individual, and each type of learner has definite characteristics based on their primary modality. While an individual typically employs all of the modalities to some degree, Reiff (1992) asserted that particular perceptual pathways might be extraordinarily stronger or weaker than others in some individuals. These students rely on the use of their preferred modalities and are often frustrated and confused if those modalities are not used. While researchers have acknowledged that learning is dependent upon numerous factors and thus have indicated that learning styles do not solely determine knowledge retention, the perceptual preferences of particular students could significantly affect the reception and retention of various types of information (Davis, 2007).

Multiple intelligences. According to Denig (2004), Howard Gardner developed the theory of multiple intelligences in opposition to the idea that a single construct could accurately determine a person's intelligence. The typical test of a person's intelligence quotient (IQ) was limited in that it only measured the mathematical and linguistic domains. In addition, the analytic style of the IQ test served to discriminate against examinees with a global approach to learning. The theory advanced by Gardner was founded upon the idea that individuals, in fact, display a wide variety of culturally

valuable intelligences that could not be measured or indicated by the standard IQ test but could be utilized to develop essential products and solutions (Gardner, 1999). As such, Gardner argued that there are at least eight intelligences including linguistic, logical-mathematical, spatial, kinesthetic, musical, interpersonal, intrapersonal, and naturalistic; a ninth, existential, intelligence should also be potentially included. A variety, if not all, of these intelligences characterize most people, but at varying levels of development and exhibited strength (Jacobs-Connell, 2000).

The theory of multiple intelligences has received some criticism for its lack of experimental research. There has been no attempt by Gardner to hide this fact, and despite the negative aspect of having little to no research base, the multiple intelligence theory has much popular support. Dunn et al. (2001) asserted that a significant factor in this method's appeal is that instead of demanding mastery of academic content, it encourages the development of each student's inherent potential. In this flexible learning environment, comprehension is the ideal pathway to knowledge and thinking is esteemed above memorization. Practical application of this theory includes recognizing the importance of each type of intelligence and subsequently changing instructional practices and teaching methodology to employ students' interests and abilities in an effort to maximize learning (Denig, 2004).

Dunn and Dunn learning styles model. An alternative way of viewing and assessing intelligence serves as the basis of a distinctly different approach, the Dunn and Dunn learning styles model (Denig, 2004). Foundational to this approach is the concept that intelligence is not definitively linked to talent or inborn capabilities (Denig, 2004; Dunn et al., 2001; Lovelace, 2005). Instead, perception, comprehension,

adaptability, the acquisition of knowledge through experiences, and analytical problem-solving and decision-making skills are acceptable and valid demonstrations of intelligence (Denig, 2004). As such, the learning styles model considers 20 elements that affect student learning and encompass the learner's environment, emotionality, sociological preferences, physiological characteristics, and psychological processing inclinations. Each of these broad categories is then broken down into the following specific elements: sound, light, temperature, seating design (environment); motivation, task persistence, responsibility/conformity, structure (emotionality); learning alone, in pairs, in a small group of peers, as part of a team, with an adult, with variety or routines (sociological preferences); perceptual strengths, time of day, need for intake, mobility while learning (physiological characteristics); and global/analytic, impulsive/reflective (psychological processing inclinations) (Dunn & Burke, 2006).

The Dunn and Dunn learning styles model proposes that students should be taught how to utilize their primary learning style to study and learn new material (Denig, 2004). In addition, students should be encouraged to employ their secondary style as a means of effective reinforcement of initial learning. According to the International Learning Styles Network (2008), all individuals have unique tendencies in their approach to the various aspects of learning. Providing support for the validity of this model is the extensive research in which experimental methods have been employed to determine the effectiveness of the approach with a variety of subjects across a wide range of populations based on grade, ability, and achievement levels, as well as socioeconomic levels, and geographic locations (Denig, 2004; Dunn et al., 2001; Lovelace, 2005).

Some significant differences that separate the learning style model from the

multiple intelligences theory are found in the implications for teaching based on the models. Rather than striving to capitalize on students' abilities as the theory of multiple intelligences emphasizes, the Dunn and Dunn model stresses capitalization on individual learning styles by modifying the instruction (Denig, 2004; Dunn et al., 2001). In addition, the focus of learning styles relies squarely on the process of education and how things are taught as compared to addressing what is taught and the product to be achieved, as is the case with Gardner's approach (Denig; Dunn et al.). While both models propose a change in the educational delivery system, they suggest a different approach for attaining this goal (Denig; Dunn et al.). Proponents of the learning style model advocate designing instructional sequences and selecting resources based upon the knowledge of each student's most effective learning style, rather than supporting the multiple intelligence approach of changing instructional methodology while maintaining the constraints upon time and the use of students' talents (Denig). Despite these differences, there is potential for synthesizing the theory of multiple intelligences and the learning styles model in an attempt to maximize student learning and achievement based on individual potential and preferences (Dunn et al.).

The Myers-Briggs Type Indicator. Carl Jung's theory of psychological types serves as the historical backbone for the learning styles model identified with the Myers-Briggs Type Indicator (MBTI). The results of the MBTI, classify students as extraverts or introverts, sensors or intuitors, thinkers or feelers, and judgers or perceivers. Individual student's preferences in each of these categories can then be combined to form any of 16 different learning style types (Felder, 1996). While the MBTI is actually a personality assessment, the information that is gathered has often been related to how

people think, learn, and make decisions. In reality, all people exhibit characteristics of each of the four categories, but individuals display their uniqueness in the extent to which they employ these characteristics and the individual's effectiveness in doing so (Reiff, 1992). McPherson (1999) supported the relevance of this connection by his assertion that the teacher's knowledge of student personality types can bolster the development of meaningful class activities.

Kolb's learning style model. Kolb's learning style model also has its roots in Jung's theory of psychological types. However, according to Felder (1996), Kolb's model differs in that it classifies students into four types of learners based on their preferences for how they take in information and how they internalize information. The former of the two aspects separates students into those who prefer concrete experience and those who prefer abstract conceptualization, while the latter distinguishes between those students who utilize active experimentation and those who employ reflective observation (Felder). Individual combinations of these preferences yield the following four learning styles: accommodator, diverger, assimilator, and converger (Loo, 2004). While each person has preferences, Loo (2004) asserted that effectiveness is based upon the ability to respond to various learning situations by successfully utilizing each style as opposed to simply employing the preferred style regardless of the circumstances. Thus, Kolb's experiential learning model attempts to incorporate each style of learning into a four-stage cycle that systematically guides students from concrete experiences to the development of concepts that will then serve as the springboard for new experiences (Loo, 2004). A circle divided in quadrants depicts each stage, all of which are important for experiential learning; however, most proponents of this theory agree that individuals

typically have a preferred stage in which they learn most comfortably (Goby & Lewis, 2000). Therefore, it is important to note that any stage preferred by an individual can serve as the starting point for learning (Young, 2002). The instructional model termed *teaching around the cycle* is a specific pedagogical approach designed to implement Kolb's experiential learning model and is the topic of a later discussion.

Learning style elements. Each model identifies elements within the scope of its view of learning styles, thus producing a wide array of potential factors for consideration. These elements vary greatly from model to model and can include many, as in Dunn and Dunn's model (Dunn & Burke, 2006), or just a few, as in Kolb's model (Loo, 2004). A brief overview of some of the significant elements, particularly those included in the study, is appropriate and beneficial.

Visual, auditory, and bodily-kinesthetic learning style preferences. The perceptual learning style elements, sometimes referred to as learning modalities, include preferences for learning through visual, auditory, and bodily-kinesthetic processes (CAPSOL[®] Styles of Learning, n.d.; Carson, 2009; Davis, 2007; Dunn & Burke, 2006; Silverman, 2006; Zapalska & Dabb, 2002). Students with a preference for the visual modality favor visual stimuli and prefer tasks that involve seeing, such as watching a demonstration, reading a book, and observing a diagram or chart (CAPSOL[®] Styles of Learning; Davis; Silverman; Zapalska & Dabb). Students who favor auditory stimuli and display a preference for hearing or listening to information characterize a preference for the auditory modality (CAPSOL[®] Styles of Learning; Davis; Silverman; Zapalska & Dabb). Students reveal bodily-kinesthetic preferences their desire to be physically involved in the learning task, through movement and touch (CAPSOL[®] Styles of

Learning; Davis; Silverman; Zapalska & Dabb).

Individual and group learning style preferences. Students also have sociological preferences, leading them to prefer working alone or with others (CAPSOL[®] Styles of Learning, n.d.; Carson, 2009; Dunn & Burke, 2006; Felder, 1996; McClanaghan, 2000). Students who have introverted tendencies typically prefer to work individually on learning tasks and focus on intrapersonal ideas and thoughts (CAPSOL[®] Styles of Learning; Dunn & Burke; Felder; McClanaghan). Alternatively, other students prefer to work with others in pairs or groups and display more extraverted tendencies with greater attention to interpersonal relationships. These students often opt for more cooperative learning experiences than do those with individual learning styles preferences (CAPSOL[®] Styles of Learning; Dunn & Burke; Felder; McClanaghan).

Oral or written expressive learning style preferences. Differences are also notable in students' expressive language tendencies, specifically between oral and written expression (CAPSOL[®] Styles of Learning, n.d.; Carson, 2009). Students who prefer oral expression tend to utilize spoken language for learning tasks and favor verbal interaction and responses (CAPSOL[®] Styles of Learning). Preference for the written expressive style manifests in students' desire to process ideas and demonstrate conceptual understanding by performing writing tasks (CAPSOL[®] Styles of Learning).

Sequential or global processing learning style preferences. Processing style elements include preferences for learning sequentially or globally (CAPSOL[®] Styles of Learning, n.d.; Dun & Burke, 2006; Felder, 1996). Students with sequential, or analytic, processing preferences are predisposed to step-by-step instructional increments; a clear and orderly process with linear progression of information and tasks is most suited to the

sequential processing mindset (CAPSOL[®] Styles of Learning; Dunn & Burke; Felder; Silverman, 2006; Zapalska & Dabb, 2002). Global learning preferences may display themselves in students who have a tendency to view information from a holistic perspective, developing a big picture view of concepts before attending to details (CAPSOL[®] Styles of Learning; Dunn & Burke; Felder).

Assessment instruments. A keyword search of the *Mental Measurements Yearbook* database for learning style returned 20 results. Of the 18 instruments related to education, two were directed toward teachers (Silver & Hanson, 1980; Gnagey & Gnagey, 1970), and nine were designed for use with intermediate level students or above (Barsch & Creson, 1980; Brown & Cooper, 1993; Canfield, 1976; Hendrix, 1989; Keefe et al., 1986; Kolb, 1976; Piney Mountain Press, 1988; Piney Mountain Press, Babich, & Randol, 1998; Schmeck & Geisler, 1977). One was identified as being for very young children (Pearson & Quinn, 1986), leaving only six instruments specifically designed to assess the learning styles of the typical population of elementary students (Dunn et al., 1976; Gnagey & Gnagey, 1982; Malcom, Lutz, Gerken, & Hoeltke, 1981; McCarron, 1984; O'Brien, 1990; Renzulli, Rizza, & Smith, 1978). Unfortunately, none of these received highly favorable reviews, and all were lacking in some aspect of reliability and validity.

Although these results highlight the limited numbers of scholarly reviewed assessment instruments, they do not reflect the vast array of tools available to consumers through the internet. Performing a *Google* search for learning style assessment instruments yielded about 1,980,000 results. Some of these are linked to websites devoted to specific, well-known models such as Kolb's experiential learning model

(Experience Based Learning Systems, Inc. 2011) and Dunn and Dunn's learning styles model (International Learning Styles Network, 2008), while others offer more generalized free online assessments that are related to various learning style concepts (LdPride, n.d.; Advanogy.com, 2011).

Implications of a Lack of Unity

The previous discussion of learning style models and assessment instruments points to some of the negative consequences of the extreme diversity that exists in the field of learning styles. The variety and ambiguity of definitions, terms, and even underlying theories is perplexing (Cuthbert, 2005; Pashler et al., 2009). Hall and Moseley (2005) described it as a “confused and expanding field” (p. 247) and acknowledged a need for greater unity and order. The noted dearth of empirical evidence (Cuthbert, 2005; Hall & Moseley, 2005; Pashler et al., 2009) corresponds with the overwhelming majority of works that simply identify and promote a particular view or approach concerning learning styles. A further cause of confusion is evident in the fact that seven of the assessment instruments reviewed in the *Mental Measurements Yearbook* database contain “Learning Style(s) Inventory” as all or part of the title (Barsch & Creson, 1980; Brown & Cooper, 1993; Canfield, 1976; Dunn et al., 1976; Kolb, 1976; Piney Mountain Press, 1988; Renzulli et al., 1978).

While individual authors and organizations may be justified in promoting their unique view of learning styles, one could argue this diversity is hurting the field in general. The variety of models and approaches highlights and supports the inherent complexity of learning styles concepts; however, there is a need for further and more focused scientific study (Cano-Garcia & Hughes, 2000; Hall & Moseley, 2005). In

addition, learning style assessment instruments seem to suffer the effects of diversity, as it is difficult to find a tool that encompasses the broad scope of the field and can boast widespread use as well as strong statistical data in terms of reliability and validity (Cano-Garcia & Hughes). The massive array of information and models available, combined with professional magazines' limited discussion of the theoretical and empirical basis underlying them (Hall & Moseley), increases the challenge for practitioners to develop a full understanding of the important concepts and practical implications relevant to the field of learning styles.

Influence of Learning Styles on Education

The field of learning styles research has implications for both teachers and students and is capable of influencing a variety of perceptions and outcomes. Many claim this influence is positive, bringing about increased understanding and improved performance (Cano-Garcia & Hughes, 2000; Evans & Waring, 2006; Hall & Moseley, 2005; Honigsfeld, & Schiering, 2004; Minotti, 2005; Noble, 2004; Rosenfeld & Rosenfeld, 2008). However, some questions remain about the most effective ways to obtain the greatest benefits from the current knowledge in the field.

Teachers

Education professionals have demonstrated an increasing interest in learning styles and related assessment instruments, instructional models and pedagogical techniques (Hall & Moseley, 2005; Pashler et al., 2009). This interest is spurred by a desire to personalize and improve student learning and is supported by a wide variety of models displayed and promoted in professional magazines (Hall & Moseley, 2005). Some claim teachers who have a greater understanding of learning styles can increase

their effectiveness in both instruction and assessment (Hall & Moseley; Honigsfeld & Schiering, 2004; Sternberg et al., 2008).

Teacher training. Despite the interest in learning styles, there is a need for increased attention to this topic in teachers' professional development (Evans & Waring, 2006; Haar, Hall, Schoepp, & Smith, 2002; Rosenfeld & Rosenfeld, 2008). Evidence has indicated training can support teachers in altering their instructional methods and planning tools can assist teachers in implementing theoretical concepts in practice (Evans & Waring, 2006; Nasmith & Steinert, 2001; Noble, 2004). However, the need remains for pre-service and in-service training and mentoring to provide instruction and support for a greater understanding of learning styles theory as well as practical implementation of learning-styles based methods (Haar et al.; Tomlinson, 2004). Further study is warranted to promote the development of effective programs for staff advancement (Minotti, 2005). If teachers are expected to provide instruction responsive to students' learning style needs, it is essential they be provided with the training and experience necessary to do so (Evans & Waring; Honigsfeld & Schiering, 2004).

Perceptions. Teachers' beliefs about themselves and their students have a profound effect on their teaching (Rosenfeld & Rosenfeld, 2008). Thus, educators' understanding of learning style constructs can significantly influence their perception of students' learning differences and various instructional practices. Providing training and opportunities for teachers to develop an understanding of their own learning style preferences can result in greater comprehension and consideration of the unique learning needs of each individual under their tutelage (Evans & Waring, 2006; Rosenfeld & Rosenfeld, 2008). Without such understanding, it is common to uphold the traditional

styles exhibited by many teachers and favored in the current educational establishment as the preferred characteristics of effective learners (Cano-Garcia & Hughes, 2000; Rosenfeld & Rosenfeld). Further, educators may also inappropriately perceive students with alternative learning styles as being weak or less capable than their more traditional counterparts (Evans & Waring, 2006; Noble, 2004).

While a knowledge of learning styles does not necessarily equate to informed practice, the provision of training and relevant tools will greatly increase the chances that teachers will feel more confident and choose to incorporate learning style-based instructional strategies in their classrooms (Cano-Garcia & Hughes, 2000; Noble, 2004). Understanding students' unique learning style preferences and instructional needs can assist teachers in developing a more favorable view of all students' abilities and thereby stimulate the development and implementation of differentiated instructional practices and the provision of intentional and personalized intervention (Evans & Waring, 2006; Honigsfeld & Schiering, 2004; Rosenfeld & Rosenfeld, 2008). Often, the resulting increased success of all students serves as further incentive for continued attention to individual learners' needs (Rosenfeld & Rosenfeld).

Instruction. Although some argue the “manner of instruction can be more important than the types of learning activities selected” (Morrison, Sweeney, & Hoffman, 2006, p. 66), it is essential that teachers develop a large repertoire of instructional strategies for use in varied settings with diverse students (Hall & Moseley, 2005; Honigsfeld & Schiering, 2004). Moral conviction for equal opportunity and fair treatment of every individual as well as current legislation, such as the No Child Left Behind Act (2001) and the reauthorization of the Individuals with Disabilities Education

Act (2007), demand that educators meet the learning needs of all students. Thus, teachers must become proficient in differentiating instruction to accommodate those needs, make learning more meaningful, and enhance student success (Honigsfeld & Schiering; Noble, 2004). An understanding of learning styles can increase teachers' confidence and ability to incorporate varied instructional practices in a way that provides for differing levels of ability and unique student learning preferences while maintaining an appropriate level of academic rigor (Noble). Further, research indicates that incorporating learning styles-based instructional strategies assists teachers in creating a comfortable learning environment, demonstrating true concern for their students, and promoting a love of learning (Honigsfeld & Schiering, 2004).

While many educators acknowledge the existence of learning styles, not all are capable or willing to implement learning style concepts in daily practice (Minotti, 2005; Noble, 2004). Thus, one can observe a broad range of instructional approaches in classrooms around the country. A review of some common designs is pertinent and helpful in understanding current practice.

Teacher-centered instruction. Teacher-centered instruction is also known as didactic instruction. This style can include such strategies as a teacher presenting a lecture, students copying the teacher's notes, and the teacher performing an experiment or demonstration for the students to observe. Didactic instruction may also take the form of teacher presentation of information followed by questioning and drill and practice such as completion of worksheets. The factory model of instruction and the behavioral approach are also both teacher-centered approaches to instruction, (Caine & Caine, 1991). The classic didactic instructional approach is the lecture, with teachers acting as a figure who

holds authority and is responsible for dispensing information (Barber, 2007). Teacher-centered instruction is a model in which teachers transmit information to students who assimilate that information and learn thereby (Goby & Lewis, 2000). This type of instructional approach caters to and revolves around the teacher and the information the students are required to learn and for which they will be responsible.

Instructional model approaches. As a response to the idea that there was a need for instruction other than teacher-centered approaches, several instructional model approaches have developed. These approaches are a teacher's means of applying an understanding of various learning styles in the development of philosophically sound instructional practices (Reiff, 1992). Each instructional model approach has a basis in one or more learning styles theories and has characteristic activities or methods of progressing throughout the learning process. In addition, they maintain a design intended to consider and address variations in student learning needs (Reiff).

Whole language is an instructional model that, according to Reiff (1992), does not require that students' learning styles be identified but is designed to provide numerous instructional options which teachers may implement in an effort to enable all children to be successful. Likewise, foxfire activities focus on relating learning activities to real-life experiences and follow a design intended to meet a variety of student needs (Reiff, 1992). One multifaceted instructional method is the 4MAT system which, according to Reiff, (1992), utilizes a series of eight steps, each of which is designed to accommodate a specific learning style, thereby maximizing the abilities of all students at some point throughout the process. Another instructional method that deliberately addresses personal differences in students' learning styles includes describing, interacting,

controlling, selecting, instructing, and evaluating. The first letter of each of these components forms the acronym that names this method, the DICSIE model (Reiff, 1992).

Constructivism. In an attempt to move away from an approach centered on a teacher who continuously dispenses information or one singularly focused on a particular strategy for presenting instruction, there has recently been significant development of an interest in the constructivist approach to education. The foundational principal of constructivism is that learners construct knowledge through their experiences as well as reflections on and responses to those experiences (Goby & Lewis, 2000). Thus, constructivism is a learner-centered approach founded upon the belief that learners derive knowledge through exploration and discovery and that they are continuously constructing and reconstructing meaning with each new experience they encounter (Alesandrini & Larson, 2002). The shared inquiry of a community and authentic activities are vital to the constructivist approach to learning. Constructivism not only stresses diversity in experiences, but also in resultant products that are characteristically unique to each student or group of learners (Alesandrini & Larson).

Experiential instruction. The goal of experiential instruction is to engage students mentally and emotionally in real-life experiences that will enable them to relate personally to the information presented (Young, 2002). Reflection allows and encourages students to develop theoretical understanding from concrete experiences by providing a framework to guide them through the learning process and drives the transformation from passive learning to active doing (Goby & Lewis, 2000). Although Dewey was one of the originators of the model that ultimately can be traced back to the ideas of Confucius, Kolb has been one of the most significant contributors to the field of

experiential learning through his development of the experiential learning model that was previously addressed (Barber, 2007). Young (2002) asserted Kolb's experiential learning cycle requires significant planning and intentional application in order to concentrate on curricular goals directly through engaging and motivating encounters with the concepts addressed in the lessons.

However, teachers who effectively implement the experiential approach do not focus on the hands-on nature of constructivist experientialism to the exclusion of serious mental involvement. Indeed, students must also interact mentally through reflection and conceptualization of their experiences (Kolb & Kolb, 2009). The implementation of this involves active experimentation and concrete experiences in the hands-on stage and reflective observation and abstract conceptualization in the minds-on stage (Young, 2002). This circular flow of instructional experiences is termed teaching around the cycle and is central to the effective use of Kolb's model to enhance learning among students with any of the four learning styles identified in the model (Felder, 1996). The first stage of the cycle involves presenting new topics in a way that will motivate students to engage in the topic and seek more information. The focus of the second stage is to provide students with the necessary essentials for understanding the principles and methodology of the topic. The fourth and fifth stages involve supplying a variety of opportunities for students to experience and gain proficiency in following appropriate strategies for implementation and then reinforcing and extending the topic through additional applications (Felder & Brent, 2005; Kolb & Kolb, 2009).

Brain-based teaching. The educational implications of neuro- and cognitive science have received increasing attention in recent years, leading to recognition of the

fact that understanding the physiology and organization of the brain has practical applications for education (Hall, 2005). However, it would be inappropriate to assume that educators could utilize this brain research to derive a simple instructional approach that would promptly solve all educational and learning issues (Hall). With a cautious approach, however, it is enlightening to consider the structure and functions of the brain and to develop educational practices that make appropriate use of this knowledge. It is important to note educators still do not completely understand the complexity of the brain and its functional processes, but there is great potential to utilize this currently untapped knowledge to increase the effectiveness of education (Caine & Caine, 1991).

According to Caine and Caine (1991), the brain consists of three interconnected components, the r-complex, the limbic system, and the neocortex, each of which plays a distinct role in learning and functioning. Because each of these creates a continuous and interrelated influence, the resulting concepts, emotions, and behaviors are also equally intertwined, implying that adequate coverage of subject matter requires it to be embedded within elements that activate all parts of the brain's capacity for learning (Caine & Caine). In addition, one must consider the role of threat as an inhibitor to optimal brain functioning, asserting that interest and attainable challenges facilitate learning, but feelings of threat and helplessness obstruct the brain's ability to receive information.

In addition to the three interrelated components, educators need to recognize and understand the brain's two types of memory systems, taxon and locale (Caine & Caine, 1991). Taxon memories include prototypes and discrete items representative of general categories; thus, they are not dependent upon specific physical contexts. The taxon memory system characteristically involves practice and rehearsal, extrinsic motivation,

resistance to change, relative isolation of items, and recollection based on demand irrespective of meaning. The analogy of following a route to a destination provides an effective depiction of the taxon memory system (Caine & Caine, 1991). Alternatively, locale memory is comprised of spatial and thematic maps that are interconnected; this memory system is survival-oriented, virtually unlimited, and always set within a rich context (Caine & Caine). The brain forms these maps quickly, but then updates them continuously, with some intricate maps requiring considerable lengths of time to develop. Novelty, curiosity, and expectations motivate map formation, and sensory acuity enhances the memories. Brain-based teaching advocates that both memory systems complement the other in the natural process of formulating meaning and should, therefore, both be used in educational practice in order to help students achieve meaningful learning that is characterized by numerous, high-quality connections that allow for easy access and retrieval whenever necessary (Caine & Caine).

Differentiated instruction. Differentiated instruction can take on many images, but ultimately refers to the process of incorporating a variety of approaches and strategies for providing instruction, practice, and assessment. Founded upon teachers' perceptions of student differences, the design of differentiation enables all students to utilize their individual styles, preferences, and interests in order to achieve academic success. The incorporation of choice, flexibility, and creativity, mingled with ongoing assessment strategies allow for variations in content, instructional methods, and demonstration of student learning (Anderson, 2007). Thus, differentiated instruction provides a means of utilizing many different teaching styles and ideas from multiple instructional models in an effort to provide opportunities for students with any learning style to be successful.

Differentiation allows teachers to take advantage of individual differences and encourage students to maximize their learning strengths (Reiff, 1992; Tomlinson, 2005a; Wormeli, 2005). This should enable all students to attend to and practice essential academic concepts, but to varying levels of depth and with individualized expected outcomes (Kiernan & Tomlinson, 1997). Conducted as such, the instruction, not the content, is the focus of differentiation. There is no question this requires attention to and understanding of learning styles. Koch (2007) argued there is no other way to differentiate instruction than by adherence to a learning styles approach, and that this type of methodology is not only encouraged but also mandated by special education funding requirements.

Assessment. When instruction allows for differences in students' learning style preferences, it is also important for evaluation to vary similarly and provide an accurate assessment of student learning (Mooij, 2008; Tomlinson, 2007). As such, proponents of differentiated instruction have also advocated for multiple and authentic assessment methods that evaluate and reflect students' mastery of essential learning (Tomlinson; Winger, 2005). Such assessment has been encouraged as a means to provide valuable feedback to both students and teachers that can guide the continued teaching and learning process (Tomlinson, 2005a; Tomlinson, 2007; Winger). Capitalizing on students' interests and individual learning preferences and enabling students to utilize methods that work for them supports the goal of helping all students achieve and demonstrate such achievement to their fullest potential (Tomlinson, 2005a; Tomlinson, 2007). Far from being unfair because students may not all be required to perform identical tasks, this type of variance in assessment has been endorsed as a means of leveling the normal curve,

promoting better engagement and increased learning, and achieving greater accuracy in reflecting true student learning (Tomlinson, 2005a; Tomlinson, 2007; Winger, 2005; Wormeli, 2005).

Students

Numerous studies have shown that learning style differences exist and that they affect students' attitudes toward learning as well as their performance in school (Cano-Garcia & Hughes, 2000; Collinson, 2000; Felder & Brent, 2005; Felder, 1996; Fine, 2003; Honigsfeld & Schiering, 2004; Kolb & Kolb, 2009; Lovelace, 2005; Minotti, 2005; Tseng, Chu, Hwang, & Tsai, 2008). This is a reasonable, though not uniformly accepted, explanation for the different results achieved by the same students under the instruction of different teachers (Felder & Brent, 2005). Other factors influencing student performance have certainly been identified and explored, including psychological threat, racial context, motivation, self-regulation of learning, socio-economic status, language proficiency, and student-teacher relationships (Bembenutty, 2008; Helm, 2007; Herman, 2009; Walton & Spencer, 2009). Despite continued debate about the direct effects of learning styles on academic achievement, it appears there is strong evidence that learning styles influence students' attention to and perceptions of learning experiences (Kratzig & Arbuthnott, 2006). This, in turn, may influence achievement and success in school.

Perceptions. Some critics of learning styles theory have argued that orientation does not necessarily imply proficiency (Cuthbert, 2005) and claimed that learning approaches are flexible rather than fixed (Cuthbert, 2005; Felder & Brent, 2005; Hall & Moseley, 2005). However, many experts affirm the value of educating students about their individual learning preferences, noting the benefits of metacognition and

empowerment resulting from such experiences (Felder & Brent, 2005; Honigsfeld & Schiering, 2004; Kolb & Kolb, 2009). Developing a greater understanding of the learning process and the ways by which they learn best improves students' perceptions of their ability to learn, encourages ownership of the learning process and outcomes, and provides increased motivation for doing learning and overcoming potential obstacles (Kolb & Kolb, 2009; Noble, 2004). Further, by learning to recognize effective methods for completing learning tasks and mastering new material, students may become more successful at learning how to learn and are more likely to become lifelong learners and maximize their true potential (Felder, 1996; Kolb & Kolb, 2009; Minotti, 2005)

In addition to increased perception of their ability as effective learners, students receiving learning-style based training also tend to demonstrate improved attitudes and behavior in school (Fine, 2003; Noble, 2004). Cultivating an understanding of students' individual learning style preferences and incorporating instructional practices that take these into consideration communicates a sense of caring, creates a comfortable learning environment, and promotes student self-esteem (Honigsfeld & Schiering, 2004; Noble). Even special populations, including at-risk students and those receiving special education services have demonstrated significant improvements in behavior, attendance, adjustment to class, and engagement in learning activities (Fine; Noble). Accommodating students' learning differences, including learning style preferences, is also one element in developing and implementing an effective program for gifted students (Mooij, 2008; Tomlinson, 2005b).

Motivation and lifelong learning. Motivation is an important factor in student learning, influencing learning in both directions. While engagement has been linked to

learning, a lack of motivation has been identified as a threat to academic achievement (Bembenutty, 2008; Tomlinson, 2005a; Tomlinson, 2007). Similarly, there appears to be a connection between motivation and learning styles in educational practice as instructional activities that accommodate a variety of learning style preferences tend to increase student motivation (Fine, 2003; Tomlinson, 2005a). While it has been argued that teachers' and the overall educational system's focus on grades and standardized performance often stifles students' innate desire for learning, it has also been acknowledged that teachers can instill a love of learning through the teaching practices they choose to incorporate in the classroom (Honigfeld & Schiering, 2004; Winger, 2005). Certainly, motivation is not simply a result of teacher influence; identified influential factors also include self-regulatory behaviors and prior achievement levels (Bembenutty, 2008; Reiff, 1992).

Regardless, students who are motivated by the sheer enjoyment of learning have been found "likely to be more effective learners over the long haul" than those who are motivated simply to achieve high grades (Tomlinson, 2005a, p. 267). This long-term motivation for learning, also referred to as a love of learning, is important in the development of lifelong learners. Lifelong learning, which involves the "continuous development and improvement of . . . knowledge and skills" (Lifelong learning, n.d.) demands that students know how to learn (Kolb & Kolb, 2009; McClanaghan, 2000). Thus, students who are motivated and have an understanding of the process of learning are likely to perform better on academic tasks and be more effective at learning in various circumstances than those who do not possess these characteristics (Kolb & Kolb; McClanaghan; Tomlinson, 2005a).

Performance. The importance of developing positive student perceptions of school and themselves as learners not only creates a better classroom environment, it also has implications for academic performance as indicated by Kolb & Kolb's (2009) assertion that "if a person does not believe that he or she can learn, he or she won't" (p. 304). Research has consistently provided results supporting the claim of a significant link between learning styles and academic achievement (Collinson, 2000; Felder & Brent, 2005; Honigsfeld & Schiering, 2004; Lovelace, 2005; Minotti, 2005; Tseng et al., 2008). The benefits of learning-styles based instruction span all academic disciplines, are experienced by students of all ages, and are not limited by gender, ethnicity, religion, or even intelligence levels (Collinson; Honigsfeld & Schiering; Minotti). Students have demonstrated gains in both short-term achievement and long-term retention as well as in their efficiency and levels of thinking throughout the learning process (Felder & Brent; Fine, 2003; Noble, 2004; Tseng et al.). Although one study found a 40% higher expected rate of student success when instruction was learning-styles based than with more traditional methods (Lovelace, 2005), the most effective means of incorporating learning-style concepts in teaching practice remains a contentious issue and will be discussed in the following paragraphs.

The Question of Matching

While most educators would agree there is no one best approach to teaching, there is a sense that some approaches are better for some learners than others. Some educators avow that unmatched educational styles cause inexcusable suffering and decreased learning on the part of students (Felder & Brent, 2005; Koch, 2007; Minotti, 2005) and advocate for tailoring instruction to students' learning style preferences (Dunn, Denig, &

Lovelace, 2001; Lovelace, 2008; Minotti, 2005; Morison, Sweeney, & Heffernan, 2006; Pedrosa de Jesus, Almeida, Teixeira-Dias, & Watts, 2007). Others claim there is little or no solid empirical evidence supporting the benefits of matching (Barber 2007; Hall & Moseley, 2005; Karns, 2006; Kratzig & Arbuthnott, 2006; Loo, 2004; Olson, 2006; Pashler et al., 2009) or that mismatching is actually beneficial (Pedrosa de Jesus et al., 2007). Although there is no visible end to the debate, some have attempted to bridge the gap between the two sides. Rather than supporting either extreme unequivocally, they promote using a variety of instructional techniques to meet the individual needs of students while helping them develop areas of relative weakness in an effort to develop capable and successful learners (Felder, 1996; Karns, 2006; Kolb & Kolb, 2009; Loo, 2004; Morison, Sternberg et al., 2008; Sweeney, & Heffernan, 2006).

Unmatched instruction. A lack of self-confidence and resentment toward school characterize students who experience repeated failure because educators consistently prohibit them from utilizing their preferred learning modalities (Reiff, 1992). Thus, students whose learning styles are not being matched may become confused and fall behind academically and simultaneously lack the confidence and interest to put forth the necessary effort to continue to attempt the learning process (Fine, 2003). Likewise, Felder (1996) noted that, if students are never exposed to instructional approaches that maximize their preferred learning style but are consistently required to utilize a less desirable style, their learning is likely to be compromised due to a significantly raised level of discomfort.

Honigsfeld and Schiering (2004) noted the significance of the results of a study that indicated teachers have a propensity for analytic processing with a particular demand

for structure. This contrasts with the reality that many students entering the classrooms of these teachers are, in fact, more predisposed to global processing with a need for taking ownership of their learning (Honigsfeld & Schiering, 2004). Educators are also urged to consider that students typically retain less than 75 percent of what is verbally presented in a given class session because they are not auditory learners Dunn and Burke (2006). Because students are generally passive and not actively or directly involved in the learning process, lectures lack effectiveness in the development of higher-level skills (Nasmith & Steinert, 2001). Instruction that is focused on what the teacher is teaching rather than what the students are learning encourages students to passively accept information and then simply repeat what they were told instead of actively processing the material and making it meaningful (Petress, 2008; Winger, 2005; Wormeli, 2005). Unfortunately, students whose learning styles do not match the instructional style in use are often designated as learning disabled (Guild, 2001). Typically, educators then provide these students with remediation for that particular learning method rather than acknowledging and utilizing the students' inherent ability to learn the required material in their own unique ways.

Some researchers claim there is no solid research base supporting the use of instructional methods that accommodate individual learning styles in order to attain higher levels of student achievement (Barber 2007; Hall & Moseley, 2005; Karns, 2006; Kratzig & Arbuthnott, 2006; Loo, 2004; Olson, 2006; Pashler et al., 2009). In fact, Olson (2006) reported that such tactics might actually lead to a lower performance level and a decline in the effort put forth by students. The findings of one study indicate similar effectiveness of transmitting information through lecture as through other teaching styles

(Barber, 2007). However, Barber also asserted that educators must consider whether the goal is simply to transmit information to their students and noted that other research results have identified other educational objectives for which there is a discrepancy between the effectiveness of lecture and other instructional methodologies. Further arguments claim that, although students often display different modality strengths, simply utilizing these strengths does not equate to increased educational achievement (Pashler et al., 2009; Willingham, 2005). Instead, modality memory strengths may only apply to some types of memories, and educators typically seek for students to develop an understanding of the underlying meaning of information, an understanding not affected by the specific modality. Thus, some have suggested that, rather than differentiate instruction based on individual student's modality strengths, educators should consider the best modality for presenting various subject matters and specific types of information (Pashler et al., 2009; Sternberg et al., 2008; Willingham, 2005).

Furthermore, Kratzig and Arbuthnott (2006), presented research evidence suggesting learning styles may not be deeply ingrained or consistent, citing data in which two different learning styles assessments failed to yield a statistically significant correlation between the results produced by the same participants. A lack of data-driven results leads some researchers to claim that learning styles are more strongly linked to personal preferences, beliefs about self-efficacy, and perceptions of effectiveness than they are to actual performance levels (Karns, 2006; Kratzig & Arbuthnott). Thus, the argument remains that one should not expect the attempt to match teaching and learning styles to produce significant improvement in academic achievement or performance. These expectations should be limited to those which can be attributed to increased

motivation for voluntary effort as a result of accommodating students' preferences by providing instruction in a manner that is popular and familiar (Karns; Kratzig & Arbuthnott; Pashler et al., 2009).

Tailored instruction. On the other side of the argument, experts claim there is no single best approach that will work for everyone, no matter how good that approach may be (Felder & Brent, 2005; Koch, 2007; Sternberg et al., 2008). Collinson (2000) cited numerous researchers whose findings expose significant variations in learning preferences among students of all ability levels and which tend to display a link between these preferences and academic achievement. One such example is that presented by researchers Tseng et al. (2008) who found that students achieved both greater learning and higher efficiency when provided with adaptive materials and presentation styles. Other research conducted with students across a wide range of demographics indicated a positive effect on both academic achievement and student attitudes when learning and teaching styles are compatible (Denig, 2004). In yet another study, although every lesson utilized a variety of teaching strategies matched to various learning styles, students had a tendency to demonstrate a preference for approaches more closely related to their unique learning styles (Pedrosa de Jesus et al., 2007). Taken together, these findings provide evidence of the value of ensuring a match between teaching and learning.

Indeed, many educational practices that have proven effective may actually have a link to learning styles (Guild, 2001). Not only does the use of preferred learning modes encourage higher levels of academic achievement and improved attitudes, it can have other widespread and long-lasting effects as well. For example, an awareness of individuals' unique learning styles encourages students not only to understand themselves

more accurately, but also to more effectively understand and relate to their peers (Goby & Lewis, 2000; Minotti, 2005). The groundwork laid throughout the educational process, then, serves to support collaboration in all future personal and professional endeavors. Finally, by allowing students to utilize their preferred learning styles, teachers can increase the personal relevance of educational experiences which results in a higher level of mental and emotional engagement and, ultimately, serves to provide meaningful connections between what is learned in school and what goes on in real life (Noble, 2004; Young, 2002).

Varied instruction. Despite the evidence for the benefits of matching teaching and learning styles, one should not view this approach alone as a guarantee for increased student achievement (Brown, 2003). Rather, it should lead to the understanding that the ability to learn is a process that most effectively begins with an individual's natural learning style (McClanaghan, 2008). These unique learning styles should neither lead to oversimplification and inappropriate generalization of research findings and group results (Collinson, 2000) nor to judgments that imply superiority and inferiority, but should rather simply be viewed as indications of variety that must be acknowledged (Felder & Brent, 2005; Honigsfeld & Schiering, 2004).

The effective utilization of learning styles assessment results can lead to the development of instructional lessons that are responsive to student needs (Dunn et al., 2009). Meeting the needs of students is essential if educators are to make substantial progress toward the goal of developing lifelong learners (Williamson & Watson, 2007). However, a singular approach to teaching and learning based on students' learning preferences may inhibit the overall development of those students, thus limiting their

potential for future academic and professional achievement (Felder, 1996). As such, some argue teachers should design instructional strategies to ensure matching of students' learning preferences some, but not all, of the time. This enables teachers and students to maximize achievement levels, develop areas of relative weakness, and increase students' abilities to perform functionally in any environment (Felder & Brent, 2005; Karns, 2006; Kolb & Kolb, 2009; Loo, 2004; Morison, Sternberg et al., 2008; Sweeney, & Heffernan, 2006). Research has shown that students receiving instruction incorporating a variety of instructional methods demonstrated greater performance levels overall (Felder & Brent, 2005; Sternberg et al., 2008). Therefore, students may obtain the universal benefits of intentional diversification of instructional methods and strategies through those activities specifically matching their particular preferences as well as through the cumulative effect of a wide variety of educational opportunities (Guild, 2001).

Learning style theories provide an effective means for helping teachers recognize the vast diversity in their students' individual learning needs as well as providing a framework from which to knowledgably develop a variety of instructional methodologies to utilize in their teaching (Cano-Garcia & Hughes, 2000; Hall & Moseley, 2005; Honigsfeld & Schiering, 2004; Minotti, 2005; Rosenfeld & Rosenfeld, 2008; Sternberg et al., 2008; Williamson & Watson, 2007). In practical application, matching teaching and learning styles does not necessarily imply that specific learning activities must be utilized in relation to each learning style, but rather that the manner in which instruction is presented and developed should take into consideration the learning styles of the students involved (Morrison et al., 2006). Although some teachers are hesitant to modify their teaching style, Noble (2004) reported an increase in teacher's willingness to incorporate

learning styles research in their instructional practices when provided a tool for practical application. These same teachers noticed greater levels of performance by students with and without disabilities when implementing educational strategies designed to match various learning styles. Thus, when given appropriate information and support, there is potential for enthusiastic acceptance of teachers in utilizing a variety of learning styles-based instructional strategies as a means of helping students achieve increased academic gains (Honigsfeld & Schiering, 2004; Noble, 2004; Rosenfeld & Rosenfeld, 2008).

Methodological Debate

Although the field of learning styles continues to garner significant attention and interest from educational professionals, some maintain there is a lack of strong empirical evidence for the influence of such models on improving academic achievement (Hall & Moseley, 2005; Pashler et al., 2009). A large majority of published resources, particularly those aimed at practitioners, promote various methods and tools for the application of learning style-based instruction in educational practice but do not present theoretical or empirical evidence in support of the effectiveness of such strategies (Hall & Moseley, 2005). Further, Pashler et al., (2009) argued that most resources claiming to provide such evidence relied upon less than desirable research designs, and they asserted that only those studies meeting stringent criteria, such as true experimental design with random assignment, multiple treatments, and controlled assessment, are deserving of attention as indicators of the influence of learning styles on teaching and learning. Of the published research studies that do exist, many involve limited samples or designs without experimental control. Those that utilize a more sophisticated research design, although still not necessarily involving researcher manipulation of variables, often address only

particular aspects of learning styles or instructional practice without exploring the complex relationships between both of these and academic achievement (Cano-Garcia, 2000; Collinson, 2000; Evans & Waring, 2006; Fine, 2003; Honigsfeld & Shiering, 2004; Kratzig & Arbuthnott, 2006; Loo, 2004). While scientific rigor is desirable, it is also essential to conduct educational research in authentic settings (Hall & Moseley, 2005). Thus, the debate lies in where to draw the line between experimental control and pertinent application to the real world of teaching and learning in typical educational settings.

Even some researchers who acknowledge the potential relevance of learning styles for educational practice have questioned if there is sufficient evidence to warrant sustained use of assessment tools and related development programs and instructional strategies (Evans & Waring, 2006; Karns, 2006; Kratzig & Arbuthnott, 2006; Pashler et al., 2009). Others have echoed the sentiment concerning the lack of empirical evidence and yet presented a more forgiving review, claiming the theoretical foundations of learning style methods provided sufficient support for continued application (Hall & Moseley, 2005). Still others contended that a more thorough investigation of the work of prominent learning styles experts yields a comprehensive research base (Glenn, 2009). Sternberg et al. (2008) provide potential evidence for this claim in a single article in which they present several research studies evidencing the beneficial influence of learning styles on educational practice.

Future Research

While there is disagreement over the current state of learning styles research, the need for further study appears obvious. Empirical evidence must support claims for

investing time and resources into the advancement of learning style-based strategies in educational practice. This evidence must exceed descriptive studies and those simply supporting the existence of various learning styles, the effectiveness of assessment tools to classify students, and the application of multiple specific approaches. Further, a means of more effectively defining and organizing the vast array of methods and approaches, such as the continuum of fixed versus fluid characteristics presented by Hall and Moseley (2005) and the dichotomous grouping of ability- and personality-based styles advocated by Sternberg et al. (2008) could help unify the field and make research findings more cohesive and understandable.

However, research design and selection of appropriate methodologies may remain an issue of contention. Some recommendations made by reviewers such as Pashler et al. (2009) are logical and practical, such as increasing the longitudinal span of studies. Indeed, rigorous design is important and to some schools of thought, imperative. However, Ary et al. (2006) acknowledged that true experimental research designs are not always feasible in the realm of education. Perhaps, the most compelling and reasonable argument is that learning styles research must be “reliably and validly measured” and “rigorously tested in authentic situations” (Hall & Moseley, 2005, p. 247). Regardless of the position one takes in the methodological debate, most agree about the need for further research concerning the practical implications for pedagogical practice and student performance outcomes (Evans & Waring, 2006; Hall & Moseley, 2005).

Theoretical Framework for the Current Study

Understanding the rich history of the field of learning styles and the expansive ground covered by the diversity of published models, I recognized and agreed with the

assertion of Hall and Moseley (2005) that current work needs to more explicitly and effectively link theory and practice. I also looked to the example of my Lord and Savior, Jesus Christ, noting that He utilized a wide variety of methods in His teaching. The way our Master Teacher presented His lessons was determined by both the situation and the message He was attempting to convey and, perhaps even more so, the characteristics of the specific audience to whom He was speaking (Williamson and Watson, 2006). His teachings reveal the significance Jesus placed on the ability of a teacher to vary his/her approach to meet the unique learning needs of all students and to ensure that instruction leads to understanding.

A review of the Scriptures provides ample evidence that Jesus Himself utilized a wide variety of methods in His teaching. For example, Jesus provided direct instruction in the Sermon on the Mount (Matthew 5-7), guided questioning to relate current lessons to past experiences and to gauge understanding (Matthew 16:5-20), experiential learning at the Lord's Supper (Luke 22:17-20 ; John 13:1-10) , and discussion with the disciples on the road to Emmaus (Luke 24:13-27). Furthermore, Jesus modified His approach in order to ensure that His listeners would be able to understand difficult and abstract principles (Williamson and Watson, 2006). His use of parables, as recorded throughout the Gospels, indicates a common means by which Jesus employed concrete experiences as a foundation for the deeper concepts He wished to convey. Perhaps most importantly, Jesus purposefully focused His teaching on those He was instructing rather than simply on the information He was presenting.

Therefore, rather than select a specific model and conduct further research in an attempt to define or support the existence of such a model, it was my desire to adopt an

eclectic understanding of learning style theory and instead focus on practical application in teaching and learning. The theoretical framework of the current study, then, incorporated a variety of learning style theories from both the Approaches to Learning Model and Brain Based Educational Theory camps as I attempted to explore the relationship between academic achievement and the degree of match between teachers' instructional strategies and students' learning styles. I intended to utilize an assessment tool that measures a broad range of learning styles, rather than adopting an instrument specific to a particular model or theory. Further, an eclectic approach enabled me to keep an open mind about the variety of learning styles and accommodating instructional strategies and the relationships that may exist between the two. The results of such a study can be particularly beneficial for promoting and guiding further research as well as leading to the development of a practical system for increasing instructional effectiveness and enhancing students' learning.

Conclusion

Helping students become lifelong learners should be the ultimate goal of education, and understanding students' various learning styles can help educators achieve that goal. Hanafin, Shevlin, and Flynn (2002) encouraged educators to embrace the diversity of their students and develop a classroom environment and a variety of instructional strategies that celebrate and support this diversity. Felder (1996) asserted that teachers must teach to students with all types of learning styles and noted that an instructional model is only effective to the extent that it is able to assist educators in meeting the needs of all students. Thus, the specific model utilized is not nearly as important as ensuring that teachers provide instruction around the cycle of all learning

style preferences (Felder). Indeed, educators must make a commitment to understanding learning styles, recognizing the unique qualities of each student, and doing everything within their power to provide the tools and opportunities necessary for every individual to achieve success.

Although recent trends have increased educators' awareness of various learning styles, this has not yet translated into widespread use of appropriate practice (Barber, 2007; Guild, 2001; Hall & Moseley, 2005). Thus, simple awareness is not enough; neither is purchasing the latest tools and programs without proper training. A clear demonstration of the danger of such an approach is evident in the frequent mistake of teachers who plan every aspect of the curriculum, materials, and environment, only to discover that the students who enter their classrooms do not fit into their plan (Parker, n.d.). Educators must get educated! Only a deep and personal understanding of learning styles and cognitively appropriate practices will produce an effective learning environment for all students.

CHAPTER THREE: METHODOLOGY

Introduction

The purpose of the methodology chapter is to address the design and implementation of the quantitative research study. A quantitative approach was necessary to provide statistical evidence concerning the relationship between academic achievement and the degree of match between students' learning style preferences and teachers' instructional strategies. The literature review revealed a gap in the research concerning empirical evidence in the field of learning styles, particularly at the elementary school level and related to educational outcomes (Hall & Moseley, 2005; Pashler et al., 2009; Romanelli et al., 2009; Sharp et al., 2008).

Research Design

A correlational research design was appropriate for this study as it allowed the researcher to determine the existence of relationships and patterns of relationship between students' academic achievement levels and the extent to which students' learning styles matched the instructional strategies incorporated by their teachers. In the study, the researcher intended to analyze a sample of approximately 200 participants, evaluating data for each specific content area as well as in terms of overall academic achievement. The researcher purposed to use extreme care when working with the collected data to ensure the confidentiality of all participants.

Although correlational research is limited in its ability to identify patterns of cause and effect (Ary et al., 2006), it is appropriate for examining the stated hypotheses of the study, which focus on relationships between variables. Due to the identified

research gap pertaining to students' academic achievement and the degree to which students' learning styles and teachers' instructional strategies are matched (Cano-Garcia & Hughes, 2000; Romanelli et al., 2009), an investigation of potential relationships was appropriate and necessary. Research designs demanding manipulation of variables and greater control by the researcher, while stronger scientifically, may not have been well-received by school administrators who are duty-bound to ensure students are provided with quality instruction. Thus, a study with no researcher manipulation of variables served as an important first step in this investigation, having the potential to reveal the existence of significant relationships between the variables under consideration (Ary et al.; Howell, 2008). The results of this type of investigation may provide the necessary statistical evidence required to secure administrative support for further studies in which the researcher may obtain approval for manipulation of the degree of match variable.

Research Questions

1. Is there a significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade English language arts students as shown by Palmetto Assessment of State Standards scores?
2. Is there a significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade mathematics students as shown by Palmetto Assessment of State Standards scores?
3. Is there a significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional

strategies of teachers) and the achievement of fourth grade science students as shown by Palmetto Assessment of State Standards scores?

4. Is there a significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade social studies students as shown by Palmetto Assessment of State Standards scores?

Null Hypotheses

1. There is no significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade English language arts students as shown by Palmetto Assessment of State Standards scores.
2. There is no significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade mathematics students as shown by Palmetto Assessment of State Standards scores.
3. There is no significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade science students as shown by Palmetto Assessment of State Standards scores.
4. There is no significant relationship between the degree of match (as determined by comparing learning style preferences of students with

instructional strategies of teachers) and the achievement of fourth grade social studies students as shown by Palmetto Assessment of State Standards scores.

Participants

The sample for the study includes students from the fourth grade public school population in northwestern South Carolina. In order to facilitate data collection throughout the study, the researcher selected a convenience sample of students from schools within close proximity to the researcher's home location.

The participants in the study included approximately 200 fourth grade students in thirteen general education classes from three public school districts in northwestern South Carolina. These participants are representatives from the total enrollment of just over 300 students in these classes. In order to participate in the study, students were required to have a signed Parent/Guardian Consent Form (see Appendix C), a signed Child Assent Form (see Appendix D), and be present in the classroom at the time the CAPSOL[®] styles of learning inventory was administered by the researcher.

The school system grouped the students and teachers into classes before the beginning of the academic year, and none of the participants received any training concerning learning styles as part of this study. Although data were not analyzed in terms of specific teachers or classes, the researcher considered the teachers to have an essential role in the study, as they were a vital source of information concerning the instructional strategies utilized in the classroom. All participants received educational instruction in a team-teaching setting with two (School A and School C) or three (School B) teachers sharing the instructional load of academic courses.

With 158 students enrolled in fourth grade, School A had six classes, producing

an average student to teacher ration of 26:1. School B had the lowest student to teacher ratio (19:1) with three fourth grade classes but only 56 students enrolled in this grade level. The fourth grade student population at School C fell neatly between the others, with a total of 94 students in four classes and a student to teacher ratio of 24:1. The classes at all three schools consisted of a fairly equal mix of boys and girls; however, boys slightly outnumbered girls with approximately 51, 54, and 53 percent of the total number of fourth grade students at each school, respectively. The students and teachers at each of the three schools were predominately native English-speaking Caucasians; however African Americans also made up a significant portion of the population. School C had the greatest diversity, with 50% of the students identified as white and 38% African American. School A's demographics showed a much greater proportion of white students, with 74%, and only 17% African Americans. At School B, 73% of the students were identified as white, and 21% as African American. Very few of the students at any of the three schools were identified as being of any other descent than Caucasian or African American, with only 9%, 5%, and 12% at schools A, B, and C, respectively. In terms of socio-economic status, the participants of this study fell into the lower range, with 100% of the 4th grade students at all three schools qualifying to receive free or subsidized meals.

Setting

School B serves kindergarten through seventh grade students and is one of four elementary schools in its rural/suburban school district. School C is located in an adjacent county and provides instruction to students in kindergarten through fifth grade. Also located in northwestern South Carolina and another neighboring county to School

B, School A serves students in grades three through five. The research was conducted in the participants' respective classrooms or some other typical school area if deemed necessary by the teachers. There were no adjustments to the typical arrangement of the rooms other than to ensure privacy when completing the learning styles assessment. Collection of achievement data occurred in a private setting in order to ensure confidentiality.

The classrooms of all participants invited students to feel comfortable and become involved in the learning process. All teachers had posted motivational and instructional graphics on the classroom walls; bulletin boards displayed students' work. The placement of furniture and the teacher's desk in each room maximized space and allowed freedom of movement, easy access to all areas of the room, and unrestricted views of all student work spaces. Student desks reflected a wide range of configurations, including rows, partners, or groups; specific arrangements varied throughout the school year.

Instrumentation

The researcher used various instruments in the data collection process of this study to obtain the scores necessary to perform the indicated statistical analyses. The CAPSOL[®] styles of learning inventory provided information concerning students' and teachers' learning styles. An instructional strategy record sheet and compilation checklist assisted in collecting teachers' instructional strategies and determining the degree of match score. The schools provided student academic achievement data in the form of quarterly grade reports and statewide proficiency test scores.

CAPSOL[®] Styles of Learning Inventory

All students participating in the study completed Form A of the CAPSOL[®] styles

of learning inventory, developed and marketed by CAPSOL[®] Styles of Learning in Mansfield, Ohio. Participating teachers completed Form B of the same 45-item inventory. The CAPSOL[®] styles of learning inventory is a 45-item Likert scale that produces a score of high (16-20), moderate (10-15), or low (5-9) preference for each of nine learning style elements. These results yield a student profile containing both diagnostic and prescriptive information (CAPSOL[®] Styles of Learning, n.d.).

According to company reports, the CAPSOL[®] styles of learning inventory is being utilized by a wide variety of educational institutions at all levels, including elementary, middle school, and high school as well as numerous colleges and universities (CAPSOL[®] Styles of Learning, n.d.). Doctoral candidates have also effectively implemented the instrument in their dissertation research (Bonacci, 1998; Peters, 2008). The CAPSOL[®] styles of learning inventory exhibits an appropriate level of face validity as the developers aligned the questions to the nine stated learning style elements, with each element represented by five questions in the inventory. Researchers utilized factor analysis to establish the construct validity of the CAPSOL[®] styles of learning inventory during an 8-month period in which the inventory was revised until a minimum factor loading of .40 was achieved for each of the 45 items (Peters, 2008). A committee of fifteen learning style experts collectively confirmed the instrument has an appropriate level of content validity (Peters). The CAPSOL[®] styles of learning inventory has also been found to be a reliable instrument, with a test-retest study involving 960 students producing a mean correlation coefficient of 0.74 (CAPSOL[®] Styles of Learning, n.d.). This exceeds the minimum recommended coefficient score of .70 as indicated by Nunnally (1978).

Instructional Strategy Record Sheet and Compilation Checklist

Because the researcher was unable to find any instruments that appropriately met the needs of the current study, the researcher developed a record sheet and compilation checklist that was utilized to determine the level of instruction provided in accordance with each of the nine learning style elements identified by the CAPSOL[®] learning styles inventory. The record sheet (see Appendix G) is open-ended, allowing teachers to simply identify and describe the strategies used in classroom instruction. The researcher selected this self-report strategy rather than observations in an effort to avoid having principals and teachers decline study participation because they felt threatened by an intrusive presence in the classroom. The researcher transferred data from the instructional strategy record sheets to a self-made compilation checklist (see Appendix H) that four education professionals then utilized to match the instructional strategies with the nine learning style elements identified by the CAPSOL[®] styles of learning inventory. This information led to an indication of high, moderate, or low accommodation for each of the nine learning style elements.

The compilation checklist instrument has an appropriate level of face validity as the researcher based it explicitly upon the learning style elements and prescriptive information included in the CAPSOL[®] learning styles inventory. A panel of educators reviewed the compilation checklist and unanimously agreed the instrument was appropriate for meeting the designated objectives of this study. A modicum of concern must be acknowledged, however, due to the self-made nature of these instruments as well as the self-reporting of the teachers' instructional strategies. While this leaves room for a margin of error, the researcher made every effort to handle these tasks objectively. The

researcher met with each teacher and provided verbal and written instructions, examples, and non-examples (see Appendices E and F) to participating teachers in an effort to improve their accuracy and consistency in self-reporting their instructional strategies. Pairing instructional strategies with more than one learning style element when applicable enhanced the validity of the compilation checklist.

A Free-Marginal Multirater Kappa Coefficient (Randolph, 2008) provided a means of assessing interrater agreement for each learning style element and produced a measure of the reliability of the compilation instrument. The achieved percent of overall agreement was higher than the free-marginal kappa for each element, and the strength of agreement fell in the ranges of fair (0.21-0.40), moderate (0.41-0.60), or substantial (0.61-0.80) using the scale set forth by Landis and Koch (1977). The agreement and kappa scores for learning style element were as follows: Visual = 0.66 and 0.32, Auditory = 0.64 and 0.28, Bodily-Kinesthetic = 0.83 and 0.66, Individual = 0.70 and 0.40, Group = 0.70 and 0.40, Oral Expressive = 0.77 and 0.54, Written Expressive = 0.83 and 0.67, Sequential = 0.69 and 0.38, Global = 0.69 and 0.37 (Randolph). Use of Microsoft Excel® spreadsheet software to conduct tabulations and to ensure consistency in pairing instructional strategies with learning style elements enhanced the reliability of the final accommodation scores.

Standardized Tests of Achievement

The Palmetto Assessment of State Standards (PASS) is a newly developed instrument adopted in the 2008-2009 school year as the annual test of achievement for students in grades three through eight who are attending public schools in the state of South Carolina. This instrument measures student achievement in relation to the state

academic standards in the following content areas: writing, English language arts (reading and research), mathematics, science, and social studies (South Carolina State Department of Education, 2011). All fourth grade students are required to take all portions of the PASS test except writing. Students with an identified plan to address special learning needs may have certain accommodations for participation in PASS testing; in more severe cases, students may take an alternate state assessment, the SC-Alt. There are no specific modifications made to the testing procedures for students identified as gifted or talented. Reports of assessment results are in the form of scaled scores (South Carolina State Department of Education). The South Carolina State Department of Education calculated standards for the test (displayed in Table 2) following the first year of administration in the spring of 2009.

The PASS instrument was subject to validity review based on three types of evidence. Two separate panels of educators who evaluated the test deemed the content validity of this instrument was appropriate (South Carolina State Department of Education, 2010). Researchers also assessed the validity of the instrument in terms of differential item functioning (DIF) using the Mantel-Haenszel procedure which analyzes both statistical significance and effect sizes (South Carolina State Department of Education). The results of this analysis indicated that, in the fourth-grade tests, all but five of the 187 items from each of the four academic domains included in this study (ELA, mathematics, science, and social studies) were free of DIF for both gender and ethnicity (South Carolina State Department of Education). A review of raw scores using Pearson product-moment correlations among standards provided further evidence for the validity of the PASS instrument. This analysis revealed correlations on the fourth-grade

tests ranging from 0.604 to 0.680 in ELA, 0.521 and 0.688 in mathematics, 0.494 to 0.604 in science, and 0.501 to 0.578 in social studies (South Carolina State Department of Education).

Table 1

Cut Score Standards for PASS Test

| | Not Met | | Met | Exemplary | |
|-------|-----------------------------|-----------|---------|-------------|-------------|
| | Not Met 1 | Not Met 2 | | Exemplary 4 | Exemplary 5 |
| Grade | English Language Arts (ELA) | | | | |
| 4 | 300-568 | 569-599 | 600-648 | 649-669 | 670-900 |
| | Math | | | | |
| 4 | 300-579 | 580-599 | 600-657 | 658-687 | 688-900 |
| | Science | | | | |
| 4 | 300-563 | 564-599 | 600-673 | 674-688 | 689-900 |
| | Social Studies | | | | |
| 4 | 300-589 | 590-599 | 600-667 | 668-692 | 693-900 |

(South Carolina State Department of Education, 2011)

Reliability of the PASS instrument was determined using coefficient alpha. The reliability indices obtained for the fourth grade tests were as follows: ELA = 0.881, mathematics = 0.910, science = 0.876, and social studies = 0.885 (South Carolina State Department of Education). These exceeded the minimum level of 0.85 set forth by the Technical Advisory Committee for the South Carolina Department of Education and, therefore, indicated an appropriate level of reliability for the instrument (South Carolina State Department of Education). Both the classical and conditional standard error of

measurements (SEM) were computed for each of the fourth-grade tests. The classical SEMs yielded through the traditional formula ranged from 15.0 in mathematics to 17.6 in science. Conditional SEM scores revealed similar patterns with mathematics being the lowest at both the Met and Exemplary levels (13.18 and 14.69, respectively) while social studies was the highest at the Met level (15.83) and science being the highest at the Exemplary level (20.85) (South Carolina State Department of Education). In addition, researchers calculated two measures of consistency for the PASS, using proportion of agreement and the kappa statistic. For the fourth grade tests, these were figured with three achievement levels (Exemplary, Met, and Not Met) and two levels, with the two proficient levels combined. In both analyses, the proportion of agreement scores were higher than the kappa scores, although all scores were higher when considering achievement in just two levels. These scores were as follows, with proportion of agreement scores followed by kappa scores: ELA = 0.879 and 0.669; mathematics = 0.894 and 0.701; science = 0.856 and 0.666; social studies = 0.892 and 0.663 (South Carolina State Department of Education).

Procedures

The discussion of procedures utilized in the study addresses those related to data collection and organization as well as statistical analysis. Throughout the study, the researcher used caution to handle all data with utmost regard for the confidentiality of all participants. The details provided in the following paragraphs describe the procedures carefully followed in the current study to allow for possible future replication of the research.

Data Collection and Organization

Participating students and teachers completed the learning styles inventory in the fourth term of the school year in which the study took place. Teachers utilized a method of self-reporting to collect and provide the researcher with instructional strategy data. The school supplied achievement data from students' standardized test scores for the school year in session during the study. In addition, the researcher obtained subject-related demographic data concerning gender, ethnicity and age as well as identification concerning the presence of special learning needs from the school. By the close of the study, the researcher collected a learning styles profile and achievement data for each participating student as well as learning style and instructional strategy information from each teacher included in the study. The researcher compiled and organized the data according to student and class in order to perform the necessary statistical analysis.

At the outset of the study, the researcher contacted the principals of the schools selected for the study to introduce them to the research and request their involvement (see Appendix A). Upon the receipt of administrative approval, the researcher introduced the study to the fourth grade teachers at each school and elicited their cooperation (see Appendix B). Participating teachers sent a request for informed consent (see Appendix C) to the parents or guardians of each child enrolled in their classes. Before administering the CAPSOL[®] styles of learning inventory, the researcher distributed a child assent form (see Appendix D) requesting the signature of each potential subject to each student who had returned a signed parent/guardian consent form. Only those students whose parents granted permission and who assented to their participation were included in the study.

Student learning style data. After the parent/guardian consent forms were distributed, the researcher scheduled a time to administer the CAPSOL[®] inventory. Form A of the assessment was administered to all students in a single class at one time, with each class completing the assessment during the fourth quarter of the school year. Teachers also completed Form B of the inventory at the same time as their respective classes. The researcher collected the completed inventories and scored them, identifying student preference profiles indicating a high, moderate, or low preference for each of the nine learning style elements. In order to maintain confidentiality, a unique alpha-numeric code assigned to each subject replaced the participants' names in the compilation and organization of all subsequent data. The results of this instrument yielded both diagnostic and prescriptive information used in the study.

Instructional strategy data. Before instructional strategy data collection began, the researcher met with each participating teacher to provide them with blank forms (see Appendix G) as well as verbal and written instructions (see Appendices E and F) including examples and non-examples of the type and format of data to be included on the forms. The researcher then asked each teacher to record all instructional strategies he/she utilized in a two-week period in the fourth quarter. The researcher clearly stated that teachers should utilize typical instructional strategies and record these during the data collection period.

At the end of the quarter, the researcher collected the finished record sheets from each participating teacher. A compilation of the instructional strategies reported by the teachers yielded a listing of all strategies incorporated throughout the study. The researcher and three other professionals, all of whom hold a terminal degree in education,

each completed the compilation checklist (see Appendix H), pairing each instructional strategy with one or more of the nine learning style elements identified with the CAPSOL[®] learning styles inventory. The researcher tabulated the results of this process, producing a final compilation checklist by matching instructional strategies with each learning style element so paired by at least three of the four raters.

The researcher then utilized these pairings to complete a cumulative accommodation data sheet (see Appendix I) for each teacher in each content area for which they are responsible. This indicated the number of times individual teachers, who were identified only by alpha-numeric code, accommodated each learning style element during the identified two-week data-collection period of the study. This procedure led to an identification of high (9+), moderate (4-8), or low (0-3) accommodation for each learning style element in each of the following four academic content areas, English language arts, mathematics, science, and social studies.

Degree of match scores. The previously obtained indication of students' high, moderate, and low preferences from the CAPSOL[®] styles of learning inventory and the indication of teachers' high, moderate, and low accommodations was then be paired to arrive at a degree of match score for each student in every content area. Linking the student preference profiles with the teachers' learning-style related instruction produced numerical scores in the following manner: high/high = 2, moderate/moderate = 2, low/low = 2, high/moderate = 1, moderate/low = 1, high/low = 0. The researcher then compiled these scores for each learning style element to achieve a score indicating the degree of match between students' learning style preferences and teachers' instructional strategy accommodations. For each student, in each academic content area, the degree of

match score could range from 0 to 18.

Student achievement data and scores. Participating schools provided student achievement data indicated on PASS test reports, and the researcher linked these confidentially to each student participating in the study. At the end of the school year, the researcher collected standardized achievement test results for each student participating in the study. Results obtained from the schools were in the form a scaled score in each academic content area, English language arts, mathematics, science, and social studies.

Data Analysis

The researcher entered all collected data into the SPSS® statistical software program (Student Version 16.0, SPSS, 2008) for analysis. Frequency distributions and histograms organized the data and provided a visual display of the variables under investigation, namely degree of match and academic achievement. Statistical analysis using Pearson's product-moment correlation coefficient explored potential relationships between variables.

The Pearson coefficient was the most appropriate statistic to use in analyzing the relationship between degree of match scores and student achievement as reported in standardized achievement test scores because these were two sets of interval data that were suitable for logically pairing. Further, Pearson's coefficient is the most common correlation statistic (Howell, 2008), and is effective for examining variables with linear relationships (Ary et al., 2006). However, if a curvilinear relationship was evident in the collected data, use of the Pearson product-moment correlation coefficient may have produced misleading results. Thus, if such a relationship existed, computation of a

correlation ratio would have been necessary to determine the degree of relationship between the two variables. The correlation ratio is more effective at revealing a coefficient that accurately demonstrates the magnitude of relationships between variables with a non-linear correlation (Gall, Gall, & Borg, 2003).

The researcher evaluated the results of all statistical analyses at a significance level of $p < .05$. Utilizing this level of significance is common in the behavioral sciences (Ary et al.) and provides as a moderate way of guarding against both Type I and Type II errors. While the researcher desired to avoid inaccurately retaining the null hypothesis, it was also important not to take excessive risk in reporting a relationship that is simply a result of chance. Because the study was correlational in nature, and therefore did not presume to identify cause and effect, the researcher was willing to risk a slightly higher chance of a Type I error than would be present if using a .01 significance level.

Identification of a relationship between variables in this study was intended to inspire further, more rigorous study that could reveal the existence of a Type I error without significant damage. However, if the current study failed to detect relationships, even if they did exist, it was less likely the results would support further study or pursuit of this topic. Thus, the importance of balancing the risk of both Type I and Type II errors led to the selection of $p < .05$ as the significance level for the current study.

The correlational research design enabled the researcher to explore the potential relationships between variables, specifically student achievement and the degree of match between students' learning style preferences and teachers' instructional strategy accommodations. The researcher conducted separate analyses for academic achievement in each content area based on year-end achievement test scores. Each analysis will

produce an r score that will provide a statistical indication of the relationship between identified variables.

Summary of Methodology

Because of the identified need for empirical data concerning the influence of learning styles on academic achievement, a quantitative approach with a correlational research design was appropriate for the current study. After obtaining the necessary informed consent from all participants, three instruments, the CAPSOL[®] styles of learning inventory, an instructional strategy recording sheet, and an accommodation checklist were utilized to collect and compile the degree of match scores. Scores from the PASS test provided the achievement data. The researcher used Pearson's product-moment correlation coefficient to analyze the data statistically, and the significance level was set at $p < .05$. The subsequent chapter will outline the data obtained through these procedures and will provide the results of each statistical analysis.

CHAPTER FOUR: RESULTS

The ensuing chapter contains findings of the current study. The researcher provides both descriptive data and correlational statistics for each academic content area studied, namely English language arts (ELA), mathematics, science, and social studies. Relevant figures are included to enhance the reader's understanding by adding a visual element to the presentation of the data and statistical analysis.

Restatement of Purpose

The purpose of the current study was to examine student learning style preferences and teachers' instructional practices in various academic content areas at the elementary school level. Data collected throughout the study provided an indication of the degree of match between student preferences and teachers' accommodations. A statistical analysis using the Pearson r correlation coefficient then determined the presence of possible relationships with student achievement scores on year-end standardized tests. The study intended to answer the following question for each academic content area included on the statewide fourth grade achievement test: Is there a significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade students as shown by Palmetto Assessment of State Standards scores? The subsequent sections address this question and present a decision concerning possible rejection of the null hypothesis for each academic content area.

English Language Arts (ELA)

The first research question and related null hypothesis concerned the degree of

match and student achievement in English language arts (ELA). The following sections include a restatement of the question and hypothesis followed by results of the statistical analysis for this content area.

Research Question 1

Is there a significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade English language arts students as shown by Palmetto Assessment of State Standards scores?

Null Hypothesis 1

There is no significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade English language arts students as shown by Palmetto Assessment of State Standards scores.

English Language Arts Results

Participants for the study included students taken from a sample of 308 fourth grade students from three school districts in northwestern South Carolina. Of those, 203 submitted the necessary consent and assent forms. However, the researcher was only able to collect a complete set of data from 187 students in the English language arts content area. Missing data from some aspect of the study were unavailable for the other 16 approved students, resulting in their omission from data analysis. Of the 187 final participants, 94 were males and 93 were females, and they demonstrated a moderate amount of diversity with 133 Caucasians, 40 African Americans, and 14 of other descent. Only 22 of the participants had identification of any type of learning disability, as

indicated by the presence of an Individualized Education Program (IEP) or 504 Plan.

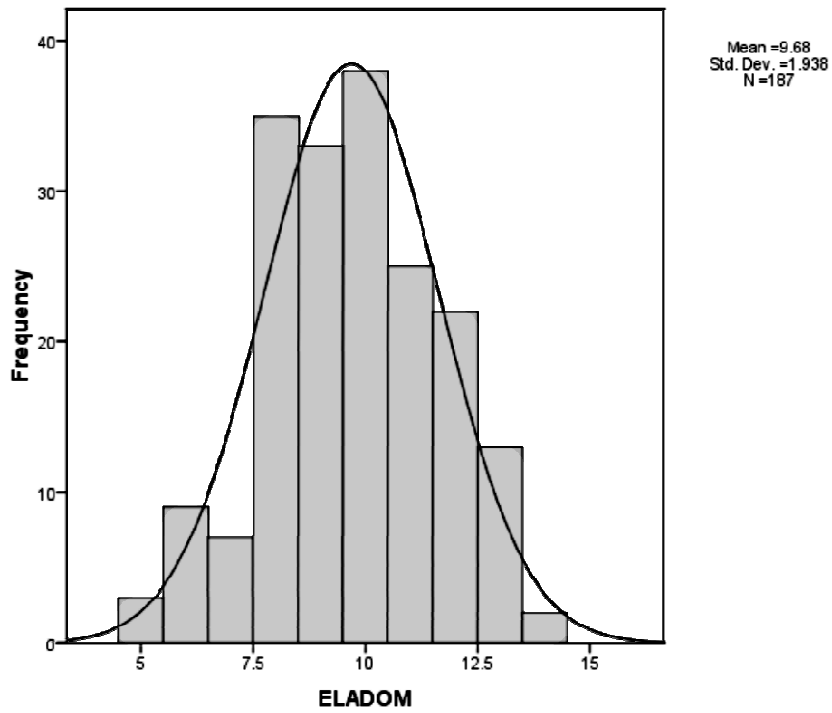


Figure 1. Frequency Histogram of English Language Arts Degree of Match Scores (ELADOM)

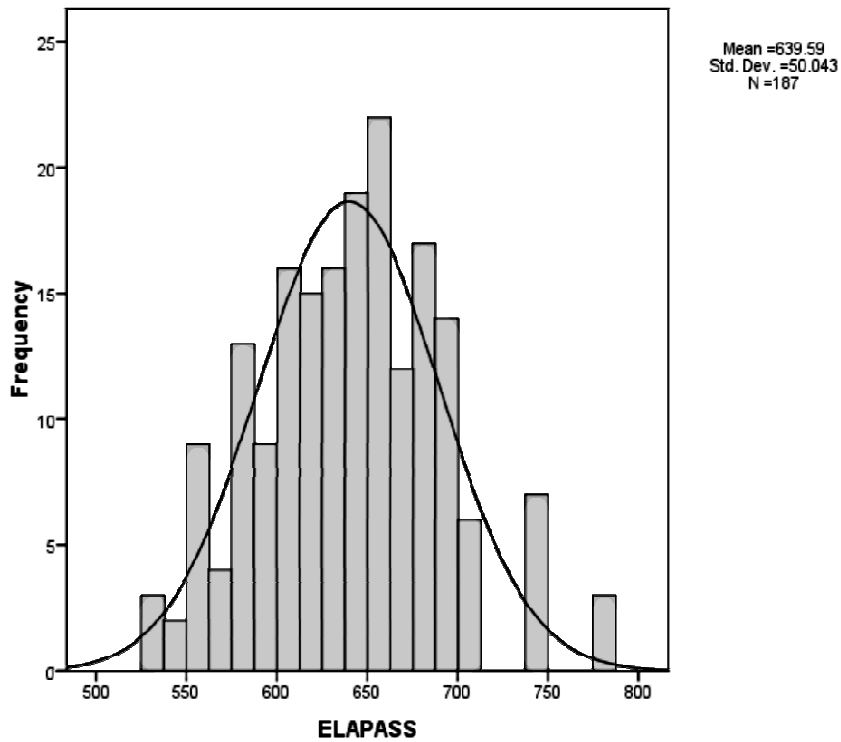


Figure 2. Frequency Histogram of English Language Arts PASS Test Scores (ELAPASS)

As shown in Figures 1 and 2, both the degree of match scores and PASS test scores followed the essential pattern of the normal curve and ranged from five to 14 and from 529 to 786, respectively. Mean scores were 9.68 for degree of match and 639.59 for the PASS test. However, a scatter plot of these two variables together revealed a rather random pattern of placement (see Figure 3). Analysis with Pearson's Correlation Coefficient produced a correlation score of $r = .030$. The results of the analysis also failed to meet the limitations set for statistical significance with a score of $p = .684$. Therefore, the data from the current study were insufficient to reject the null hypothesis for the content area of English language arts.

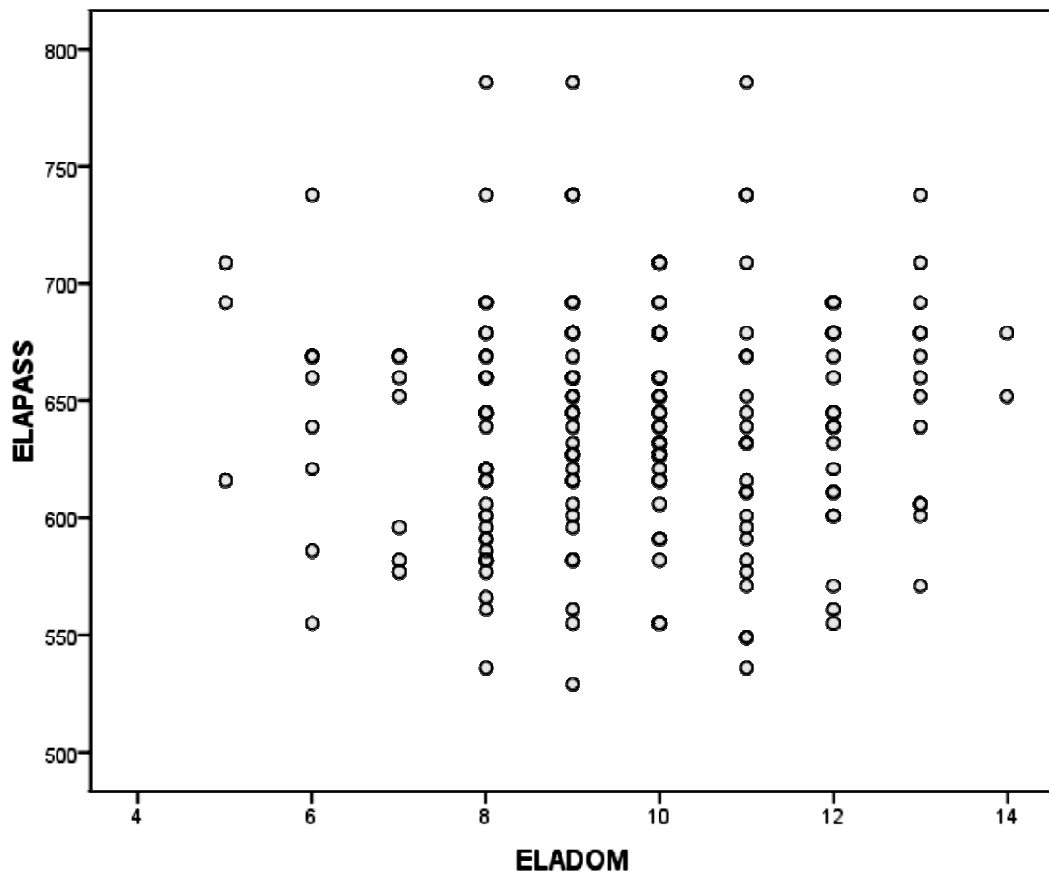


Figure 3. Scatter Plot Displaying Relationship between English Language Arts Degree of Match (ELADOM) and PASS Test Scores (ELAPASS)

Mathematics

The second research question and related null hypothesis concerned the degree of match and student achievement in mathematics. The following sections include a restatement of the question and hypothesis followed by results of the statistical analysis for this content area.

Research Question 2

Is there a significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade mathematics students as shown by Palmetto Assessment of State Standards scores?

Null Hypothesis 2

There is no significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade mathematics students as shown by Palmetto Assessment of State Standards scores.

Mathematics Results

Mathematics content area data collected from the same participants as in ELA produced similar results. Degree of match scores ranged from six to 16 with a mean score of 9.87, while PASS test data in the area of mathematics indicated a minimum score of 546, a maximum of 859, and a mean score of 656.17. As with the ELA data, although an acceptable representation of the normal curve was present in both degree of match scores and PASS test scores (see Figures 4 and 5), a combined scatter plot of the data in the mathematics content area produced the display shown in Figure 6.

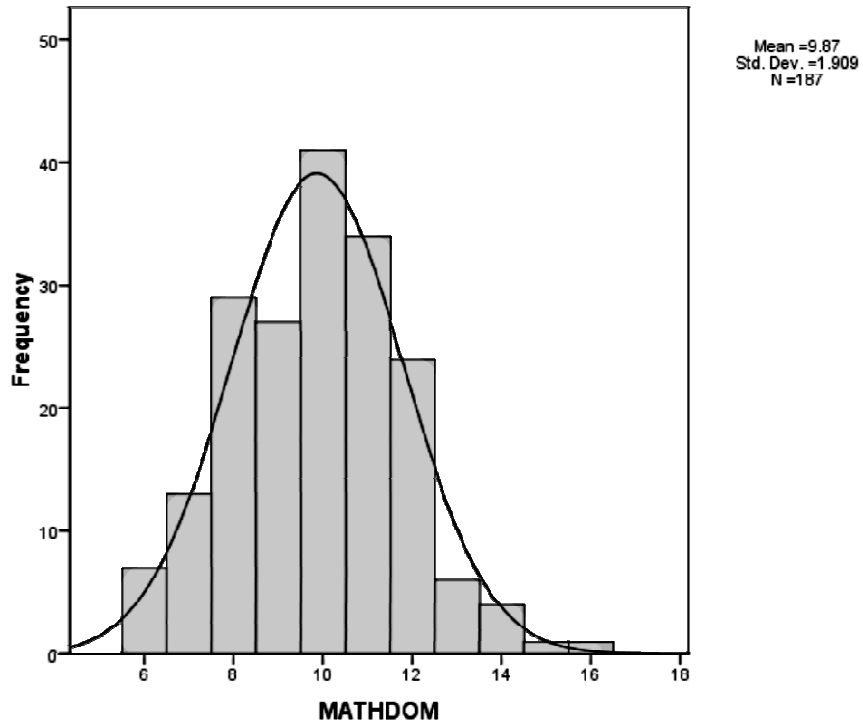


Figure 4. Frequency Histogram of Mathematics Degree of Match Scores (MATHDOM)

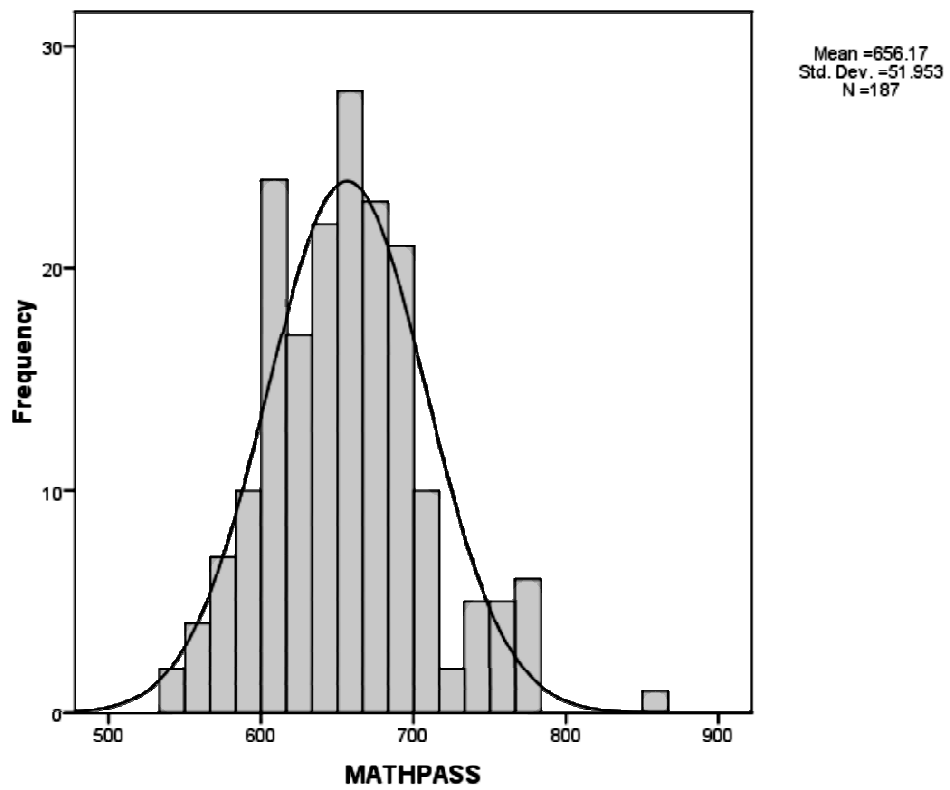


Figure 5. Frequency Histogram of Mathematics PASS Test Scores (MATHPASS)

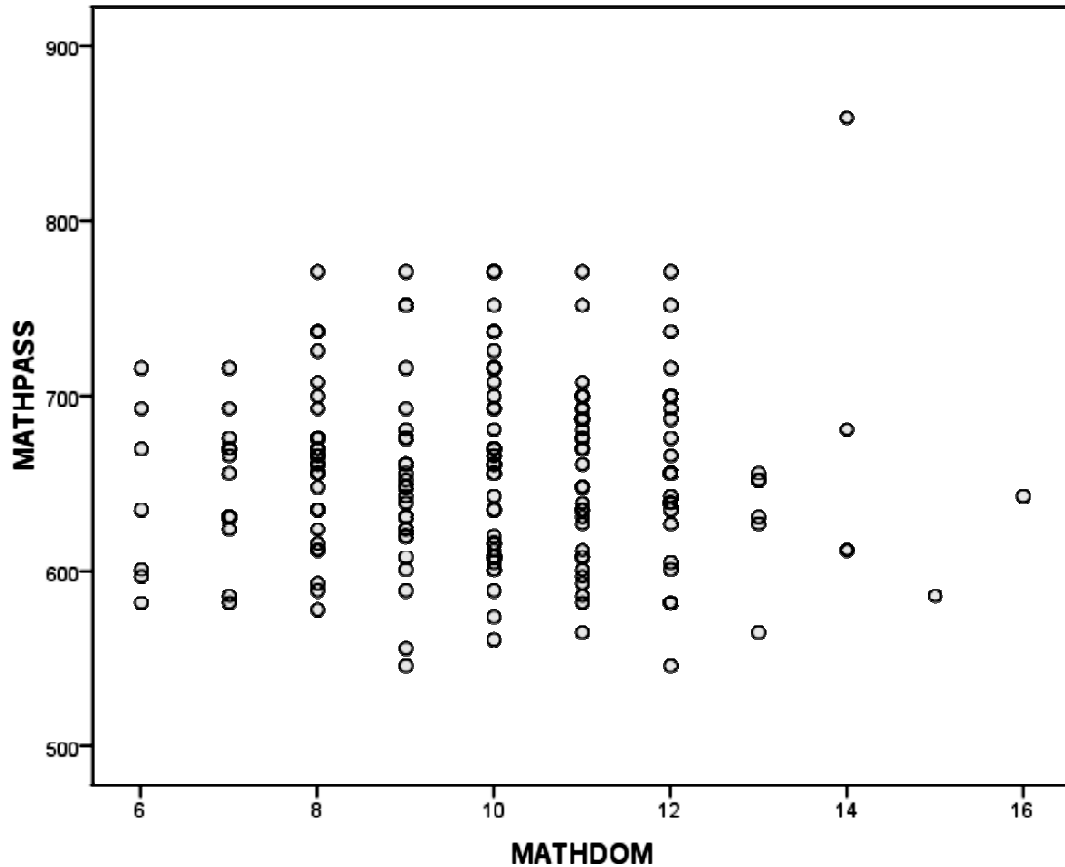


Figure 6. Scatter Plot Displaying Relationship between Mathematics Degree of Match (MATHDOM) and PASS Test Scores (MATHPASS)

Statistical analysis likewise indicated a correlation of $r = .013$ with a significance level of $p = .857$. This prevented the researcher from rejecting the null hypothesis that there is no significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teacher) and the achievement of fourth grade mathematics students as shown by Palmetto Assessment of State Standards scores.

Science

The third research question and related null hypothesis concerned the degree of match and student achievement in science. The following sections include a restatement

of the question and hypothesis followed by results of the statistical analysis for this content area.

Research Question 3

Is there a significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade science students as shown by Palmetto Assessment of State Standards scores?

Null Hypothesis 3

There is no significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade science students as shown by Palmetto Assessment of State Standards scores.

Science Results

Data in the science content area collected from the same 187 participants again revealed similar findings. The lowest degree of match score was two, the highest was 15, and the mean score was 9.57. On the science portion of the PASS test, students' scores ranged from 523 to 844, with a mean score of 646.61. Once again, this data presented a fairly normal distribution as was achieved in both ELA and mathematics (see Figures 7 and 8).

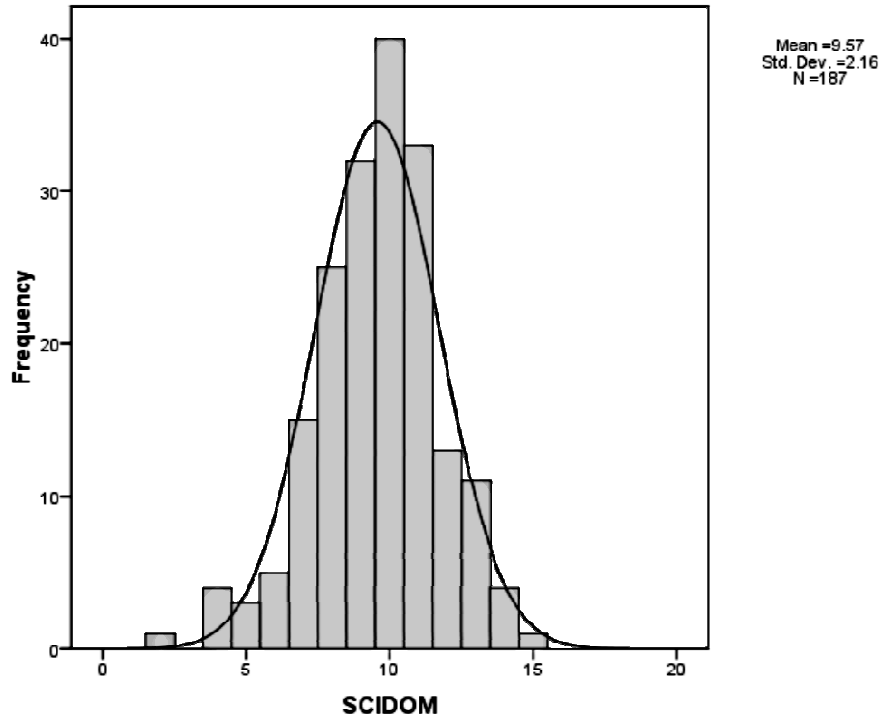


Figure 7. Frequency Histogram of Science Degree of Match Scores (SCIDOM)

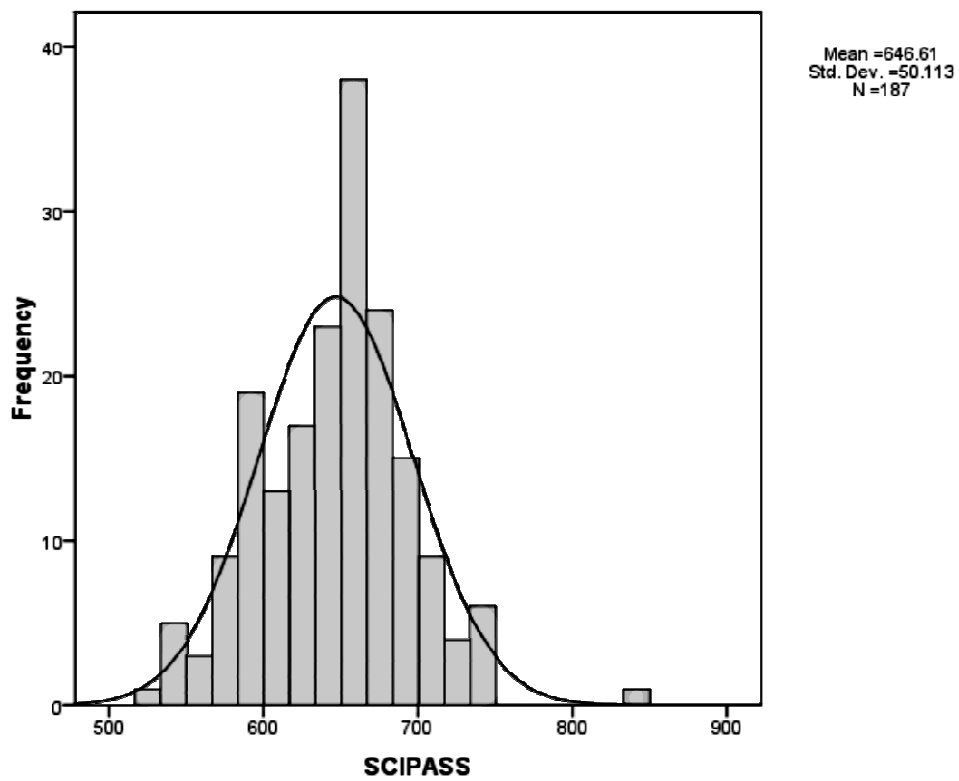


Figure 8. Frequency Histogram of Science PASS Test Scores (SCIPASS)

Also similar to results from the other academic content areas, the scatter plot displayed in Figure 9 did not reveal a strong relationship between the two variables, degree of match and achievement scores on the PASS test. The resulting correlation coefficient (r) was .087 with a significance level (p) of .235. Although these scores were the strongest of any analysis in the current study, they still failed to produce the necessary results to reject the null hypothesis of the research question concerning potential relationships in the science content area.

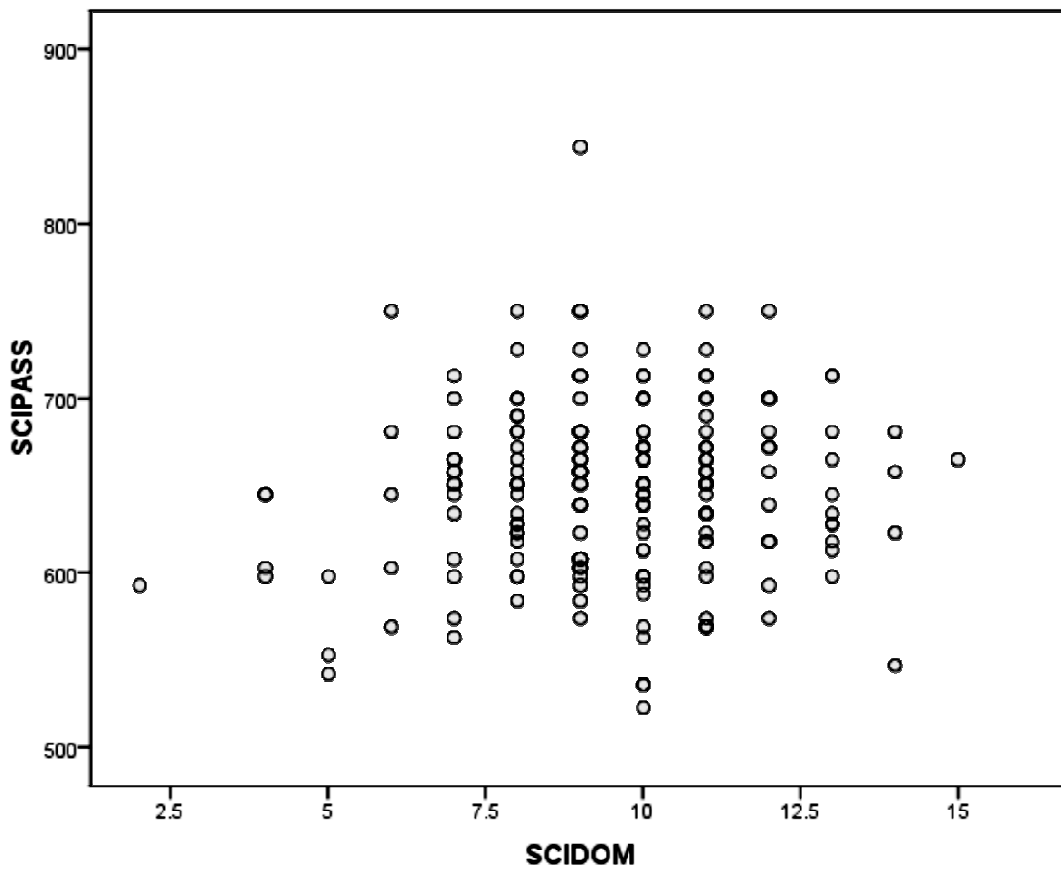


Figure 9. Scatter Plot Displaying Relationship between Science Degree of Match (SCIDOM) and PASS Test Scores (SCIPASS)

Social Studies

The fourth research question and related null hypothesis concerned the degree of match and student achievement in social studies. The following sections include a restatement of the question and hypothesis followed by results of the statistical analysis for this content area.

Research Question 4

Is there a significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade social studies students as shown by Palmetto Assessment of State Standards scores?

Null Hypothesis 4

There is no significant relationship between the degree of match (as determined by comparing learning style preferences of students with instructional strategies of teachers) and the achievement of fourth grade social studies students as shown by Palmetto Assessment of State Standards scores.

Social Studies Results

Fewer participants were included in the social studies portion of the study, as students in two classes did not receive any social studies instruction during the two-week period of instructional strategy recording at their school. Thus, only 171 students made up the total number of participants for this section of data analysis. Of those 90 males and 81 females, 125 were Caucasian, 33 were African American, and 13 were of other ethnicity. Most of these students had no identification as having any special learning needs, as only 19 had an IEP or 504 Plan in place.

Despite having slightly fewer participants, the results of the data analysis for the social studies portion remained consistent with the rest of the study. As displayed in Figures 10 and 11, the basic arrangement of the normal curve was evident in the collected data of both degree of match and PASS test scores. The smallest degree of match score obtained was four, while the highest was 14, and the mean score of 9.67 was similar to that found in the other academic content areas. Also closely resembling scores in the other areas, the minimum score on the year-end test of social studies achievement was 550, the high was 834, and the mean was 659.98.

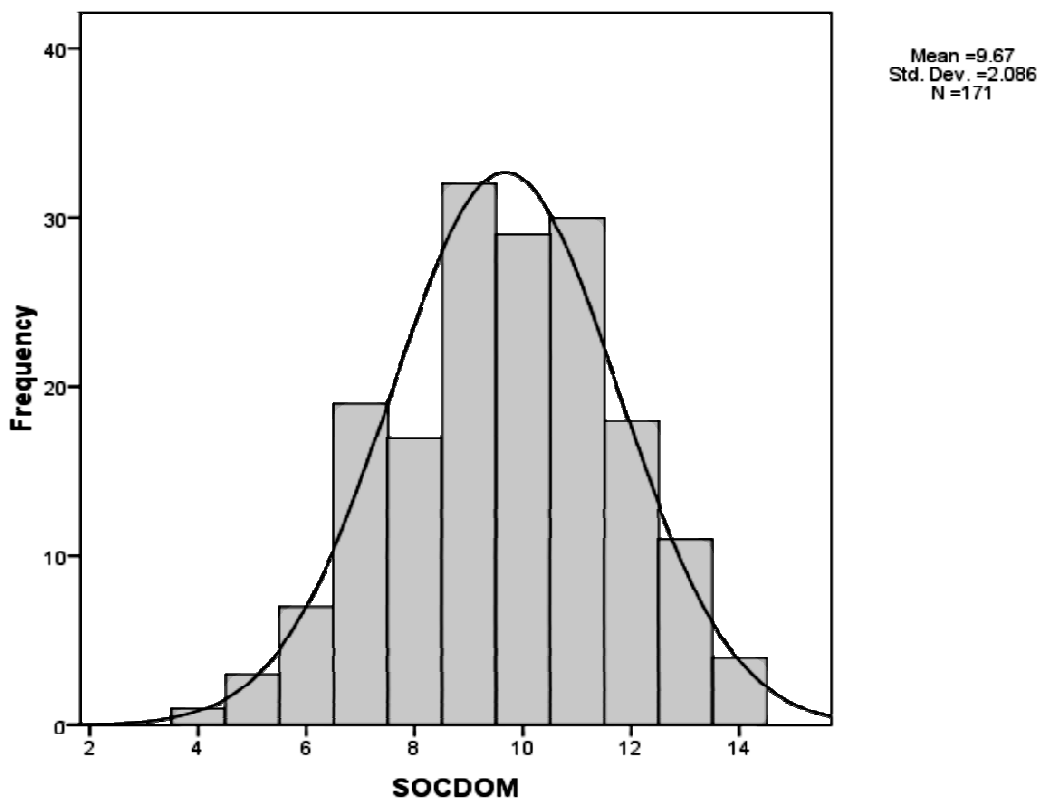


Figure 10. Frequency Histogram of Social Studies Degree of Match Scores (SOCDOM)

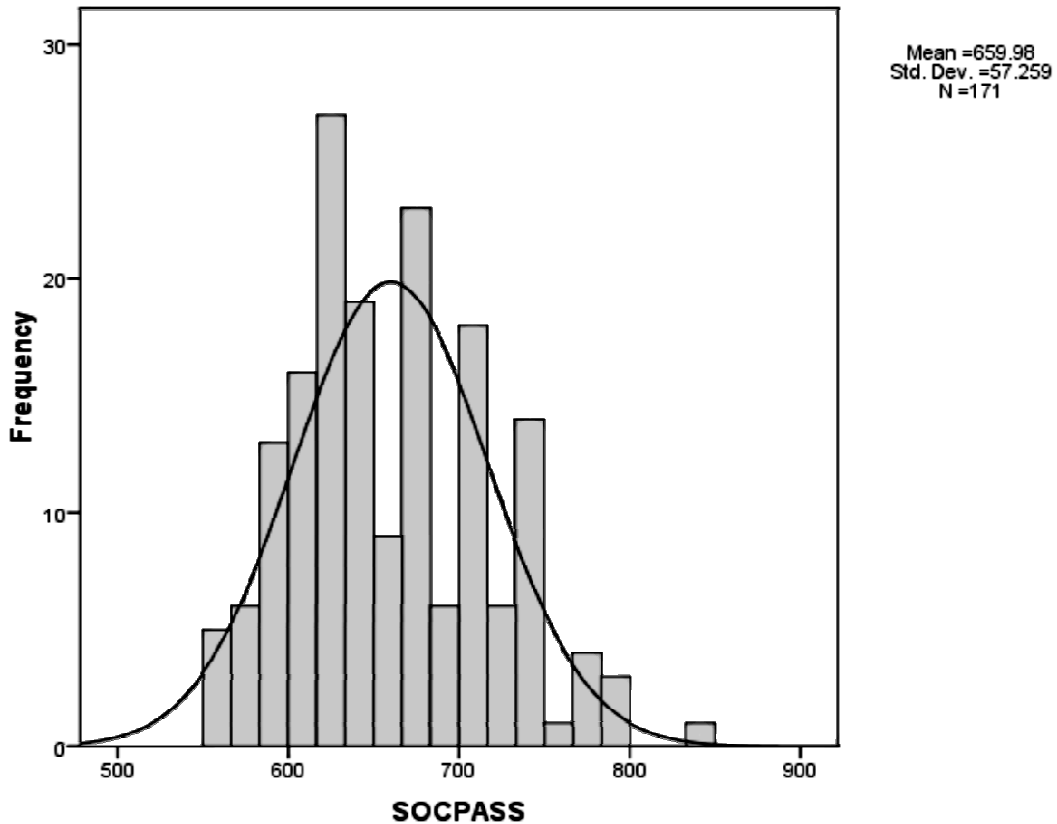


Figure 11. Frequency Histogram of Social Studies PASS Test Scores (SOCPASS)

The scatter plot displayed in Figure 12 evidenced a lack of a strong relationship between the degree of match variable and academic achievement in the social studies content area. Statistical analysis using Pearson’s correlation coefficient produced a corresponding r score of .045. Consistent with the previous findings, this result was not statistically significant, with a p value of .562. Hence, the evidence for a potential relationship between degree of match scores and students’ academic achievement in the social studies content area was insufficient to reject the null hypothesis related to the fourth and final research question.

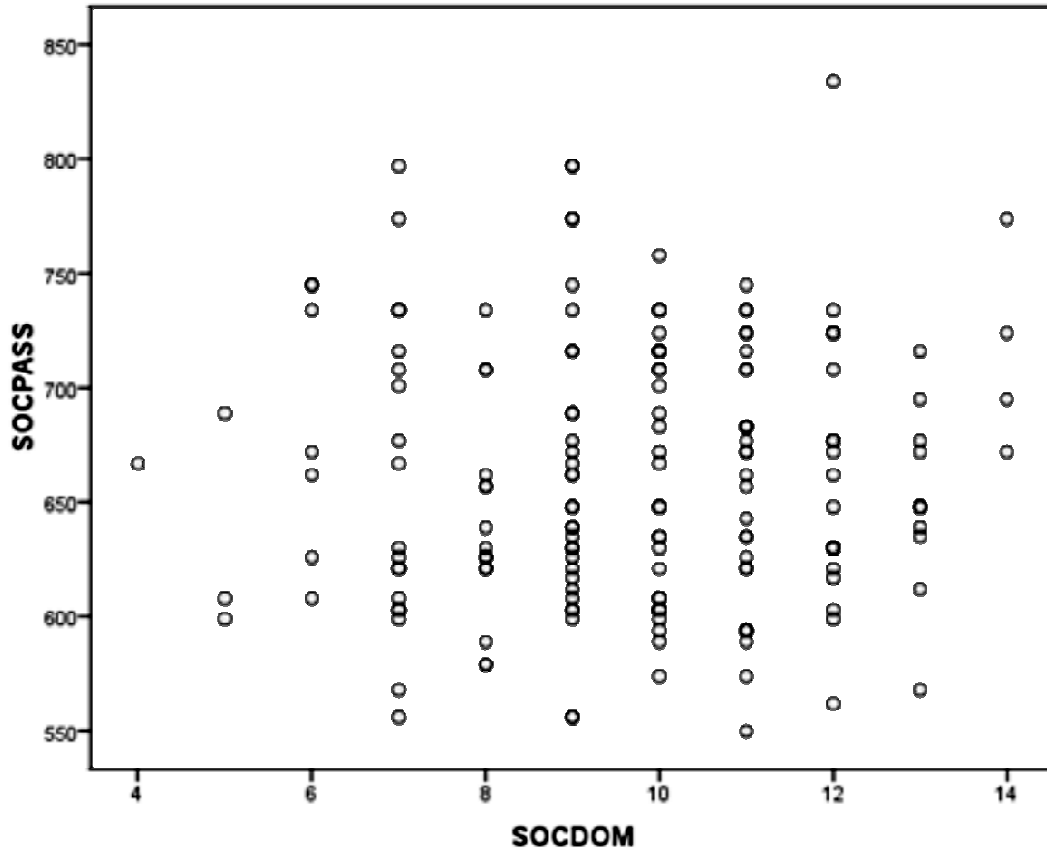


Figure 12. Scatter Plot Displaying Relationship between Social Studies Degree of Match (SOCDOM) and PASS Test Scores (SOCPASS)

Conclusion

The results of the data analysis in the current study yielded little valuable information concerning possible relationships between the degree of match in the learning style preference of students in fourth grade and the instructional strategies of the teacher, and the academic achievement of those students as reflected in achievement test scores. Pearson correlation coefficients for the four content areas included in the study, ELA, mathematics, science, and social studies, all indicated a lack of a strong relationship between variables. However, none of the analyses produced statistically significant results and, therefore, led the researcher to fail to reject the null hypothesis for

all research questions. Nevertheless, the results of the current study do provide important information concerning the field of learning styles and have valuable implications for educators. The following chapter provides a discussion of the findings, implications for practice, and recommendations for future research.

CHAPTER FIVE: DISCUSSION

The purpose of the final chapter is to discuss the findings of the current study in light of relevant research. This section includes a summary of the study results, followed by a discussion of the findings and the implications of such for educational practice. The chapter also addresses the delimitations and limitations of the study and presents recommendations for further research.

Summary of Findings

Analysis of the data collected in the current study provided the researcher with information concerning the participants' degree of match scores based on their learning style preferences and the teachers' instructional accommodations for each learning style element included in the study. The degree of match scores for each content area included in the study (English language arts, mathematics, science, and social studies) presented a fairly normal distribution with the greatest range being from two to 15 in the area of science and the smallest from five to 14 in English language arts. The mean scores were very similar for all content areas, ranging from 9.57 (science) to 9.87 (mathematics).

Participants' scores on a year-end achievement test were also collected and analyzed to provide a measure of students' academic performance. Aggregation of these scores also displayed a relatively normal curve although there was greater variation in the achievement scores than in those reflecting degree of match. In each content area, the mean score fell within the acceptable range of proficiency (Met), although individual students' scores ranged from the lowest (Not Met 1) to the highest (Exemplary 2) possible levels according to the cut score standards presented by the South Carolina State

Department of Education (2011).

Statistical analysis of the relationships between degree of match scores and students' academic achievement yielded low correlations in all academic content areas. Pearson r values ranging from .235 in science to .857 in mathematics demonstrated little relationship between the variables studied. However, none of the analyses were statistically significant, with the researcher attaining p values of .235 (science), .562 (social studies), .684 (English language arts) and .857 (mathematics). Therefore, the evidence was insufficient to reject the null hypothesis for any academic content area.

Discussion

Although these findings demonstrate weak, if any, correlation between students' academic achievement and degree of match in learning style preferences and accommodations, the lack of statistical significance requires the use of extreme caution when considering the results of the current study. A serious concern in researching the field of learning styles is the issue of scientific control when conducting studies, and critics have asserted relevant research has generally lacked the necessary rigor or failed to produce solidly favorable results (Alaka, 2011; Bishka, 2010; Hall & Moseley, 2005; Pashler et al., 2009). Thus, the current study is not alone in failing to provide strong empirical evidence; however, this does not imply the findings of the current study lack relevance or importance for the field of education.

The degree of match data demonstrated students' learning style preferences were not all equally compatible with their teachers' instructional accommodations. It was also obvious the elementary students who participated in the study held unique learning style preferences, which is consistent with the results of prior research (Alaka, 2011; Felder &

Brent, 2005; Fine, 2003) and confirms the appropriateness of exploring this field for educational relevance. Further, the teachers in the current study clearly favored certain modes of instruction over others, as accommodation levels were higher for visual and auditory instruction than for bodily-kinesthetic activities, and teachers assigned written expressive tasks more frequently than oral expressive. However, it was outside the scope of this study as to why this was the case.

Further, there were obvious discrepancies between the learning style preferences of students and the strategies implemented by the teachers in this study. Some learning style elements, such as visual and auditory, were fairly well matched at moderate to high preference between both students and teachers. Others, however, were in direct opposition as demonstrated by an overwhelming 97% of students indicating a moderate or high preference for the bodily-kinesthetic learning style while the majority of teachers (eight of 13) provided low accommodation for such activity and none provided high accommodation.

The second variable addressed in the current study, academic achievement, also provided the researcher with valuable information. Students in the same classroom experienced extremely different degrees of academic success. Receiving instruction from the same teachers, some students in the current study performed at highly proficient levels while others failed even to meet the basic requirements. The greater variation in achievement scores versus degree of match was not surprising due to the greater range of potential scores on the PASS Test. The logic of this fact, though, does not reduce the concern that many children were achieving below the compulsory standards and perhaps even farther below their true potential. However, due to the research design chosen and

the limitations encountered throughout data collection, the current study was not able to identify the cause of this disparity, and it left unanswered the question of whether or not the degree of match between learning style preferences and teaching strategies play a part. One might assume there are a variety of reasons, leading to the complexity of exploring such topics in educational research.

Implications

While the lack of empirical evidence found in this study was consistent with much prior research (Alaka, 2011; Bishka, 2010; Hall & Moseley, 2005; Pashler et al., 2009), the concept of learning styles still holds appeal for educators (Bishka; Martin, 2010; Scott, 2010). A potential benefit of incorporating learning styles research in the classroom is helping teachers and students alike develop a greater awareness and understanding of the unique characteristics of each individual represented in any given classroom (Alaka; Charlesworth, 2008; Koçakoğlu, 2010; Lauria, 2010). Learning style assessments can help identify personal preferences as well as potential strengths and weaknesses in how learners deal with content and approach learning tasks (Hawk & Shah, 2007). However, students may be inaccurate in their responses to assessment items (Bishka), and teachers must be careful to avoid labeling students based on assessment results, as this would be counterproductive to a theory designed to encourage and support diversity (Scott, 2010). Instead, teachers should utilize assessment findings to assist them in broadening their methods to incorporate the variety of styles expressed by the students under their charge (Cox, 2008; Hawk & Shah; Koçakoğlu).

Even if teachers or schools choose not to administer assessments, teachers can still use an understanding of learning style characteristics to inform their instruction.

Although research studies have been unable to consistently provide evidence that matching styles is beneficial to students' academic achievement, there are indications that this may be the case (Hsieh, Jang, Hwang, & Chen, 2011; Lauria, 2010). Further, the literature also supports the notion that teaching to a variety of learning styles may be even more beneficial than tailoring instruction to exactly match student preferences (Alaka, 2011; Martin, 2010). However, the overwhelming learning style theories plethora of physiological preferences, psychological tendencies, and personality traits can leave teachers bewildered (Alaka). The CAPSOL[®] styles of learning inventory includes a manageable number of important components from these various learning style theories, making it a worthwhile tool to help teachers develop an awareness of learning styles concepts and assessment information. Teachers can then use such information to monitor their instruction and ensure they are utilizing a variety of strategies and selecting those most appropriately suited to particular lesson content (Koçakoğlu, 2010).

Ultimately, it is essential to return the focus to teaching students and helping them become successful learners. Teachers must be empowered to refine the art of instruction, trusted to develop and utilize their skill and intuition, and encouraged to implement strategies that meet the needs of the children (Martin, 2010). It is essential to return the spotlight to the students rather than content standards and proficiency scores. Obviously, it is necessary to maintain measures of accountability and uphold high standards, but the education system must not do this at the expense of teaching for student learning. An awareness of learning style preferences and the ability and willingness to differentiate instruction by incorporating a variety of teaching style approaches suited to such preferences can help teachers make great strides in reaching and meeting the educational

needs of all their students (Cox, 2008; Hawk & Shah, 2007; Hsieh et al., 2011; Lauria, 2010).

Delimitations and Limitations

In the current study, the researcher attempted to utilize authentic settings and procedures, with students and teachers following their typical educational patterns. However, this necessarily inhibited the researcher's control over the variables in the study and produced serious limitations affecting the outcome. Further, the researcher had limited resources and connections, which also influenced the data and subsequent findings. The following paragraphs discuss the delimitations of the study as well as the limitations in both design and data.

Delimitations

The participants in the study consisted of approximately 200 fourth grade students from three schools in neighboring districts in northwestern South Carolina. The researcher selected these subjects due to the proximity of the location around the researcher's home. All participants who returned the necessary permission forms, were present at the time of administration of the learning styles assessment, and had all achievement scores reported by the school were included in the study. The researcher did not select or deny any participants based on gender, ethnicity, or any other demographic categorization.

Limitations in Design

Despite the effort to conduct careful research, several limitations exist in the design of this study, particularly due to the use of convenience sampling as a means of obtaining the participants. Because the researcher did not utilize a random procedure for

selecting subjects, there may be differences between the observed sample and the total population (Ary et al., 2006; Leedy & Ormrod, 2010). The researcher attempted to minimize the resulting threats to internal and external validity by incorporating a large sample size of approximately 200 students from public schools in three different school districts. However, it remains that the ability to generalize the findings of this study is limited to those schools with equivalent demographics as well as similar class structure and design. One must also consider the influence of such factors as socio-economic status, student motivation, family support and involvement when determining the extent to which generalization to other settings is appropriate. In addition, proper generalization requires use of the same instrument to assess students' learning style preferences and incorporation of comparable instructional strategies in the classroom.

Another threat to the internal validity of this study exists in the instrumentation utilized to gather data concerning teachers' instructional strategies. The researcher-made and self-report nature of these instruments subjected them to lower levels of reliability than might be found in instruments using a more objective approach with prior testing in other studies or in a pilot test (Ary et al., 2006). The accuracy and comprehensiveness of the teachers in reporting their instructional strategies therefore limited the study, as did the researcher's ability to perform an objective compilation of the data. Efforts to minimize this threat involved providing teachers with instructions for completing the record sheet and withholding information concerning the results of students' learning style inventories until the completion of the study. A further attempt to reduce the implied limitations involved the use of the CAPSOL's[®] (n.d.) prescriptive information to guide the compilation process as all raters received the same information and were asked

to use this as an informative tool.

Finally, history and maturation could both have had a potential effect on the study, as students were continually growing and changing. School-wide and/or personal events occurring at home, school, the community, and at national or even global levels may have affected students' efforts or interest in school and achievement, thus altering the collected data and, therefore, the findings of the study (Ary et al., 2006). Although the study participants were all enrolled in fourth grade, there certainly was some variation in age and, therefore, developmental levels. Even children of similar ages differ in their rate of physical, psychological, and intellectual development, thus introducing a variable outside the researcher's control (Felder & Brent, 2005; Trochta, 2008). Likewise, there is a lack of consensus concerning the nature of learning style development, with some saying these characteristics are fixed, others indicating they are stable, but not fixed, and still others who assert they are fluid, constantly changing as individuals mature and are exposed to various influences (Alaka, 2011; Charlesworth, 2008). Aside from these inherent differences in individual developmental levels, however, the effects of maturation were not likely to have significantly affected the findings, as scores of achievement were not analyzed in terms of change throughout the study.

Limitations in Data

In addition to limitations in design, there were also several limitations influencing the accuracy and usefulness of the data collected. Due to the necessary constraints of conducting the current study within the confines of the academic year and meeting the requirements of the dissertation process, the study took place in just the final quarter of the school year. Thus, teachers were completing their instructional plans for the year and

many had already covered the core standards measured on the year-end achievement test before data collection began. Some teachers stated their recorded instructional strategies were not entirely typical for the year because they no longer had pressure to cover standards-based content by that point and because interruptions and activities related to the commencement of school for the summer were interfering with normal schedules. The lateness of the data collection period also made it impossible for the researcher to request refinement and clarification from all teachers involved in the study.

Further, group planning and inconsistency in recording may have compromised the accuracy of teachers' instructional strategy data. Some teachers simply reported the plan developed by their grade-level team of content area teachers and did not include any personal modifications they may have made in their actual classroom activities. In addition, some teachers were much more explicit in their reporting, including all instructional strategies through the data collection period while others only reported general approaches concerning activities relevant to the main focus for each content area. This discrepancy as well as lack of clarity and insufficient information for particular descriptions could account for variations and inaccuracies in teachers' accommodation data and contributed to measurement error, therefore, affecting the achieved degree of match scores.

Additional limitations to the data involve a lack of knowledge or skill on the part of various individuals involved in the study (Ary et al., 2006). Students with disabilities or lower reading levels may not have accurately decoded and responded to the learning styles inventory and/or year-end achievement test, possibly providing inaccurate assessment of these variables. Likewise, the accommodation checklist may not have

given an accurate measure of the true instructional strategies provided by teachers. Due to the researchers' inability to secure experts in the field of learning styles research, the education professionals called upon by the researcher to complete the accommodation checklist were limited in their understanding and experience with the topic although they do all hold a terminal degree in education.

Finally, the learning style elements included in the study present varying levels of difficulty in identifying them based on brief written descriptions of classroom activities. Some elements, such as written expressive, appeared straightforward and easy to identify, while others had much more discrepancy between the raters. The bodily-kinesthetic element was perhaps misleading as activities involving movement necessitated categorization as such although the actual activity may have had no relationship to the actual learning process. For example, students pushing a button to indicate their desire to answer a question orally received identification, in part, as a bodily-kinesthetic instructional strategy. However, one may question the benefit of such a technique for a student with a preference for bodily-kinesthetic learning. If the student did not understand or master the information in previous lessons, such a review activity would likely be ineffective for this student, and it is entirely possible he or she would never even push the button. The sequential and global elements also proved particularly challenging to identify based on short descriptions of discrete instructional activities. Because only those strategies identified by three of the four raters were included, the final checklist rating 200 instructional episodes included zero accommodations for the global element and only thirteen for the sequential element. This necessarily influenced the degree of match scores and, therefore, the final correlations. However, it is illogical to think the

teachers did not utilize either of these strategies throughout their instruction, but rather one must ascribe the limitation to the process of recording and categorizing the data.

Recommendations for Future Research

While the limitations of the current study influenced the results, they also provided important insight into both the content and procedural issues requiring consideration in further research. Future investigations must devise a method of collecting and categorizing instructional data that is more consistent and thorough, perhaps involving the researcher as an observer rather than relying on self-reporting by the teachers. This would require the schools and teachers to allow a more intrusive presence in the classroom and would demand a considerable investment of time and resources from the researcher; however, it would provide a greatly enhanced view of the instructional approach of the teachers and yield much more uniform data for analysis. Enlisting seasoned experts in the field of learning styles to review and categorize the instructional strategies would also help to ensure the accuracy of the accommodation data and, therefore, the degree of match scores as well.

Research investigating specific aspects of learning and teaching styles could also benefit the field by adding greater understanding of the various aspects involved. One area of exploration could investigate the possibility that students' learning style preferences may change as they mature or in various subject areas (Glenn, 2009; Hall & Moseley, 2005). Factors influencing teachers' instructional practices could also be the focus of future inquiry, providing insight in the role of such things as personal knowledge and experience, time constraints, convenience, and subject matter. Researchers also could explore the implications of having limited methodological and material resources

and their effect on teachers' selection of and planning for various instructional episodes.

It is logical to recommend the conduction of various types of studies as they may provide a unique perspective from which to view the issues relevant to the field. Both qualitative and quantitative designs provide an important means for developing a broader base of knowledge concerning learning style preferences and the relationship to academic achievement as well as a deeper understanding of the implications for students and teachers. Solid empirical studies are essential to provide the necessary scientific evidence to warrant substantial investment of time, personnel, and resources (Cuthbert, 2005; Hall & Moseley, 2005; Pashler et al., 2009). However, a qualitative approach such as a case study may benefit the field of knowledge by affording the researcher an insider's view of the day-to-day interactions between students and teachers and the interplay of learning style preferences, instructional accommodations, and student achievement in environments where students may either be thriving or experience academic failure. A research approach such as a multicase study would provide the type of detailed and thorough investigation needed to understand the daily practices of effective teachers and would also enable the researcher to observe student responses to these strategies as well as any ancillary effects that might result from such teaching practices (Ary et al, 2006; Leedy & Ormrod, 2010). While scientifically weaker than a quantitative analysis, these methods may prove more beneficial for investigating the field of learning styles, as it is naturally a discipline of individualization (Cox, 2008; Leedy & Ormrod, 2010; Lauria, 2010).

Other recommendations for future research include longitudinal studies and additional analyses conducted with various subgroups of students. Researchers may seek

to investigate the influence of gender and cultural variables on both learning style preferences and academic achievement. In addition, studies examining the role of learning style preferences for students with and without identified learning needs could provide valuable insight for educators.

Conclusion

While the current study did not provide support for the existence of relationships, it also did not negate the possibility that such relationships may exist. What it did clearly show is that further studies investigating learning style preferences need to take careful precautions to protect against the design and data flaws exposed in this study. Such flaws rendered the researcher unsuccessful in the attempt to bridge the gap effectively between theory and practice in terms of how learning style preferences and academic achievement are related. Therefore, the current study left unanswered questions about the practical application of learning style theory (Cano-Garcia & Hughes, 2000; Romanelli et al., 2009; Sharp, Bowker, & Byrne, 2008) and whether potential results are worth broad scale investment (Evans & Waring, 2006; Karns, 2006; Kratzig & Arbuthnott, 2006; Pashler et al., 2009). However, the limitations revealed in the study and the lack of definitive findings actually expose the need for further research to delve into the complexities of how students learn and teachers provide instruction.

At the very least, the findings of the current study substantiate the existence of differences in learning and teaching styles and clarify some important ways in which one can evaluate these processes. Due to its straightforward design and its ability to produce acceptably reliable results (CAPSOL[®] Styles of Learning, n.d.; Nunnally, 1978), the CAPSOL[®] styles of learning inventory was a useful tool for assessing learning style

preferences and could easily provide teachers with informative data concerning their students' as well as their own preferred learning modes. Such awareness could prompt attention to the methods of instructional delivery utilized in the classroom as teachers begin to think about how their instruction may or may not meet the needs of the students under their tutelage.

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- Teachers, parents/guardians, and students will receive consent forms
- Participating teachers will be asked to complete a short (45-item) question-and-answer inventory concerning your learning style preferences. The inventory should take about 15 – 20 minutes to complete.
- I will work with the teachers to arrange a 30-minute period of time in October for me to administer a student version of the inventory in your classroom. I would request that the teachers be present in the classroom while they complete the inventory.
- Participating students will be asked to complete a short (45-item) question-and-answer inventory concerning his/her learning style preferences. The inventory should take about 15 – 20 minutes to complete and will be administered in the children’s classrooms, with the teacher present in the classroom.
- Teachers will be asked to record all of the instructional activities they utilize in the classroom during a two-week period of time. This would be similar to reporting lesson plans and is not intended to encourage or elicit any type of modification or deviation from their typical routines.

I would also need to collect the following information concerning participating students from the teachers or the school office:

- Demographic data (gender, ethnicity, age)
- Data concerning indication of special learning needs (no specific information will be obtained, simply whether or not the child has an IEP or 504 Plan)
- Grade reports for the 4th quarter
- Scores from the PASS test for the current school year (2010-2011).

Risks and Benefits of being in the Study

The study has minimal risks that are no greater than the participants would encounter in everyday life. All collected teacher and student data will be kept confidential and no names or identifying information will be included in the research reports.

The potential benefits of your participation include the following:

- Assisting yourself and your teachers in understanding the various learning styles favored by themselves and their students and recognizing the important relationship between the instructional strategies they utilize and the success their students may experience.
- Providing motivation and direction for an increased thrust in exploring the concept of learning styles and matched instructional strategies in training experiences for pre-service teachers as well as professional development programs for current teachers.
- Informing teachers of an instrument that could then also be used as a means to assist them in continued self-reflection as they monitor their instructional strategies and attempt to incorporate a wider variety of methods in their teaching repertoire.

- Providing an impetus for increased differentiation in regular education classrooms, which would enable higher levels of success for all students as well as having the potential to ease the discomfort some teachers feel about inclusion.
- Providing the basis for further research in the field of learning styles, instructional strategies, and their effects on academic achievement.

Compensation:

If you agree to participate in the study, the following compensations will be provided:

- All participants will receive an ice cream treat after completing the inventory.
- Once all data has been collected, participating teachers will be provided a \$5.00 gift card as a token of thanks.

Confidentiality:

The records of this study will be kept private. In any sort of report I might publish, I will not include any information that will make it possible to identify individual participants or classes. All participants will be assigned an alpha-numeric code that will be used to compile and organize all subsequent data. Data analysis will be conducted on the basis of the entire sample and with subgroups of gender and presence of identified special learning need. Research records will be stored securely in password-protected files, and only the researcher will have access to the records. Data will be entered into the researcher's personal computer for organization and analysis, and a back-up copy will be kept on a USB flash drive at the researcher's home. Any paper copies of data will be destroyed once entered into the computer and stored digitally. An exception will be the results of students' learning styles inventory; these will be provided to the students at the completion of the study.

Voluntary Nature of the Study:

Participation in this study is voluntary. Your decision concerning whether or not your school participates in the study will allow and encourage teachers and students to participate. However, each individual will have the opportunity to decide whether or not they will participate. There is no obligation to participate, nor are there any adverse consequences for those who choose not to participate or to discontinue their participation at any time throughout the study.

Contacts and Questions:

The researcher conducting this study is Mary Wilson under the direction of Liberty University School of Education professor, Dr. Leonard Parker. You may ask any questions you have now or at any time during the study, **you are encouraged** to contact me in one of the following ways:

- Mail: 2 Jasmine Lane, Due West, SC 29639
- Phone: 864-379-0061
- E-mail: mlwilson4@liberty.edu

You may also contact my advisor, Dr. Leonard Parker in one of the following ways:

- Mail: 1971 University Blvd, Suite 2400, Lynchburg, VA 24502
- Phone: 434-582-7709
- E-mail: lwpark@liberty.edu

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), **you are encouraged** to contact the Institutional Review Board, Dr. Fernando Garzon, Chair, 1971 University Blvd, Suite 1582, Lynchburg, VA 24502 or email at irb@liberty.edu.

You will be given a copy of this information to keep for your records.

Statement of Consent:

I have read and understand the above information. I have asked questions and have received answers. I consent to the participation of the students and faculty at _____
(name of school)_____ in the above study.

Signature

Title

School Name

Date

Signature of Investigator: _____ Date: _____

IRB # 1058.030811

IRB Expiration Date: 3/8/2012

APPENDIX B

Teacher Letter/Consent Form

Student's Learning Style Preferences and Teacher's Instructional Strategies:
Relationships between Matched Styles and Academic Achievement

Mary Wilson, Doctoral Candidate
Liberty University, School of Education

You and your class are invited to participate in a research study concerning the relationship between the degree of match in students' learning styles and teachers' instructional strategies and the students' academic achievement. Your class was chosen as potential participants because you are a fourth grade teacher at _____ (name of school) _____. Your school administrative official, _____ (official's name) _____ has approved your participation and has pledged the full cooperation of the school in providing me with the participants' demographic and achievement data necessary to complete the study. Please read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted by: Mary Wilson under the direction of Liberty University School of Education professor, Dr. Leonard Parker.

Background Information

The purpose of this study is to examine student learning style preferences and teachers' instructional practices in an effort to explore the extent to which these are matched in a typical classroom setting. The observed degree of match will then be paired with students' academic achievement to detect the presence of a relationship between these two variables. In addition, characteristics such as gender and the presence or absence of special learning needs will be considered as variables that may affect the potential relationships between the level of matched learning and teaching strategies and student achievement.

Procedures:

If you agree to participate in this study, I would ask you to do the following things:

- Complete a short (45-item) question-and-answer inventory concerning your learning style preferences. The inventory should take about 15 – 20 minutes to complete.
- Arrange a 30-minute period of time in September for me to administer a student version of the inventory in your classroom. I would request that you be present in the classroom while they complete the inventory.
- Record all of the instructional activities you utilize in the classroom during a two-week period of time. This would be similar to reporting lesson plans and

is not intended to encourage or elicit any type of modification or deviation from your typical routine.

I would also collect the following information concerning your students from you or the school office:

- Demographic data (gender, ethnicity, age)
- Data concerning indication of special learning needs (no specific information will be obtained, simply whether or not the child has an IEP or 504 Plan)
- Grade reports for the 4th quarter
- Scores from the PASS test for the current school year (2010-2011).

Risks and Benefits of being in the Study

The study has minimal risks that are no greater than the participants would encounter in everyday life. All data collected about you and your students will be kept confidential and no names or identifying information will be included in the research reports.

The potential benefits of your participation include the following:

- Assisting yourself and other teachers in understanding the various learning styles favored by themselves and their students and recognizing the important relationship between the instructional strategies they utilize and the success their students may experience.
- Providing motivation and direction for an increased thrust in exploring the concept of learning styles and matched instructional strategies in training experiences for pre-service teachers as well as professional development programs for current teachers.

Compensation:

If you and your students agree to participate in the study, you and your students will receive an ice cream treat once the inventory has been completed. In addition, once all data has been collected concerning instructional strategies, you will receive a \$5 gift card as a token of my appreciation for your involvement in the study. Finally, you will be given a confidential report concerning data collected and analysis conducted specifically for your class. No one else, including your principal, will be given this information.

Confidentiality:

The records of this study will be kept private. In any sort of report I might publish, I will not include any information that will make it possible to identify individual participants or classes. All participants will be assigned an alpha-numeric code that will be used to compile and organize all subsequent data. Data analysis will be conducted on the basis of the entire sample and with subgroups of gender and presence of identified special learning need. Research records will be stored securely in password-protected files, and only the researcher will have access to the records. Data will be entered into the researcher's personal computer for organization and analysis, and a back-up copy will be kept on a USB flash drive at the researcher's home. Any paper copies of data will be destroyed once entered into the computer and stored digitally. An exception will be the results of students' learning styles inventory; these will be provided to the students at the completion of the study.

Voluntary Nature of the Study:

Participation in this study is voluntary. Your decision concerning whether or not you participate will not affect your current or future relations with Liberty University or your school. If you decide to participate, you are free to not answer any question or to withdraw at any time without affecting those relationships.

Contacts and Questions:

The researcher conducting this study is Mary Wilson under the direction of Liberty University School of Education professor, Dr. Leonard Parker. You may ask any questions you have now or at any time during the study, **you are encouraged** to contact me in one of the following ways:

- Mail: 2 Jasmine Lane, Due West, SC 29639
- Phone: 864-379-0061
- E-mail: mlwilson4@liberty.edu

You may also contact my advisor, Dr. Leonard Parker in one of the following ways:

- Mail: 1971 University Blvd, Suite 2400, Lynchburg, VA 24502
- Phone: 434-582-7709
- E-mail: lwparker@liberty.edu

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), **you are encouraged** to contact the Institutional Review Board, Dr. Fernando Garzon, Chair, 1971 University Blvd, Suite 1582, Lynchburg, VA 24502 or email at irb@liberty.edu.

You will be given a copy of this information to keep for your records.

Statement of Consent:

I have read and understand the above information. I have asked questions and have received answers. I consent to participate in the above study.

Signature

Date

Signature of Investigator: _____

Date: _____

IRB # 1058.030811

IRB Expiration Date: 3/8/2012

APPENDIX C

Parent/Guardian Consent Form

Student's Learning Style Preferences and Teacher's Instructional Strategies:
Relationships between Matched Styles and Academic Achievement

Mary Wilson, Doctoral Candidate
Liberty University, School of Education

Your child is invited to be in a research study concerning the relationship between learning styles, teaching strategies and academic achievement. Your child was chosen as a participant because he/she is a 4th grade student at _____ (name of school) _____. Your child's teacher has agreed to be involved in the study, and all children in 4th grade at your child's school are invited to participate. Please read this form and ask any questions you may have before agreeing for your child to be in the study.

This study is being conducted by: Mary Wilson under the direction of Liberty University School of Education professor, Dr. Leonard Parker.

Background Information

The purpose of this study is to look at student preferences for how they learn and teachers' instructional practices in order to explore how closely these are matched in a typical classroom setting. This information will then be paired with students' academic achievement to identify possible relationships. In addition, characteristics such as gender and identified special learning needs will be considered as they may affect the relationships between the level of matched learning and teaching strategies and student achievement.

Procedures:

If you agree for your child to be in this study, I would ask him/her to do the following things:

- Complete a short (45-item) question-and-answer inventory concerning his/her learning style preferences. The inventory should take about 15 – 20 minutes to complete and will be administered in your child's class at school, with the teacher present in the classroom.

I would also collect the following information about your child from the school:

- Demographic data (gender, ethnicity, age)
- Data concerning indication of special learning needs (no specific information will be obtained, simply whether or not the child has an IEP or 504 Plan)
- Grade reports for the 4th quarter
- Scores from the PASS test for the current school year (2010-2011).

Risks and Benefits of being in the Study

The study has minimal risks that are no greater than the participants would encounter in everyday life. All data collected about your child will be kept confidential and no names or identifying information will be included in the research reports.

Although there may not be any direct benefit to your child, the potential benefits of your child's participation include the following:

- Assisting teachers in understanding the various learning styles favored by themselves and their students and recognizing the important relationship between the instructional strategies they utilize and the success their students may experience.
- Providing motivation and direction for an increased thrust in exploring the concept of learning styles and matched instructional strategies in training experiences for pre-service teachers as well as professional development programs for current teachers.

Compensation:

If you and your child agree to participate in the study, your child will receive an ice cream treat once the inventory has been completed.

Confidentiality:

The records of this study will be kept private. In any sort of report I might publish, I will not include any information that will make it possible to identify individual participants or classes. All participants will be assigned an alpha-numeric code that will be used to compile and organize all subsequent data. Data analysis will be conducted on the basis of the entire sample and with subgroups of gender and presence of identified special learning need. Research records will be stored securely in password-protected files, and only researchers will have access to the records. Data will be entered into the researcher's personal computer for organization and analysis, and a back-up copy will be kept on a USB flash drive at the researcher's home. Any paper copies of data will be destroyed once entered into the computer and stored digitally. An exception will be the results of students' learning styles inventory; these will be provided to you at the completion of the study.

Voluntary Nature of the Study:

Participation in this study is voluntary. Your decision concerning whether or not your child participates will not affect your current or future relations with Liberty University or your child’s school. If you decide for your child to participate, your child is free to not answer any question or to withdraw at any time without affecting those relationships.

Contacts and Questions:

The researcher conducting this study is Mary Wilson under the direction of Liberty University School of Education professor, Dr. Leonard Parker. You may ask any questions you have now or at any time during the study, **you are encouraged** to contact me in one of the following ways:

- Mail: 2 Jasmine Lane, Due West, SC 29639
- Phone: 864-379-0061
- E-mail: mlwilson4@liberty.edu

You may also contact my advisor, Dr. Leonard Parker in one of the following ways:

- Mail: 1971 University Blvd, Suite 2400, Lynchburg, VA 24502
- Phone: 434-582-7709
- E-mail: lwparker@liberty.edu

If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher(s), **you are encouraged** to contact the Institutional Review Board, Dr. Fernando Garzon, Chair, 1971 University Blvd, Suite 1582, Lynchburg, VA 24502 or email at irb@liberty.edu.

You will be given a copy of this information to keep for your records.

Statement of Consent:

I have read and understand the above information. I have asked questions and have received answers. I, as the parent or guardian, give consent for my child,

_____ to participate in the above study.

Signature

Date

Signature of Investigator: _____

Date: _____

IRB # 1058.030811

IRB Expiration Date: 3/8/2012

APPENDIX D

Child Assent Form

I have been told it is OK for me to be in a study at school. The study is about how students like to learn. I know I will get a paper with some questions to answer. When I am done, I will get an ice cream treat or a popsicle to thank me for answering the questions. I also know the person doing the study will look at my grades and my PASS test scores.

I want to do this. I know I do not have to do anything I do not want. If I do not want to be in the study, it will not change my grades.

_____ Name

_____ Date

Signature of Investigator: _____ Date: _____

IRB # 1058.030811

IRB Expiration Date: 3/8/2012

APPENDIX E

Instructions for Completing Instructional Strategy Record Sheet

Please keep the following in mind as you complete the Instructional Strategy Record Sheet for this quarter:

- Choose two consecutive weeks when instruction will be typical of this quarter.
 - Information for each week must be recorded on separate sheets.
 - You may make photocopies of the record sheets if you need additional space.
- Complete the identification portion of the record sheet including:
 - Dates
 - Name of Teacher and School
- Record all instructional activities used for each content area during each day of both selected weeks.
 - Identify all activities, keeping in mind the involvement of both:
 - Teacher
 - Students
 - Briefly describe the “*what*” and “*how*” of each activity.
 - Thinking in the following terms may be helpful:
 - Format
 - Methods
 - Interaction
 - Approach
 - Do not include content-specific topics or objectives.
- Please note the example and non-example each for one day of instruction on the attached Sample Instructional Strategy Record Sheet.

***Thank you again for your willingness to participate in this study.
Your involvement is important and appreciated!***

APPENDIX F

Sample Instructional Strategy Record Sheet

| | | | | | |
|---|---------------|---|------------------|---|---------------|
| <p>Term: <u>2nd Quarter</u></p> <p>Teacher: <u>Mrs. Jane Doe</u></p> <p>School: <u>Learning Place Elementary School</u></p> | | <p>Week Dates: <u>April 4, 2011</u> to <u>April 8, 2011</u></p> | | | |
| Mathematics | Monday | Tuesday | Wednesday | Thursday | Friday |
| | | <p>Example: * Teacher presents a new topic and works examples on the board</p> <p>* Teacher writes problems on the board; has individual students come and solve problems on the board</p> <p>* Teacher assigns textbook problems; students work individually at their desks</p> | | <p>Non-Example: *Textbook lesson #51</p> <p>* Adding fractions</p> | |
| | | | | | |
| | | | | | |
| | | | | | |

APPENDIX G

Instructional Strategy Record Sheet

| | | | | | |
|------------------------------------|--------------------------|----------------|------------------|-----------------|---------------|
| Term: _____ | Week Dates: _____ | | | | |
| Teacher: _____ | to _____ | | | | |
| School: _____ | _____ | | | | |
| Content Area | Monday | Tuesday | Wednesday | Thursday | Friday |
| English Language Arts (ELA) | | | | | |

| | | | | | |
|--|--|-----------------------|-------------------------|------------------------|----------------------|
| <p>Term: _____</p> <p>Teacher: _____</p> <p>School: _____</p> | <p>Week Dates: _____ to _____</p> | | | | |
| <p>Content Area</p> | <p>Monday</p> | <p>Tuesday</p> | <p>Wednesday</p> | <p>Thursday</p> | <p>Friday</p> |
| <p>Mathematics</p> | | | | | |

| | | | | | |
|-----------------------|--------------------------|----------------|------------------|-----------------|---------------|
| Term: _____ | Week Dates: _____ | | | | |
| Teacher: _____ | to _____ | | | | |
| School: _____ | _____ | | | | |
| Content Area | Monday | Tuesday | Wednesday | Thursday | Friday |
| Science | | | | | |

| | | | | | |
|-----------------------|--------------------------|----------------|------------------|-----------------|---------------|
| Term: _____ | Week Dates: _____ | | | | |
| Teacher: _____ | to _____ | | | | |
| School: _____ | | | | | |
| Content Area | Monday | Tuesday | Wednesday | Thursday | Friday |
| Social Studies | | | | | |

APPENDIX H

Compilation Checklist for Instructional Strategies

| | Auditory | Visual | Bodily Kinesthetic | Individual | Group | Oral Expressive | Written Expressive | Sequential | Global |
|-----|-----------------|---------------|-------------------------------|-------------------|--------------|----------------------------|-------------------------------|-------------------|---------------|
| 1) | | | | | | | | | |
| 2) | | | | | | | | | |
| 3) | | | | | | | | | |
| 4) | | | | | | | | | |
| 5) | | | | | | | | | |
| 6) | | | | | | | | | |
| 7) | | | | | | | | | |
| 8) | | | | | | | | | |
| 9) | | | | | | | | | |
| 10) | | | | | | | | | |
| 11) | | | | | | | | | |
| 12) | | | | | | | | | |
| 13) | | | | | | | | | |
| 14) | | | | | | | | | |
| 15) | | | | | | | | | |
| 16) | | | | | | | | | |

APPENDIX I

Cumulative Accommodation Data Sheet

| | Auditory | Visual | Bodily Kinesthetic | Individual | Group | Oral Expressive | Written Expressive | Sequential | Global |
|---------------------|-----------------------------|--------|--------------------|------------|-------|-----------------|--------------------|------------|--------|
| Content Area: _____ | | | | | | | | | |
| Content Area: _____ | | | | | | | | | |
| Content Area: _____ | | | | | | | | | |
| Content Area: _____ | | | | | | | | | |
| | Teacher Code : _____ | | | | | | | | |