

AN EXPERIMENTAL INVESTIGATION OF THE RELATIONSHIPS
BETWEEN PERCEPTUAL MODALITY PREFERENCES OF
MIDDLE SCHOOL STUDENTS AND THEIR
ACADEMIC ACHIEVEMENT

by

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(ABSTRACT)

Individual differences in perceptual and cognitive abilities affect school achievement. More specifically, students who cannot selectively attend to modality information processing will not become high achievers. Efforts to improve academic achievement have failed partly because all students have been expected to use the same approach for learning, and little has been done to match learning programs to the perceptual modality preferences of individuals.

The primary purpose of this study was to determine whether the visual, auditory, tactual and kinesthetic scores (based on the LSI) of students in grades six, seven, and eight from four middle schools were significantly related to academic achievement in Mathematical Concepts and Reading Comprehension, based on the Iowa Test of Basic Skills (ITBS) scores. The secondary purpose was to determine whether there were relationships among grade, gender, schools and perceptual modality preferences. Students in grades six,

seven and eight in four middle schools were selected by section class at all three grade levels. Although the sampling method is by group instead of by individual, there was no reason to believe that such an approach to population sampling would significantly affect the results of this study, as all the class groups were already fully heterogenized. The Learning Style Inventory (LSI) (Dunn, Dunn & Price, 1987) was administered to them to identify their visual, auditory, tactual and kinesthetic modality preferences. These data were analyzed for their relationship to modality matched achievement scores for each student. Multivariate Analysis of Variance was utilized to determine the relationships between perceptual modality strengths by gender, grade, school, and academic achievement.

In general, achievement and learning modality were not related. Although this finding differs from earlier research findings using the LSI model, it does not necessarily contradict them, basically because this study was more correlational than experimental, whereas the previous studies in this area were fully experimental and almost always achieved significance with the administration of intervening treatments. Visualization was moderately related to reading comprehension and reference source utilization. There were no relationships among gender,

grade, and school with learning modality. Strong modality indicators were found for the classrooms of the study, which in turn were recommended as practical guidelines for improving the learning environment in the four schools.

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CHAPTER I

INTRODUCTION

Man's never ending quest is to seek meaning from his environment. This implies that man's curiosity causes him to continually search for reasons which attach meaning to life experiences. The aim of this quest for knowledge is represented by a mass of educational models and theories which serve to explain various phases of the educational regimen (Hill, 1974).

Human beings, individually and in community, have the desire and potential for achieving wholeness. Development of the human potential is the central purpose of education. It is the realization of that potential to which the business of education should be dedicated.

One of the major tasks of schooling is to bring to students the skills of learning and learning how to learn that will widen for each of them the spectrum of learning environments, or they will be limited in what they learn. This is based on the idea that schooling should introduce learners systematically to a wider and wider repertoire of approaches to learning (Joyce, 1987).

The tasks of growth and integration cannot be accomplished externally. Rather, they are an internal process - a personal journey of discovery. The locus of learning is with learners. Educators should, therefore, provide relevant guidance and growth support.

People's learning styles reveal how they identify, judge, substantiate, confirm and validate truth. Because education is intently involved in the processes of purposeful learning, how individuals learn is important.

Every child can learn but not like every other child. Student learning styles differ, and an awareness of this difference will help maximize the overall learning process.

In learning to learn, one of the competencies that students would be expected to acquire and demonstrate is that of knowing their own individual personal learning style and how this can enhance the learning process.

Some people gain information best through visual experiences, others through auditory experiences, and others through tactual/kinesthetic activities. To know which approach is the best for any given child is the first step; to plan activities that utilize these strengths is the second.

The learning style theory accommodates the individual differences of students in instructional and counseling

processes so that each student is supported in achieving full potential. Diagnosing individual learning style preferences and prescribing complementary strategies and interventions are critical procedures in developing giftedness and high academic achievement.

Helping learners understand more about their own preferences for learning, and suggesting ways to cope more effectively in courses taught in ways inconsistent with their styles are promising strategies. Doing so can also help students control their own learning. Educators can help learners to achieve at higher levels by teaching to their modality strengths/preferences and by responding to how each student learns new or difficult information. Learning how to learn is thus an empowering experience that students need if they are to be successful learners, and teachers if they are to be successful instructors.

Individualization in learning has been a major concern of educators for many years. It has only been within the past few decades, however, that behavioral scientists and educators have begun to recognize the importance of individual differences in styles of learning and thinking. Messick (1976) indicated that concern about differences in prior learning and achievement and in levels of social and cognitive development is not enough. He noted that if

teaching is to be more effective, educators must go beyond such individual differences in content and level of learning and focus more upon differences in the process of cognition and creative thinking to find a basis for individualizing instruction. He added that educators must be concerned not only with what a student already knows, but with the manner in which information is processed.

Given the complexity of learning in the classroom, Lesser (1971) suggested that expanded knowledge of individual differences is not enough. He also pointed out that to this must be added an equally expanded range of instructional alternatives which will fit students with particular needs and strengths. Educators must discover how to adjust and adapt instructional strategies to differences they have identified among students.

Research findings (Witkin, Moore, Goodenough & Cox, 1977; Claxton & Balston, 1978; Dunn & Dunn, 1979) show that learning is enhanced if students' individual cognitive styles are identified and matched appropriately with teachers' styles, instructional methods, and subject matter. Specifically, Witkin (1976) suggested that optimal learning results when the instructional style of the teacher is designed to concentrate on the strengths of the learner's cognitive style.

Adolescence is a period of rapid change and extreme variation in physical, intellectual, emotional, and social development, characterized by dramatic behavioral fluctuations.

Middle school students are very active and mobile, and love sound and interaction. They also behave in contradictions; i.e., they may act maturely at one moment, and childishly or irresponsibly at another. Their attention span varies dramatically and despite being curious, they are alternately easy and difficult to motivate. They may be at times challenging in their approach to authority, yet frequently are slaves to the current customs and fads of their peer group, as they are peer-oriented. They struggle for independence while feeling a strong need for discipline and guidance.

How to motivate and teach such children is a challenge to educators, and therefore a very specialized environmental design is needed.

The need to improve teaching and learning in middle schools is great. This is evidently true from the difficulties faculties face with the diverse preparation of today's students.

In a period of transition, with all its traumatic patterns, middle schoolers are exposed to do too much too

soon - including issues of decisions/choices to make, freedom and rights, and responsibilities.

According to the Carnegie Report entitled "Turning Points : Preparing American Youth for the 21st Century" (1989), during early adolescence, youth enter a period of trial and error during which many first experiment with alcohol and drugs, and risk permanent addiction. It stresses that the early adolescent years are crucial in determining the future success or failure of millions of American youth.

Furthermore, the conditions of early adolescence have changed dramatically from previous generations. Young people today enter a society that at once denounces and glorifies sexual promiscuity and the use of illicit drugs - a double standard. It is just like telling somebody to run forward while expecting him to run backward. Such diversity of behavior may negatively impact the learning and growth of middle schoolers.

At the same time, providing early adolescents with a useful and stimulating educational experience is a challenging responsibility for educators, because of the complex issues involved. The middle school curriculum should be based on the wide range of developmental needs of early adolescence; i.e., acquisition of the varieties of

basic skills and relevant experiences required for personal growth and competence in today's competitive job market. The curriculum should, therefore, be based on content that is relevant to , and methods that can accommodate, the intellectual needs of this unique group of learners so that they can experience the new capacity to think in more abstract and complex ways than they could as children.

An effective middle school should, therefore, develop curriculum offerings in which its students are enthusiastically involved; i.e., useful, interesting, and responsive to their diverse needs, by basing it on their learning modality strengths, as will be seen throughout this study.

Teachers need to be aware of the modality strengths of their students through assessment. The chief reason is that instruction can then be organized around those strengths so identified. Instructional methods and materials that are consistent with the modality strengths of students have a greater likelihood of success, and are often more enjoyable to both students and teachers. There is no rule that says that education has to be painful.

An overview of learning styles is necessary to establish the rationale that learning styles are a major factor within the process of education. Learning styles, in

this study, are conceptualized as individual differences in the process of learning performance.

How someone learns is called his or her learning style. Learning style is the broader concept that encompasses environmental, affective, physiological, and cognitive variables (Keefe, 1979; Dunn, 1983). This basic construct, learning style, is often defined differently by different researchers (Dunn, DeBello, Brennan, Krinsky & Murrain, 1981). Keefe (1979) described it as the "characteristic cognitive, affective and physiological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment."

Extensive studies have related, according to Price, Dunn and Sanders(1981), that at least 18 elements from four basic stimuli--environmental, sociological, emotional and physiological -- affect each person's potential to absorb and retain information. The combinations and variations among those elements suggest that few students learn exactly alike.

Aspects of learning styles fall into three categories - - cognitive, affective, and physiological. The cognitive aspect includes the processes of decoding, encoding, processing storage, and retrieval of information. One must also consider how these aspects are performed - randomly or

sequentially, concretely or abstractly, or between these poles along a continuum - and operate utilizing each to some degree (Cornett, 1983).

Cognitive styles represent the narrow delineation of the term and are information processing traits utilized by the learner to perceive, think, solve problems, and remember (Keefe, 1979). Affective learning styles are motivational processes viewed as the learner's typical mode of arousing, directing and sustaining behavior (Keefe, 1979). Keefe (1979) defines physiological styles as biologically based modes of response that are founded on sex-related differences, personal nutrition and health and accustomed reaction to the physical environment.

A broader and more expansive definition of learning style was postulated by Dunn, Dunn and Price (1979). They described learning style as the "manner in which twenty two different elements from our basic stimuli affect a person's ability to absorb and retain" (p.41). These four basic stimuli are: environmental, emotional, sociological and physical (perceptual strengths, etc.).

A more recent definition was established by the National Task Force on Learning Style (1983). That committee affirmed:

Learning style is the composite of characteristic cognitive, affective, and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment. It is demonstrated by the pattern of behavior and performance by which an individual approaches educational experiences. The basis of learning style lies in the structure of neural organization and personality which both molds and is molded by human development and the learning experiences of home, school, and society. (National Task Force Defines ... , 1983, p.1).

How people learn is of interest not only to educators but to everyone, because all would like to read and remember more. While people do not all learn in the same way, teachers often teach all students in the same way, using a teaching style proven more successful for the teacher in his own learning.

"Education today is making an insufficient impact on the potential for human learning" (Gregorc, 1982, p.3). To date there is no one single approach to instruction that accommodates the needs of all students in a given classroom.

The learning style approach to instruction as a curriculum reform is a response to the problem of school learning. It focuses instruction with individual learning styles, by appealing to individual human characteristics. These characteristics are individual personal tendencies in perceiving and processing information based on one's natural and/or acquired modality preferences, developed since childhood.

Thus, the evolution of learning style assessment in education is due in part to the inadequacy of general and traditional methods used to respond to individual needs of learning (Cornett, 1983; Joyce, 1987). Another factor seems to be a fragmented view of school instruction; i.e., a lack of universal principle(s) which could be used as a guide for designing and delivering instruction, according to Gregorc (1982).

The current interest in learning styles, therefore, comes from a humane concern with individual differences. Whatever teaching strategies are used our students will not respond identically. In fact, there will be vast differences. The learning style approach to curriculum reform will better accommodate individual differences.

Purpose of the Study

Education, according to Dewey (1986), is a matter of helping learners to reconstruct experiences so they will see their world and themselves with new meaning; learning is primarily a meaning-seeking affair, and meaning-seeking way of life, therefore, both the subject matter and the experiences of individuals should be taken seriously - a subject-method-mode congruence.

If children are to be successful in school it is important that: (a) their teachers correctly identify and accommodate their unique learning style characteristics; and (b) individuals understand their own uniqueness and how to capitalize on personal strengths. A learning style profile can be used to meet these objectives, designed to assess the learning preference of individuals. Using such a profile can assist students to understand themselves and their program of study; and teachers to understand themselves and the children that they teach so they can design and deliver a more appropriate program of instruction for improved academic achievement.

The primary purpose of this study was to determine whether the visual, auditory, tactual and kinesthetic scores of students in grades six, seven, and eight from four middle schools are significantly related to academic achievement in

mathematics concepts and reading comprehension, based on the Iowa Test of Basic Skills (ITBS) scores. The secondary purpose was to determine whether there were grade and gender differences among the modality groups.

The specific questions to be answered by this study were:

1. What is the nature of perceptual modality preferences of students in grades six, seven, and eight, regarding elements of visual, auditory, and tactual/kinesthetic cognitive skill variables? That is, how are modality preferences for visual, auditory and tactual/kinesthetic approaches to learning distributed within and among grades six, seven and eight by grade and gender?.
2. What is the nature of the relationships between perceptual modality preferences of students in grades six, seven and eight, and their standardized academic achievement scores? That is, how is the relationship between perceptual modality preferences in visual, auditory and tactual/kinesthetic approaches to learning distributed within and among grades six, seven and eight, by grade and gender, for academic achievement?.

Research Hypotheses

The following hypotheses have been generated in null form:

1. There will be no relationship between learning modalities and academic achievement.
2. There will be no relationship between grade, gender, and modality preferences.
3. There will be no difference between schools in the relationship between modality preferences and academic achievement.

Significance of the Study

The concept of learning style is important, because it is one of several variables that faculties and other professionals can use in dealing with the complex issues of teaching and learning.

A major effort of educators over the past two decades focused on improving the academic achievement of students. Several programs were implemented in elementary schools, such as individualized education, open classrooms, and team teaching, but they did not result in the improvement of student learning. The Ford Foundation after spending \$30 million towards school innovations concluded that "the decade of change and innovation in the schools has little or

no lasting effect...on the quality of teaching and learning..." (Brown, 1973). One apparent reason for this lack of success, according to Kiernan (Keefe, 1979), is that all students were expected to use the same approach for learning. Little was done to match the programs to the learning style of individual students.

Cognitive learning style appears to be a potent variable in student learning. Yet, relatively little research has been done compared to what is possible and needed in the area of cognitive style (Witkin, 1976). Specifically, few studies have focused on the learning style of middle school students.

The findings of this study may have future implications for curriculum design and staff development at the middle school level. The study provides a possible research base for a model of instruction grounded on learning style theory.

Definition of Terms

1. Achievement - Academic achievement in this context is, therefore, acquisition of skills and abilities in learning. Achievement in this study refers to understanding of the subject matter at the knowledge and application levels, measured by standardized subject matter achievement tests such as standardized measurement. More specifically, it is the knowledge or proficiency demonstrated by a student, in the content areas of reading comprehension and mathematical concepts as measured by Iowa Test of Basic Skills (ITBS) scores.
2. Auditing - refers to the process by which the continuous flow of sounds is translated into meaning and involves indexing, making comparisons, sequencing, forming sensory impressions, and appreciating (Scheer, 1982).
3. Auditory learner - is a person who prefers learning by listening and can distinguish between sounds (Powell, 1987).
4. Auditory preference - a standard score of 60 or above on the Learning Style Inventory (LSI) in the area of auditory indicates auditory preference (Powell, 1987).
5. Auditory perception - the manner in which students receive information through listening.
6. Aural style - utilizes listening (French, 1975).

7. Cognition - is the present mental structure or process which integrates an experience related to a problem (Bruner, 1963). This is accomplished by encompassing and accommodating the process or modification of the student's internal structure to fit an increasingly logical viewing of the world (Piaget, 1970; Robeck and Wilson, 1974).

8. Cognitive style - is the individual's instructional preference for learning including the processes by which sensory input is transformed, reduced, elaborated, stored, recovered, and used when that person interacts with a specific body of material (Neisser, 1969). It is consistent individual differences in ways of organizing and processing information.

A) Visual-cognitive style - is a conceptualizing process whereby one's world is symbolized or schematized primarily on the basis of the visual input channel (Leeper, 1951; Shouksmith, 1970).

B) Auditory-cognitive style - is a conceptualizing process whereby one's world is symbolized or schematized primarily on the basis of the auditory input channel (Leeper, 1951; Shouksmith, 1970).

9. Comprehension (reading) - is the ability to gain literal and inferential meaning from printed material (Robeck and

Wilson, 1974).

10. Dominant Modality - The dominant modality is that channel through which information is processed most efficiently. It is the sensory channel that allows the child to process information most effectively and efficiently synonymous with learning strength. It identifies the sensory channel through which major learning occurs as measured by the Swassing - Barbe Modality Index (SBMI) (Barbe & Swassing, 1979).

11. Early Adolescent - A person 10 to 14 years of age. The term is considered synonymous with young adolescent and pre-adolescent.

12. Haptic style - involves touching, holding, and grasping.

13. Hearing - refers to the process by which speech sounds in the form of sound waves are received and modified by the ear (Taylor, 1964).

14. Immediate environment - an area of learning style including sound, heat, light, and design (Solberg, 1985).

15. Instructional strategy - a formalized plan for producing learning. It includes both the decisions, a conception of the plan and the actions representing its execution (de Tornyay, 1971). It is a mode of content manipulation. In this study, this term may also be called a teaching or learning strategy. The use of visual media is an example of

an instructional strategy.

16. Kinesthetic learner - a person who prefers learning by doing or being physically involved in real-life experiences (Powell, 1987).

17. Kinesthetic preference - a standard score of 60 or above on the LSI in the area of Kinesthetic indicates kinesthetic preference (Powell, 1987).

18. Kinesthetic style - involves body movement.

19. Learning styles - Style is here defined as a natural tendency that is neurologically predisposed in how a person receives and processes information (reconstruction of reality). Consensus of opinion achieved so far is, that learning style is a blend of both biological design or predisposition and environmental development or acquisition. It refers to consistent individual differences in ways of organizing and processing information and experience, "conceptualized as stable attitudes, preferences, or habitual strategies determining a person's typical mode of perceiving, remembering, thinking and problem solving." (Messick, 1976, pp. 4-5). It is the manner in which several elements affect a person's ability to absorb and retain new information, values, facts or concepts (Dunn & Dunn, 1978; Dunn, R., 1983). The term is synonymous with teaching style. It is the range of instructional strategies through

which students typically pursue the act of learning (Solberg, 1985). It is the way/tendency learners are better able to concentrate.

20. Learning Style Inventory (LSI) - an instrument designed to assess and identify how individuals in grades 5 through 12 prefer to learn (Dunn, Dunn, & Price, 1981). It is a self-report questionnaire yielding information about how a given student learns. There are 36 subscales covering 18 elements in four areas: environmental, emotional, sociological and physical.

21. Listening - refers to the process of becoming aware of sound sequences. In listening to speech, the person first identifies the component sounds and then recognizes sound sequences as known words through auditory analysis, mental organization and/or association of meaning (Taylor, 1964).

22. Matching - having students examine their own needs and goals and provide teaching styles based on their stated preference (Smith, 1983).

23. Memory - Memory is the cognitive process of preserving information for use now or in the future. The three basic memory processes are: a) Acquisition - the process of perceiving information, encoding it, and registering it in memory; b) Retention - the process of

maintaining information in storage; c) Retrieval - the process by which we get information from storage and bring it back into awareness. Memory is the retention of the data so processed and learned - incorporated into the existing body of knowledge. Klatzky (1975) defines it as the process of matching incoming sensory information with previously stored information. It is the means by which the perceived data are retained or stored, and retrieved.

24. Middle School Curriculum - The approach to the instruction of 10-14-year old students (usually in grades 6, 7, & 8), which meets their unique physical, intellectual, social and emotional needs.

25. Mixed Modality (Preference) - This modality occurs when no single modality is clearly dominant. Children with mixed modalities are able to process information in two or three modalities, with equal efficiency. Learners can benefit from lessons adapted in all the three modalities (visual, auditory, & tactual/kinesthetic). It refers to use of multiple modes (multisensory approach) as measured by the SBMI (Barbe & Swassing, 1979).

26. Mnemonics - learned strategies for organizing (creating connections or associations between separate items) and encoding information with the sole purpose of making it more memorable (Bellezza, 1981). It is the use of those

techniques available for assisting or intended to assist memory for new words being learned (Bower, 1970).

27. Modality - A modality is any of the sensory channels (i.e., auditory, visual, tactile, and kinesthetic) through which an individual receives and retains information. The critical components of this definition, "receives" and "retains," imply that sensation, perception, and memory constitute what we call modality. "Because these three processes are the essence of learning itself, the modalities can be called the keys to learning" (Swassing & Barbe, 1979). They are closely related phenomena.

28. Modality-based Instruction (MBI) - This is an instruction which is organized around one or more of the channels through which people receive and retain information in a meaningful whole (Barbe Swassing, 1979).

It is a method of instruction organized and presented to meet the individual needs of students (Simmons, 1986).

29. Modality preference - the identification of the learners's differences in ability to receive and learn new information through various sensory channels such as auditory, visual, tactile and kinesthetic (Powell, 1987). Preference is an immediate/intuitive personal feeling or reaction to the method or process of learning.

30. Modality Strength - When preference is a perceptually-based selective response to incoming stimuli, it becomes strength, although this result occurs mostly after treating the identified profile. The LSI initially identifies preference(s) which the intervening treatment(s) develop into a strength by means of pre-and-post treatment tests. Following this step, when students' perceptual modality preferences consistently correlate with increased academic achievement in matched situations, perceptual modality preference becomes perceptual modality strength, hence a PREFERENCE is a STRENGTH, Coleman, 1988 (Della Valle (1983; Pizzo, 1981; Shea, 1983; and Virostko, 1983). When preference is found to repeat itself consistently a significant number of times in correlation with increased academic scores, it can be understood as a personal tendency of that individual's habitual way of problem-solving. Hence, preference is no longer seen as only one's likes (pleasure) or dislikes (pain) for learning certain ways, and attributes more to one's neurological predisposition or environmental acquisition, based on the modality of ability than interest, in matched situations more often than not, hence -a strength. Modality strength is the ability of an individual to perform an academically relevant task in each of the major modalities. This definition acknowledges the

role of both heredity and the environment in shaping an individual's modality strengths. The educationally relevant modalities that have the greatest utility in the classroom are the visual, auditory, tactual and kinesthetic (Barbe & Swassing, 1979). Throughout this study, then, modality strength will be equated with functioning in each modality in terms of receiving, processing, storing, and retrieving/remembering information most efficiently. Modality as a preference will be studied as a self-report, while modality as a strength will be studied as a measurable behavior.

31. Perception - "Perception is an ... inferred process that intervenes between the measurable stimulus conditions and the measurable overt response" (Swassing & Barbe, 1979, p.1). Perception is when some meaning is ascribed to a sensation. It is the means by which sensations can be organized in a useful manner. It is the art of forming mental images. Perception is the awareness of elements of the environment through physical sensation. It is the process of becoming aware through use of the senses.

"Perception, then, is the process through which we become aware of our environment by organizing and interpreting the evidence of the senses." (Kagan & Haveman, 1968, p.154). Perception begins with elementary sensory processes which

are supplemented by other mediating processes (Gibson, 1969).

32. Perceptual elements - auditory, visual, tactile, and kinesthetic elements.

33. Perceptual Modality Preference - Perceptual modality preference operates on the premise that each individual is neurologically programmed early in life to learn most efficiently in certain ways. In this view, perceptual strengths are identified in the pattern of internalization of an individual's native language. The perceptual response subscales measure the tendency of an individual to react to a series of words (representing various concepts and objects) in terms of visual, auditory, kinesthetic or tactile modalities. A higher score on each subscale indicates a greater initial preference for that response (Keefe & Monk, 1988). Perceptual modality preference is then the approach an individual learner uses in gathering information and knowledge through the visual, aural, tactual and kinesthetic senses.

Perceptual Modality Preference Raw Scores - is the number of correct responses each subject made in all four modalities. This number will be analyzed as to its relationship to the academic achievement variables; i.e., reading comprehension and math concept.

34. Physical needs - an area of learning style including perceptual preferences, time of day, food intake and mobility.

35. Reading - is, according to Robeck & Wilson, the process of translating signs and symbols into meanings and incorporating the new meanings into (understanding) existing cognitive and affective systems (Robeck and Wilson, 1974).

36. Secondary Modality - The secondary modality is one upon which we can rely when the situation demands it. Secondary modality is important because it is not always possible to capitalize upon a child's dominant modality. It is not so efficient as its counterpart dominant modality, but it complements/enhances a dominant modality.

37. Sensation - Sensation corresponds to the reception of the stimulus condition. The senses provide the raw material for perception and memory. A sensation occurs when an object or energy source from the environment impinges upon an individual. Sensation is the purest interaction between an individual and the environment (Barbe & Swassing, 1979).

38. Sensory Modality - refers to "...a system for interacting with environment through one of the basic senses: sight (visual), hearing (auditory), or touch (kinesthetic)..." (Dembo, 1977, p. 61).

The term is considered synonymous with perceptual modality.

39. Sensory Modality - Auditory: refers to receiving "...meaning from the sound of the word without any visualization..." (Reinert, 1976, p. 161).
40. Sensory Modality - Kinesthetic: refers to having "...a feeling ...reaction, either emotional or physical." (Reinert, 1976, p. 161).
41. Sensory Modality - Vision: refers to " 1)...a mental image of an object or activity, 2)... a mental image of the word spelled out..." (Reinert, 1976, p. 161).
42. Tactile learner - a person who prefers learning by touching (manipulating).
43. Tactile preference - a standard score of 60 or above on the LSI in the area of tactile indicates tactile preference.
44. Tactual/Kinesthetic - When we refer to tactual/kinesthetic modality, we are including the involvement of large muscle movements, small muscle movements and the sense of touch in learning situations. It refers to the sense of touch and movement, as measured by the SBMI (Barbe and Swassing, 1979).
45. Visual image - a visual image is defined by Fleming (1977): Perception is "the art of forming mental images.

Images are internal representations of external objects. Pictures become images when they are stored and retrieved (internally generated) by the mind" (p.44). A visual image is defined as a stored internal pictorial representation presumably retrieved during recall when the external visual stimuli is no longer present. The image here is presumed to be an isomorphism of the externally presented illustration.

46. Visual learner - a person who prefers learning by seeing and observing.

47. Visual memory - the ability to remember the configuration, location and orientation of figural material through vision (French, Ekstrom and Price, 1975, 1976).

48. Visual perception - refers to the reception of information through vision as measured by the SBMI (Barbe & Swassing, 1979).

49. Visual preference - a standard score of 60 or above on the LSI in the area of visual indicates visual preference.

50. Visual style - involves seeing pictures, images, objects and activities.

Assumptions of the Study

The study was based on the following assumptions:

1. Learning styles are a major factor within the process of education.
2. Neurological instruments can measure brain behavior relationships.
3. Information processing strategies can be understood.
4. Compatibility between teaching strategies and learning style of the student should lead to greater mathematical concept and reading comprehension achievement.
5. Students in grades six, seven and eight can identify their own learning styles.
6. Not all students have the same preference for a particular perceptual element.
7. Student learning style at the age level examined would remain stable throughout the period of study.
8. Students' learning styles could be accommodated by matching with the styles of teaching strategies.
9. Students use different modes of learning which are sensory in nature and that they can be measured.
10. Student achievement scores represent student achievement.
11. This study assumes the validity and reliability of the standardized instrument used.

12. Academic performance of students could be affected by matching or mismatching teaching methods to their perceptually preferred mode of learning a new and/or difficult information.

13. Congruency of teaching method to cognitive style is a significant variable in education.

14. Individuals differ in their styles of thinking and modes of expression.

15. These differences have important consequences for ways in which individuals learn and perform.

Delimitations of the Study

1. The study is delimited by the investigator to grades six, seven and eight in four schools in the Stafford County, Virginia Middle Schools.

2. The findings and conclusions of this study can be generalized only to school children similar/comparable to those represented in the sample.

3. Of the 22 style elements reported by Dunn, Dunn and Price (1981) only the perceptual elements of auditory, visual and tactual/kinesthetic are investigated. The remaining learning style elements are not germane to the problem.

Limitations of the Study

1. The Learning Style Inventory is administered for only the physical/physiological needs category of visual, auditory and tactual/kinesthetic perceptual modalities.
2. The results of the study cannot be generalized beyond the population examined.
3. The study is limited to the data resulting from the use of tests specified in the instrumentation section.
4. The study data collection inventory will be completed by 300 predominantly white students from grades six, seven and eight.
5. When the study inventory is administered, it is possible that modality-specific interference(s) occurs at the time of completion (e.g. intermodality response imagery competition, etc.).
6. Parent education background and socio-economic information were not available for this study.
7. This study is limited to the following five variables: perceptual modality preferences, Math concept, Reading comprehension, sex and age of sixth, seventh and eighth grade students.
8. This study does not explore other factors related to learning modalities or academic achievement.

9. This study is limited to the characteristics of the participating students.

CHAPTER II

REVIEW OF LITERATURE AND RESEARCH

Our understanding of how the human mind works is on the increase due to new research technologies. Research findings from the field of cognitive psychology have helped us to better understand memory and the role it plays in learning, from the time information is received by the sensory receptors until it is stored in the long-term memory or forgotten as unessential.

Perceptual Modality Strengths

Throughout this study "STRENGTH" only means the learner's PREFERENTIAL STRENGTH for learning in a given perceptual modality, which is a mind-mode-method function/relationship, and is NOT meant to be APTITUDE or IQ. This concept of STRENGTH is also known as "HIGH/LOW PREFERENCE" - meaning WEAK/STRONG PREFERENCE, or POSITIVE/NEGATIVE STIMULI-RESPONSE for learning. When asked why she calls students' PREFERENCES their STRENGTHS, in the October 1990 Educational Leadership, Professor Rita Dunn answers as follows: " Because many researchers have

repeatedly documented that, when students are taught with approaches that match their preferences as identified by the Learning Style Inventory (LSI) (Dunn, Dunn, and Price 1975, 1979, 1981, 1985, 1989), they demonstrate statistically higher achievement and attitude test scores - even on standardized tests - than when they are taught with approaches that mismatch their preferences. If learning through your preference consistently produces significantly better test scores and grades, then your preference is your strength." She further stated that in multiple (more than 50%) experimental studies where the LSI identified students' preferences and they then were taught through their preferences, students achieved statistically higher test scores through their preferences than when they were taught through their non-preferences. Therefore, their preference was their strength.

This chapter discusses research related to cognitive approaches to teaching styles, learning styles and student achievement. Learning style cuts across content and skill areas and is concerned with HOW to learn (Cornett, 1983).

The primary purpose of this study is to determine whether the visual, auditory, and tactual/kinesthetic scores of students in grades six, seven and eight, identified as visual, auditory, and tactual/kinesthetic, are significantly

related to their academic achievement in math concepts and reading comprehension, based on the Iowa Test of Basic Skills (ITBS) scores. The secondary purpose is to determine whether there are grade and gender differences among the modality groups, with respect to modality strengths and relationships.

The study purpose is based on the theoretical assumption that since a person's perceptual style is a typical mode of individual problem solving strategy, hence the study inquires into the extent to which such problem solving strategies of individuals do facilitate/predict change in academic achievement. As such it is an investigation of the relationship between an individual's sensory input processes or learning modalities and achievement scores.

A broad overview of the current literature involving cognitive style and learning modality as they relate to performance is included in the present chapter. In the following chapter, the methodology and procedures for conducting the investigation of whether or not a relationship between learning modality and achievement exists will be described.

Perceptual Modalities

Barbe and Swassing (1979) define a learning modality as "any of the sensory channels through which an individual receives and retains information". According to the authors, the critical component of this definition is the phrase "receives and retains," since it implies that sensation, perception and memory constitute what is known as modality. Because these three processes are the essence of learning itself, Barbe and Swassing call the modalities "keys to learning."

The three modalities (sensory channels) that have the greatest utility in the classroom are visual, auditory and kinesthetic. Children can learn through all three channels because all of them function to a degree during activities of learning, but most children have a single modality strength (or dominant modality). This strength or dominant modality is the sensory channel that allows the child to process information most effectively and efficiently. A secondary modality may be present that complements the dominant modality. Some children have no single modality strength. Instead they have mixed modalities and are therefore more likely to succeed in school because of their ability to transfer information from one modality to another (Barbe & Swassing, 1979). Dunn and Carbo (1981) observed

that teachers seemed to prefer the mixed modality students because the ability of these students with intermodality information transfer freed the teachers to utilize their own teaching styles. Children with mixed modalities are said to have developed an integrated modality approach to learning.

Cognitive style is an individual's characteristic manner of responding to diverse cognitive tasks. Learning modalities more specifically provide a direct link to actual perceptual or sensory skill. Learning modality is the ability to receive and process information via specific sensory channels. Perceptual ability implies not only an individual's tendency to use certain channels for acquiring information but also demonstrates the level of proficiency in responding to sensory stimuli.

Cognitive theory portrays learners as those who construct their own meanings dependent on their individual cognitive structure and cognitive style. Emphasis on receiving, perceiving, organizing and storing ideas is paramount in cognitive psychology.

Academic achievement is defined as an individual's school achievement as assessed by the subtests and totals from the Iowa Test of Basic Skills. From the 14 subtests (or achievement variables) for the Iowa Test of Basic Skills, only two achievement variables will be used to

define academic achievement in this study, namely, Reading Comprehension and Math Concept. According to Barbe and Swassing (1979), there are three different views of modality; i.e., modality as a fixed neurological characteristic, modality as a preference, and modality as a measurable behavior.

The fixed neurological view treats modality as a physiological characteristic endowed. In this view modality strength is determined chiefly by hereditary factors, and changes very little between childhood and adulthood. When modality is defined as a fixed neurological characteristic it is equated with sensation only (gatherer of raw information). That is, modality is localized in the pathway between the sensory organ and the brain region where the sensation is processed. Differences in modality strengths between individuals can be attributed to differences in the efficiency of the sensory pathways, and the environment.

While modality strength is readily explained and simply researched, its chief disadvantage is that it ignores the foremost modifier of human behavior, the environment. This perspective of modality, Barbe and Swassing (1979) believe, fails to acknowledge the central role of learning in human development (the use of environment to shape an individual).

Although Barbe and Swassing (1979) so far do not feel that modality strength can be fully explained by approaching it as a fixed neurological characteristic, they do agree that each one of us is predisposed to certain modality feature/factors. With respect to differences in the modality of interest and/or strength, they state that neonates differ within themselves and from other neonates with respect to many features, and that it is reasonable to assume that modality preferences and/or strengths may be among these features.

The basis for describing modality as a preference takes the view that individuals can give a definite answer when asked how they learn best and like to learn -- by seeing, hearing, or doing. Preference does exist, and is valid in that it is based upon extensive personal experience (the pain and pleasure of learning). Barbe and Swassing (1979) state the following, regarding modality as a preference:

On the other hand preference is not very reliable since most individuals are not trained observers of their own behavior. Their judgement will be inconsistent, and will reflect the immediate situation rather than long standing behavior (p.4).

Barbe and Swassing (1979) proposed a definition that acknowledged the role of both heredity and the environment in shaping an individual's modality strengths. The concept of modality as a measurable behavior presented here in Barbe and Swassing's view, aims at being comprehensive and functional. It considers all the links of the chain between a sensation and the individual's resultant behavior, and defines modality strength operationally as the ability of an individual to perform an academically relevant task in each of the main modalities.

Throughout this study, then, modality strength will be equated with functioning in each modality, based on the concept of perceptually-based preference, as summarized in the LSI. It can also be described as "strong perceptual preferences" in one or more of the three perceptual modality elements. The definition of modality to which this study subscribes is thus a broad one that comprises sensation, perception, and memory.

As individuals mature, their modalities become mixed and interdependent, thus achieving mixed modality strength by adulthood.

Carbo (1980) found statistically significant results when reading treatments were matched to children's modality strengths.

Historical Background

Educators and school psychologists have just begun in the last decade to fully utilize the valuable contributions that neuropsychology has made to help us understand and to improve our knowledge of the learning process (Obrzut & Obrzut, 1982). Neuropsychological analysis of the central processing system offers a potentially more efficient approach to the study of learning styles, disorders, and information processing than the traditional descriptive methods (Gaddes, 1981). Explanation of the brain-behavior relationship in children will help educators and school psychologists provide learning experiences to maximally develop abilities of all children (Hynd & Obrzut, 1981).

The learning style concept was first developed in the field of psychology to depict observable behaviors. It came into use when researchers began to look for specific strategies for combining course presentation and materials to match the particular needs of each learner (Kirby, 1979).

During the 1960's "learning styles," as a term, came into use by researchers. Riessman (1964) identified the styles of learning as "the idiosyncratic style elements in the learning process." He reported elements of learning style that included visual or auditory, temperature, a single mode or a flexible use of several modes, preference

for pressure or plenty of time for learning, need for mobility and the necessity for few or many breaks during learning. Since the 1960's the term has been expanded and refined.

In primitive education the emphasis was different than it is today. In primitive times the focus was on survival; today the focus is on the development of human life through enriched curricula, over his material environment (Eby & Arrowood, 1940). Nevertheless, the primary objective of education remains the same, i.e., the enlightenment of man through imparted knowledge and developed skills.

Eby and Arrowood (1940) suggest that there were three ways in which primitive children learned. They observed life, they shared in work, and they received instruction in the important beliefs. The methods used were story telling, demonstration, and participation in the activities of survival. The kinesthetic approach was very important. Children were encouraged to learn by the trial and error method, the method of experience.

Primitive peoples permitted their children to handle hot objects and sharp implements in order that they might learn the consequence. It is probably safe to say that the kinesthetic mode was emphasized more in primitive times than it is today, and that this, in fact, was the modality of

preference for instructing the young.

Among researchers reporting on perception were Wundt (Mayer, 1981), Montessori (1912), Orton (1937), and Barbe & Swassing (1979). Itard, Seguin, and Montessori (Montessori, 1912) initiated educational practices designed to assist individuals who were handicapped. Perceptual preference research was reported by many researchers including Ringler and Smith (1973) and Barbe and Swassing (1979). Barbe and Swassing (1979) found that the auditory mode was preferred by more primary level students while the visual mode was preferred by older elementary students. The authors concluded that younger children preferred listening activities while more adults utilized mixed modalities.

Achievement and perceptual modality correlational research has been reported extensively since the 1950's. Reports of significance relationships between the two variables were made by many researchers, among which are Bateman (1968), Birch and Belmont (1965), and Carbo (1983).

Educators should base instructional plans on knowledge of student perceptual strengths and weaknesses.

In early 20th century, Maria Montessori (1912) described her work with mentally handicapped and impoverished children. In educating the senses, Montessori provided kinesthetic and tactile activities before beginning

verbal instruction. Her structured method provided the practical experiences needed by these children. Orton (1963) concentrated on the stronger perceptual modalities for children who experienced learning difficulties. The combination of the visual, auditory, tactile, and kinesthetic procedures were beneficial for students she taught. Visual-motor skill training was recommended by Strauss and Lehtinin (1957) and Kephart (1960).

Keefe (1979), in discussing the value of matching instruction to the student's learning style, suggests that learning style diagnosis places individualized instruction on a more rational basis. Price (Dunn, Dunn & Price, 1977) suggested that teaching methods in the 1980's should be different from strategies used in the past, and concluded that students should be placed in programs that enhance their most effective learning style. There is a need for teachers to recognize individual needs of children and be aware of individual learning styles of students as a part of needs assessment and curricular planning.

Individual differences in perceptual and cognitive abilities affect school achievement. In recent years, the trend toward individualized instruction has made instructors much more aware of individual learning situations.

Current research investigating perceptual and cognitive

variables is oriented toward determining how children receive and process information and if significant differences exist among academic achievement, sex and age, as they relate to information processing.

Individual differences in basic skills and achievement are a major thrust of current research.

Individual Differences

Children differ basically in their cognitive styles. Their learning behavior often reflects a cognitive style of one kind or another. Cognitive styles are the activities of learning, which are ways of perceiving, organizing, and remembering information.

The problem of individual differences in learning affects both the classroom instruction and the field research. This problem is created by students' individual needs in learning situations. In a study entitled "Individual Differences In Learning: Predicting One's More Effective Learning Modality," by Beatrice J. Farr (1970), Glaser asserted "The investigation of individual differences in the study of learning and the incorporation of individual difference parameters in learning theory is an unavoidable assignment for increasing relevance to instructional practice" (1968, p. 5).

Ignoring the direction and magnitude of individual differences involves risks for the educator and researcher alike. The researcher is in danger of developing an inaccurate and unrealistic theory of learning, while the educator may be forced to teach to the average group characteristics, which probably do not adequately reflect the requirements for any given student, according to Farr (1970). She further states that with classes often composed of students representing varying learning patterns, the temptation is to try for some middle ground, for if special attention is given to one group, it will have to be at the expense of others, almost invariably. Therefore, teaching methods are often chosen without regard for the individual differences of students.

With reference to individual differences in learning (as a pluralistic approach to instruction), Manuel Ramirez III of the University of Texas (1974), believed that the mental and behavioral strategies vary from child to child when they are learning new concepts or skills. Some children like to try new tasks (experiment) on their own; others prefer to watch someone else do the task or to be shown explicit steps before using that guidance in mastering concepts or skills themselves; others find learning easier if they have a visual representation or can touch or

manipulate objects; while yet others like to be given information verbally.

Most research on the development of individual differences in learning style indicates that socialization practices play a large role in determining learning behavior preferences in children (Ramirez, 1974). This means that the teaching styles of family members (e.g. motivation, experimentation, listening, etc.); the types of learning behaviors encouraged in families and the ways in which these behaviors are encouraged seem to contribute to the development of preferred learning behaviors in children. Therefore, the predominant teaching style of a family may be of basic importance, in deciding the direction a child's learning preferences may take.

In sum, the many differences that children show in learning behaviors reflect aspects of cognitive style and are critical in understanding how children learn best. It is further indicated that researchers who have examined many models of cognitive styles, focusing on various aspects of perception and organization of information, conclude that children's cognitive styles are influenced by the ways their families socialize them.

Therefore, the most important educational challenge of our time is to recognize and respect individual differences

in learning styles, because these differences reflect the diversity of contemporary society, in which case the school should follow and reflect more than lead and create.

Despite their manifold individual differences, the children are all the same in their human nature.

Their sameness as human beings - as members of the same species - means that every child has all the distinguishing properties common to all members of the species. They all have the same inherited tendencies, powers, and capacities, but in differing degrees. The fact that individuals possess these common traits to different degrees is itself proof that they share a common nature at the same time that they differ in the many ways that make each a unique individual. Thus, individual differences are always and only differences in degrees, never in kind.

These are the facts of sameness that justify the sameness of the objectives at which our program for schooling should aim, the facts that justify requiring the same course of study for all and satisfactory standards of accomplishment for all.

What, then, must be done to temper the same to the different, in order to make up for or cope with individual differences? The answer lies in adjusting that program to individual differences by administering (presenting) it

sensitively and flexibly in ways that are in accord with whatever difference must be taken into account, so the children can make the most of themselves as well as possible. The way to match one and the same curriculum with learners of diverse characteristics is to find some way of equalizing the existing differences which stand up as impediments to the success of a uniform curriculum planned for the different.

Once again, there is no uneducable or unteachable child, or irremediable deficiencies which block the attainment of the same educational goals for all. There are only children that we fail to teach in a way that befits their individual conditions (appropriate mode of instruction). Schools or school programs, therefore, should make the best of the sameness that underlie the differences.

The concept of perceptual modality strength is based on the theory that when students' preferences consistently correlate with students' increased academic achievement in matched situations, a preference is not just the modality of interest but a modality-based preference, hence, a strength, Coleman, 1988 (Della Valle, 1983; Pizzo, 1981; Shea, 1983; and Virostko, 1983).

While the concept of modality strength is an attribute of the entire continuum of learning profile, it should be

qualified as "high", "average", and "low" perceptual strengths corresponding to primary (dominant), secondary, and tertiary modalities. This is based on the fact that individual differences in the preference of learning modalities are differences by degree - a continuous, rather discrete phenomenon. All individuals, with varied strengths, can learn through all the three perceptual modalities, and it is not that some individuals can learn through only one or two modalities; or have only preferences (immediate reaction) while others have strengths (perceptually-based preferences) in one or more of the modalities. Thus, the concept of perceptual strength is a continuous one rather than a fixed characteristic in all the three modalities of learning, intermodally, interpersonally and intrapersonally.

The Age-Sex-Learning Style Relationship

The effect of the interaction among sex, age and learning style could have relevance for classroom application of learning style ideas. Research demonstrating that girls progress along the perceptual continuum faster than boys (from kinesthetic toward visual and, eventually toward auditory preferences), has been substantiated by Restak (1979). Evidence that many behavior differences in

brain functioning are biologically inherent and unlikely to be modified by cultural factors alone has been discovered. From birth, female infants are more sensitive to sounds; their enhanced learning performance persists throughout life and they experience decreased hearing ability much later than males. Girls speak sooner, have larger vocabularies, sing in tune at an earlier age, exceed boys in language abilities, read sooner, learn foreign languages more easily, and are likely to enter occupations involving language mastery. In addition fewer girls than boys demonstrate speech defects; for example, stuttering occurs almost exclusively among boys. In contrast, boys excel in kinesthetic activities that require total body coordination.

Although we know that all girls and boys do not mature at the same rate perceptually, Restak's data suggest that more girls than boys can learn to read through a phonics approach, and that more boys than girls require tactile/kinesthetic resources in combination with a word recognition approach to learn how to read easily.

Price, et. al., (1976, 1977) in their research on the Learning Styles Inventory (LSI) revealed that the higher the grade level the less males preferred to learn through the tactile/kinesthetic modalities. Females in the upper grades expressed a greater preference for learning through auditory

senses than did females in the lower grades. This may be due to how schools reinforce learning by teaching mainly through auditory senses. Therefore, individuals, in traditional instructional environments, gradually learn the best way to get along is to learn through the auditory sense. The higher the grade, the less females preferred to learn through tactile/kinesthetic modality; but this seems to decrease the higher the grade. This may be the result of maturation or may be due to the fact that this modality is not commonly used and reinforced in the learning environment.

Price, et. al., (1976, 1977) listed the statistically significant results within grade levels. Females preferred learning through the auditory sense in grades 6, 10, and 12. Males preferred learning through visual sense in grades 6 and 11 and preferred learning using the tactile/kinesthetic senses in grades 5, 6, and 8.

Modality Preferences

In studies by Rita and Kenneth Dunn (1978) the term modality preference refers to the way in which (sensory channels through which) students like to learn. This may or may not be related to modality strength. The Dunns developed and experimented with a series of questions

designed to elicit student's likes and dislikes for learning style elements. Eighteen elements were identified one of which was perception (visual, auditory, kinesthetic or tactile). For five years the instrument was tested and revised using students from seven school districts in Nassau County, New York, and the Board of Cooperative Educational Services in that county. Finally, in 1974 Gary E. Price conducted a content analysis of each of the questionnaire items and isolated those that achieved 90 % consistency or better. A shortened form of the Learning Style Inventory (Dunn, et. al., 1978) was completed and reliability, face, and construct validity were achieved. The Dunns report:

- (1) students can identify their own learning styles;
- (2) when exposed to teaching style consonant with the ways they believe they learn, students score higher on tests, fact knowledge, attitude, and efficiency than do those taught in a manner dissonant with their style; and,
- (3) it is advantageous to teach and test students in their preferred modalities (Dunn & Dunn, 1978, PP. 4-5).

The Dunns cited studies by Farr (1971) and Domino (1970) as evidence of this research. The Dunns believed that students

do know how they learn. In many cases this knowledge would correlate with assessments of modality strength, but in designing classroom procedures teachers must make the distinction between strength (perceptually-based preference) and mere preference before designing strategies (Barbe & Swassing, 1979). For the purpose of assessing modality strengths, the modality preference(s) scales of visual, auditory and tactual/kinesthetic modalities, as studied in this research, are explained as follows:-

1. Visual preferences:

A learner whose primary perceptual strength is visual can recall what has been read or observed; such people, where asked for information from printed or diagrammatic material often can close their eyes and visually recall what they have read or seen earlier.

2. Auditory preferences:

This perceptual area describes people who can learn best when initially listening to a verbal instruction such as a lecture, discussion, or recording.

3. Tactual preferences:

Students with tactile perceptual strengths need to underline as they read, take notes when they listen, and keep their hands busy - particularly if they also have low auditory ability.

4. Kinesthetic preferences:

Learners with kinesthetic preferences require whole-body movement and/or real-life experiences to absorb and retain material to be learned. Such people learn most easily when they are totally involved. Acting, puppetry, and drama are excellent examples of kinesthetic learning; others include building, designing, visiting, interviewing, and playing.

Determiners of Learning Styles

The following information is substantiated by Claudia E. Cornett's pamphlet - What You Should Know About Teaching and Learning Styles. Learning style may be viewed as a combination of nature and nurture in that it is not static, as change occurs with age and experience. Cognitive style tends to become more abstract and field independent. However, this phenomena is confined to technical societies. Manuel Ramires and Alfredo Casteneda (1974) specifically found that culture is a determiner of developmental phases, and that American Indian and Mexican American children educated in their own culture tend to become more field dependent (Cornett, 1983).

Jean Piaget and Lawrence Kohlberg identified discrete stages of cognitive development that are influenced by

"immediate others." Piaget was more concerned with how the mind works than what it does (Cornett, 1983) and the influence of internal and external factors.

Learning style changes throughout life, either through assimilation and accommodation or as Patricia Kirby (Cornett, 1983) distinguishes, through the developmental variation of interstyle and intrastyle differences.

The means of influencing style changes in students may be achieved through modeling of styles by teachers, asking appropriate questions, and creating the appropriate level of dissonance (Kohlberg, 1975). Therefore, one may say that the determiners of learning style are internally based (maturation), externally based (modeling) and both externally and internally based (dissonance).

Learning Styles and Instruction

If we begin with the fact that most teachers verify that some methods work well with certain students but not with others and that they also attest to the individual differences among youngsters, then we can begin to explore how those differences may (or may not) respond to alternative methods (Price, Dunn, Sanders, 1981).

Cornett (1983) stresses that when a student is taught "learning-to-learn," which is adjusting learning style to teaching style and task, he can then transfer this ability to all learning situations and become progressively less dependent on the teacher. This adjustment of learning style is termed style "flexing." One can discern that the way a teacher structures his/her classroom facilitates opportunities for utilizing learning style preferences for learning alone, with peers or small groups, or teacher directed (Monroe, 1983).

What teachers do and HOW they do it relates to style. Monroe (1983) states that the weaving of these two aspects of the teaching-learning process into meaningful instruction is essential if the end goal of the teaching process is to make a positive difference in student achievement.

Learning style refers to the method of introducing material and places emphasis on learner strengths. Carroll (1963) defined quality instruction as the degree to which presentation, explanation and ordering of elements matches learner need. The "links" Monroe (1983) states of teacher behavior and learning style, are vital to successful instruction; coupled, they provide a bond essential in the learning process. The single emergent pattern impacting instructional programs over which teachers have complete

control is his or her own behavior.

Teachers must be involved in ongoing evaluations of their instructional approaches suggests Smith (1983) in her study involving L.D. students, because these students' progress depends upon how they interact with what is taught and how it is taught -- teaching style. Learning progress can be maximized when the classroom tasks are well-matched to what the child is ready to learn and how the child prefers to approach learning (Smith,1983).

It has been said by Hunt (1981), Dunn (1981), Gregorc (1982) and others that discovering the learning style of each student can very well serve as a catalyst in assisting teachers to effectively respond to specific learner characteristics.

While the terms "cognitive style" and "learning style" are often used interchangeably, it is important to clarify their differences in their use. Generally speaking, cognitive style according to Messick (1976) is:

- (1) as personal characteristics that may interact with treatment variables to moderate learning, retention and
- (2) as dispositions to be monitored to detect many possible undesirable side effect of instruction,

(3) as qualities to be fostered either directly as specific objectives of the instructional program or indirectly as byproducts of other efforts. (P. 147).

According to Kogan (1971):

Cognitive styles can be most directly defined as individual variations in modes of perceiving modes of perceiving, remembering, and thinking or as distinctive ways of apprehending, storing, transforming and utilizing information. It may be noted that abilities, also involve the foregoing properties, but a difference should be noted: Abilities concern levels of skill--the more or less of performance -- whereas cognitive styles give greater weight to the manner and form of cognition (p.25).

While there is a distinct relationship between the definitions of "cognitive style" and the definitions offered of "learning style," there is a technical difference even though it is generally not made, and beyond the scope of this study.

Cognitive Style

Learning styles researchers take cognitive style into consideration (as a subset of perception), so a section on cognitive style is included in this review of the literature.

Cognitive psychology deals with processes of knowing and understanding the world - with attribution of meaning. It is concerned with mental processes, with the organization of knowledge in the mind, in ways which make understanding, perceiving, encoding, recoding or elaborating information possible.

Withins (Keefe, 1979) described how an individual's perception of the learning environment falls along a continuum ranging from field independent to field dependent. Field independents are generally analytic and systematic while field dependents tend to be holistic or global.

According to Gardner and associates (Keefe, 1979), the learner who is sensitive to distraction while receiving information possesses a constricted receptive style. Another receiver style is known as the flexible style which identifies individuals who stay on task. The third factor in information reception is the individual's tolerance for incongruous or unrealistic learning environments.

Cognitive styles were described by Gregorc (1979) as distinctive, observable behavior which contribute evidence to the functioning of the mind. In 1971, Hill reported that cognitive style is the unique way in which an individual researches for meaning. Hunt (1971) examined learning styles in terms of educational conditions under which students most likely would learn. He believed in matching educational strategies to student learning styles.

Cognitive style has been defined as the "activity of knowing" (Neisser, 1976). Human beings seek to organize the relationships between ongoing experience and whatever information they have already stored (Bruner, 1963). A person's internal structures are adapted to fit an increasingly logical viewing of the world (Piaget, 1970; Robeck and Wilson, 1974).

Evidence suggests that cognitive operations appear prior to birth and develop through adulthood (Inhelder and Piaget, 1958; Goldman, 1965; Jackson, 1965). The characteristic approach a person brings to a wide range of situations is one's " 'style' -- and because the approach encompasses both his perceptual and intellectual activities --- we speak of it as his ' cognitive style' " (Witkin, 1966).

Sensation and perception act as on-going activities, and cognition "pertains to sensations and data already received and perceived" (Lerner, 1976). The organism perceives the surrounding environment (attention), translates it into a language for communication (auditory and/or visual cognitive style), encodes that language to provide meaning (pattern recognition), and stored that language-symbol for later use (memory).

Reading comprehension influences learning. As a common denominator to school learning, reading comprehension is likely to be a generalized cognitive entry behavior which is essential to the school curriculum (Bloom, 1976). Both auditory and visual cognitive styles do affect achievement in reading. Differences in perception and cognition account for variation in individual performance. These variations in taking in and processing information have been defined as cognitive styles. Cognitive styles can be defined as the perceptual and conceptual modes of approaching a task or responding to stimuli. Sigel and Brodzinsky (1977) define cognitive style as:

how an individual comes to a task, how his or her environment is organized, and how he or she processes information. It is not intelligence as we commonly know it, nor is it purely personality.

It is the combination of these working together to effectuate a response (p. 324).

According to Forgas and Shulman (1979), perception is a superset of cognition subsuming learning, memory, and thinking. Individuals behave according to their own system of construing.

A cognitive style is a perceptual organization which includes instructions about an individual's self-concept, world view, typical instrumental responses, and ideas. It determines his modes and accuracy of perception, his style of thinking, his goal-directed behavior, his personal belief and myth system, and the focus of his attention (Forgas & Shulman, 1979).

The effects of cognitive style preference were investigated by Roach (1979). Mathematics achievement was found to have a significant positive correlation to analytic/conceptual style. At the two-year college level, Hinton (1980) examined the role of cognitive style and found it to be related to the learning of mathematics.

Described as "psychological differentiation," Witkin, et. al., (1962) defined cognitive style in terms perceptual differentiation ability. Cognitive style was determined by an individual's ability to overcome embedded or misleading visual cues. Those subjects able to overcome

the incongruity of misleading spatial orientation or keep an object isolated from compelling background forces were declared field independent. Conversely, the field dependent subjects had difficulty distinguishing geometric figures from surrounding context or adjusting a rod to a true vertical position when provided with misleading visual or spatial cues. Field dependent subjects relied on external referents as guides in information processing, while field independent subjects gave greater credence to internal controls (Witkin et al., 1977). Perception is the awareness of elements of the environment through physical sensation. It is the process of becoming aware through use of the senses. "Perception, then, is the process through which we become aware of our environment by organizing and interpreting the evidence of our senses" (Kagan & Haveman, 1968, p.154). Hartlage (1975) assessed relationships of five perceptual skill areas to reading achievement and found differential age correlates of reading ability. The magnitude of the correlations decreased with age.

Miller and McKenne (1981) investigated multiple relationships among reading achievement, intellectual, and perceptual capacities at differing ages and found perceptual abilities related more strongly to reading achievement for younger subjects while intelligence related more strongly

for older students.

Haptic performance or the sense of touch as it relates to first-grade reading achievement was investigated by Gurucharri (1973) and results indicated that haptic abilities were significantly related to reading achievement.

Cognitive Approach to Instruction and Learning

The cognitive approach to instruction emphasizes the interactions between the learners' cognitive processes and the characteristics of instructional treatments. According to Wittrock (1978):

Understanding involves the cognitive processes and structures of the learner. Comprehension occurs when the learners use their semantic processes to construct meaning for stimuli by relating them to abstract and distinct memories (p. 25).

Instruction, therefore, should enable the learner to relate previous learning schemata to incoming information.

The cognitive approach to instruction considers learning to be more than an automatic response to the sensory qualities of the learner's environment. People learn in a variety of ways. People learn by observing, viewing television, participating in discussions, and by listening. According to Wittrock (1978) learning involves

the construction of the learner's own unique reality.

Instruction is a matter of stimulating relationships between the stimuli and stored memories by inducing verbal or imaginal elaborations. Wittrock (1978) suggests that verbal elaborations may be stimulated by holding discussions, constructing summaries or topic sentences, recalling previous experiences, and constructing inferences. Drawing pictures and viewing illustrations and diagrams may be used to induce mental images involving memories of experience and new information.

A cognitive view of learning examines some important assumptions about the process of learning. First, a person brings his/her own knowledge to a learning situation. According to Di Vesta (1974) a knowledge system consists of intellectual skills and conceptual or symbolic knowledge, self-knowledge, and knowledge about one's interactions with others. The learner's developmental stage determines whether this knowledge system is organized as activities, images, concepts, or symbolic systems.

Fully developed knowledge systems are characteristic of a prepared mind, or a mind set to assimilate information, and to create new knowledge (Di vesta, 1974, p.360).

A second assumption examined by a cognitive approach to learning is that learners are selective about the information they process. Selection of information is dependent upon the learner's level of cognitive development and processing strategies aimed at the facilitation of learning.

Finally, a cognitive approach assumes that learners transform the information they receive (Di Vesta, 1974). Learners employ a variety of strategies for reconstructing the information they receive. Comprehension and inferential thinking are among the higher thought processes comprising the strategies used to reconstruct information.

Comprehension and inferential thinking are developmental matters (Piaget, 1952). The relationship between comprehension and language is important when examining the processes used for reconstructing information. According to Di Vesta (1974), comprehension does not necessarily proceed in parallel with language. The use of **language** for processing information is important to **education**. Much of education is based on paraphrase without relating new information to familiar data. Instructional approaches are needed that will accept the proposition that **language** may be used to stimulate thinking and thinking involves the active reconstruction of ideas in terms of the

learner's existing knowledge structures.

An educational psychology of instruction ought to be applied in the sense of answering questions about the nature of human knowledge, the process by which it is acquired, and how knowledge acquisition can be facilitated through instruction (Di vesta, 1974,367).

The cognitive approach to instruction raises the question of whether comprehension can be facilitated by instructional events. The use of advance organizers (Ausubal, 1963) represents one answer to this question. Other answers are offered by experiments based on the use of schema theory (Pithert & Anderson, 1977) as a means of facilitating comprehension and retention.

Philosophers have noted that humans have a tendency to organize and reorganize information into more manageable and more easily recalled "chunks of information."

Descartes suggests that rehearsal or repetition has the very important effect of organizing many separate items into a single unit, thereby reducing the load one's memory must carry and leaving one free for further thinking. Early schema theorists alluded to organizational strategies in learning. In his classic works on the nature of memory, Sir Frederick Bartlett (1932) states:

Every human cognition--perceiving, imagining, remembering, thinking and reasoning ---is an effort after meaning. Remembering is not the re-excitation of innumerable fixed, lifeless, and fragmentary traces. It is an imaginative reconstruction or construction---(when) the need to remember becomes active, an attitude is set up, in the form of sensory images or isolated words; some part of the event is then reconstructed on the basis of the relation of this specific bit of material to the general mass of relevant past experience or reactions, the latter functioning, after the manner of the "schema," as an active organized setting (p. 213).

Contemporary Gestalt learning theorists suggest that organization of incoming information and the integration of that material into a conceptual framework is necessary for learning to occur. Humans perceive and organize incoming information to make sense. They impose their own organization of the information if the organization is not already implicit in the material to be learned, and, furthermore, unless a conceptual framework within which they can integrate new information is already in the memory or is provided with the material, purposeful leaning is not likely

to occur.

Experiments by Tulving (1966) and Tulving and Osler (1968) provide empirical evidence for subjective organization. G.A. Miller's (1956) concept of unitization attempts to explain the relationship between organization and recall. Miller found that immediate memory span imposes a basic limit on what can be recalled, that is, immediate memory span is relatively constant at seven plus or minus two units over a wide range of materials and situations; what varies is the size of the functional unit. For more efficient learning, individual elements can become grouped into larger wholes or higher-order structures called "chunks" that can function as "unitary memorial elements." Items grouped together come to be recalled together as an interassociated cluster. The number of items recalled depends on the degree of organization possible under conditions of a particular experiment and the availability of effective retrieval cues.

In summary, the work of Miller and others, offers a framework within which to examine the effects of organization on learning. This investigator feels that grouping and relating are basic cognitive processes and inevitably affect what is learned and how it is learned. When presented with a large amount of unrelated material,

students who can approach the task with an organizational strategy will learn faster and retain longer.

Organizing Visual Information

Learning theorists disagree about the exact nature and storage of mental imagery. For example, Paivio (1971) argues for a dual-coding theory, suggesting that incoming information may be stored as words or images or both (see "Assumption" in Chapter I). Plyshyn (1973) and Smith and Larson (1970) claim, on the other hand, incoming visual and verbal information is stored in a universal propositional memory structure. That is, the perceived image is analyzed, abstracted, and reduced to descriptive lists of features in a way analogous to lists of data a computer stores; images are then reconstituted from memory lists of such features as color, shape, brightness, etc. The image is therefore closer to being a "description" of the scene rather than a "picture" of it. Craik and Lockart (1972) say the nature of storage is not the issue; the level or depth of processing of information is at the heart of remembering. Anderson (1978) says we may never know how visual information is stored.

Bower (1970a) has suggested that individual differences in learning and academic performance might be attributed to

the use of different learning strategies, i.e., superior students may make more use of mnemonics* than less talented students. Mnemonics are defined as learned strategies for organizing and creating connections or associations between separate items and encoding information with the sole purpose of making it more memorable (Bellezza, 1981). A study by Carlson, Kincaid, Lance and Hodgson (1976) confirms this. They administered a post-questionnaire to a control group (not given any instructions about mnemonics strategies) and found that almost half of the subjects in the control group used one or more self-generated mnemonics and all were effective aids. More importantly, spontaneous use of mnemonics was associated with academic performance; students using spontaneous mnemonics had higher grade point averages than those who did not use it.

Paivio and Desrochers (1981) postulate that "the mnemonic increases the availability of multiple retrieval routes, involving both visual and verbal associations..." They claim the strength of the image-based technique is that it explicitly stresses the idea of mapping a second language onto the learner's existing world knowledge.

Research and Theory On Perceptual Modalities

The concept of modality is a measurable behavior indicating the manner in which information is most efficiently received and processed.

Perceptual elements are auditory, visual, tactile and kinesthetic elements. A person with auditory preference learns by listening and can distinguish between sounds. A person with a visual preference learns by seeing and observing. An individual with tactile preference learns by touching. A kinesthetic preferred learner is one who learns by doing or being physically involved in a real-life experience.

One of the physical elements of learning style is Perceptual Preference. Perceptual preference consists of 4 modalities -- auditory, visual, tactual, & kinesthetic.

Researchers differed in their views about perceptual learning styles. Cornett (1983) suggested that the individual learns by organizing incoming stimuli. Barbe and Swassing (1979) were convinced that auditory perception was preferred by lower elementary levels, while visual and kinesthetic perceptions were preferred by the upper elementary grades. Although the terms perception and learning are used interchangeably in the literature, the two terms are not exactly synonymous.

Blanton (1971) suggested that preferred learning modalities are readily identifiable. In his view the preferred modality for superior learning was auditory. Gasper and Brown (1973) agreed that the auditory mode was preferred by young learners, but latter learning was influenced by visual perceptual skills. Tinker (1969) also found in his review that modality preferences were different for younger and older students.

Carbo (1983) reviewed research dealing with auditory, visual, and kinesthetic perceptual approaches. She concluded that students who preferred the auditory and visual modalities made superior achievement in reading while those whose preferences were kinesthetic made only limited progress. In addition, learning style-teaching style compatibility provided for superior academic growth. Balmuth (1969), Tinker (1969), and Kampwirth and Bates (1978) found no decisive evidence that modality based instruction produces superior achievement. There are various reasons that account for these conflicting findings over the method-mode based school curriculum. Harris (1969) and Tarver and Dawson (1978) enumerated the following reasons for the differing conclusions in perceptual modality-teaching method research:

- (1) Differing combinations of variables were used;

- (2) Different assessment techniques were used;
- (3) Some studies controlled for ability levels but many did not;
- (4) Treatment periods differed;
- (5) Teaching methods were not consistent for all studies;
- (6) Modality preferences vary depending upon the population studied;
- (7) The samples are often small;
- (8) Many instruments lack sufficient reliability (Palacios, 1985, p.14).

Birch and Belmont (1965) investigated achievement for 220 students in grades 1 through 6. Auditory-visual integration and reading achievement were measured. IQ was used as a covariate in the statistical analysis. The maximum growth in auditory-visual integration skills was found for first and second graders, with gradual increases through fifth grade. Approximately 50% of the variance in reading was accounted for by A-V integration, while 83% was accounted for by A-V integration and IQ. The authors concluded that A-V integration and reading achievement correlated strongly for younger students, but IQ was more important for successful reading achievement for older students. In this review of perceptual development,

research variables, objectives, and modalities have been diverse.

The following conclusions were developed from the review of perceptual development research:

1. that children generally mature in recognition, matching, and memory for visual and tactile stimuli by age 4 (Somers and Miller, 1978; Cornin, 1973).
2. that visual and tactile perceptual performance stabilizes for children between 4 and 5 1/2 years (Cornin, 1973).
3. That modality preference varies depending upon the population studied. However, greater numbers of students in the studies preferred auditory or visual modalities rather than kinesthetic or mixed modalities (Palacios, 1985, p.44).

In studies of modality-achievement research, students with superior reading achievement experienced strengths in auditory, visual or auditory visual perceptual skills (Golden, 1967; Bryden, 1972; Pelham, 1979; Lindgrev & Richman, 1984; Sabatino & Streissguth, 1972).

The effects of perceptual modality and teaching method compatibility have been studied extensively (Arter and

Jenkins, 1977). Barbe and Swassing (1979), Kampwirth and Bates (1980), and Barbe and Milone (1981) reported that mode-method compatibility produced superior achievement scores for students. Wepman and Morency (1975), Dunn, Dunn, and Price (1981), and Carbo (1983) concluded that students do in fact perform better when learning modalities match style of instruction or procedures used.

Consensus of opinion has not been obtained in regards to just which observable behaviors should be part of the construct (Barbe and Swassing 1979; Dunn, 1983; Dunn & Carbo, 1981; Coop & Sigel, 1971).

Few studies have been conducted to determine the effects of perceptual elements on learning. Carbo (1980) studied the effects of selected reading treatments matched to modalities of kindergarten subjects. She found that children taught through their strongest perceptual modalities learn more easily or remember better than those taught through either their secondary or tertiary strengths or weaknesses. Her findings supported the view that matching modality strengths and treatments is mandatory for many children to learn and achieve successfully.

Dunn, Dunn and Price (1981) investigated the relation between learning style and achievement in reading and mathematics. Their findings revealed students with high

reading achievement did not prefer using tactile or kinesthetic senses while low achieving readers preferred involving tactile and kinesthetic senses. The researchers noted also that it is highly possible that individuals who achieve well in math are being taught in ways that best meet their learning preferences. They suggested that if math teachers changed instructional strategies to match the learning style preferences of underachieving learners, it is possible there would be fewer underachievers in math. The investigators recommended that educators become knowledgeable about learning styles and individual differences that each individual brings to the educational environment and be willing to plan and implement teaching strategies based on accurate assessment (Dunn, Dunn, and Price, 1981).

In a related study, Weinberg (1983) examined the effects of matching student perceptual strengths with an instructional treatment to determine the relationship of such a process to achievement in arithmetic. Although his findings yielded nonsignificant F ratio in change scores and achievement between the groups taught by modality preferred strategies and nonpreferred teaching methods, he concluded that teaching by a lecture method is detrimental to students with auditory deficits and

recommended that the commonality system of teaching be discontinued.

Studies have generally indicated that listening can be improved by instruction. The majority of these studies have focused upon developing basic components of listening, such as auditory training and auditory memory. David Russell (1964) has stressed the need for educational researchers to explore the development of listening abilities and apply the findings to other academic areas, including reading and language arts. Studies dealing with auditory perception, and auditory discrimination in particular, are increasingly numerous as educators are becoming more and more aware of the learning process. These studies have reported that auditory perceptual abilities are related to reading achievement at the primary level.

Studies Related To Memory Skills

Other investigations, such as Patton and Nelly (1970) examined the effects of auditory memory training on recall of auditory stimuli. The subjects were 48 preschool children who were randomly assigned to three groups. All three groups received training in one of three methods: vocalized auditory sequences; vocalized sequences with simultaneous visual stimuli; and, vocal stimuli followed

immediately by visual stimuli. The results of two 3 X 3 ANOVA showed there was no significant difference between the groups. Patton and Nelly concluded that preschool children can profit from receiving training in auditory memory.

Investigations in reading achievement and memory training have mainly taken place during the 70's. Feldman (1970) did a study predicting first grade reading achievement from selected factors of Guilford's Structure-of-Intellect. Memory factors were found to be best predictors, along with structural units, in decoding visual forms to speech and the memory of figural units. Hays and Pereira (1972) studied the effects of visual memory training on reading ability of kindergarten and first-grade pupils. The two-year longitudinal study included 89 children who were assigned to experimental and control groups. It was concluded that memory training techniques contributed significantly to reading achievement and that further research on visual memory improvement and reading, auditory memory and reading, and evaluation and reading was needed.

Beneson (1972) also investigated the relationships between visual memory for designs and early reading achievement. The subjects were 192 first-grade children in a white, upper-middle class suburban community. Results showed that intermediate memory was more strongly related to

reading achievement than was short-term memory. Although positive relationships were found between the visual memory tests and reading readiness test, the reading readiness test correlated more highly with reading achievement than did visual memory tests. The Auditory Blending subtest of the reading readiness test was most closely associated predictively with the reading measures of vocabulary and comprehension. It was suggested that the auditory modality or auditory-visual integration are of greater importance than the visual when predicting reading achievement.

Whisler (1974) investigated whether a program of visual memory would cause growth in visual discrimination skills and total reading skills of 295 first-grade students of middle-class socioeconomic backgrounds. The experimental group was comprised of six classes of 152 students who received visual memory training for fifteen weeks in addition to a basal reading program. The contrasted group was comprised of six classes of 143 students who received only basal reading instruction with no emphasis of visual memory. Both pre-test and posttest data were collected. The results showed that the experimental group made significantly greater gains with .01 level in visual discrimination than the control group. Each of the sub-skills that comprise the total reading score was also

analyzed. There was a significant difference at the .01 level between the experimental and control groups in development of word recognition skills as measured by the Word Reading subtest. There was no significant difference between the experimental and control groups in comprehension skills as measured by the Paragraph Meaning subtest. It was concluded that practice in visual discrimination skills and total reading skills. Whisler suggested the possibility of providing additional specific training in other readiness and beginning reading skills to improve total reading ability.

Warrey, Widawski, and Anooshian (1976) conducted a study concerned with the prediction of first-grade reading achievement from performance on perceptual tests in kindergarten. Predictions were assessed against the reading achievement scores. Results showed that the difference between the mean reading level of the children who were predicted to be poor readers and the mean of those predicted to be adequate readers was significant at the .01 level. The predictive formulas were found to be successful. It was concluded that reading achievement in the early grades is more dependent on relatively simple perceptual abilities such as visual and auditory memory than on visual-auditory integrative abilities.

An early study was done by Morency (1967) to determine the effects of auditory discrimination and auditory memory on beginning reading instruction. One hundred and seventy seven first-grade children were followed for 3 years. Results showed that there was a significant difference between auditory discrimination and memory, and visual discrimination and memory at the first and third grade levels. It was concluded that there is a developmental progression in perceptual ability, and appropriate learning in the early grades is of great importance to successful academic functioning.

Studies Related To Auditory Discrimination

Perceptual factors have been considered important in the development of reading and listening skills. It has been theorized (Harris, 1969) that empowered reading comes with empowered discrimination, which includes recognition of beginning sounds, final sounds, and vowel and rhyming or consonant sounds in words.

McNinch, 1971 (Scheer, J.C., 1982) explored the predictive relationship between auditory perceptual variables and later reading achievement. Subjects were first-grade children who were pretested on auditory discrimination, auditory memory, auditory integration, and

auditory and visual integration at the beginning of the school year. At the end of the school year the subjects were administered the SRA Achievement Series at the .01 level of significance. It was found that there were significant correlations among the various auditory perceptual measures and between the auditory perceptual measures and reading achievement. There were no significant differences on the auditory perceptual measures between boys and girls.

A later investigation (Pollack, Naheem & Krippner, 1978) studied the effects of an auditory perception skills training program upon kindergarten children. The authors hypothesized that kindergarten children taught auditory perceptual skills would learn to read better than those taught the regular kindergarten curriculum, and those taught by student tutors would gain more than those who were not. The subjects were 200 kindergarten children in the same school. The authors concluded that the tutors neither helped nor hindered the perceptual achievements but that auditory perceptual skill instruction had positive effects upon reading achievement.

In the Barbe and Swassing study, 637 (K - 6) preschool and kindergarten students were found to have dominant auditory modalities. First graders were visual and

auditory. The majority of second graders was visual, and the visual modality continued to dominate in grades three through six with kinesthetic ranking second and auditory third (Barbe & Swassing, 1979).

Dominant modalities result from the interaction of many factors: heredity, prenatal environment, nutrition, stimulation and experiences, and interactions with adults and other children. Often the dominant modality of a person is mirrored in his/her daily behavior (Milone, 1981).

Barbe and Swassing describe modality-based instruction as a "comprehensive approach to education ... organized around a student's learning strength" (Barbe & Swassing, 1979). They also stated that modality-based instruction could be applied to all levels of education.

The key to modality-based instruction is teaching to the learning strengths of the students. The purpose of MBI is to utilize the dominant modalities of the students to **teach basic skills. After the basic skills have been mastered, the focus should be redirected towards strengthening the weaker modalities.** The ultimate goal is to help students learn to transfer information presented in all modalities to their areas of strength (Kampwirth & Bates, 1980; Milone, 1981).

Planning instruction matched to modality strengths should take place only after the strengths of the students have been assessed (Barbe & Milone, 1980). Lessons should be structured so the children can respond in their own modalities. Teachers are encouraged to move from a presentation that focuses upon one modality to one that includes all three. This will help children learn to transfer information from other modalities to their area of strength (Barbe & Swassing, 1979).

Rousseau proposed that sensory experiences were the basis for all knowledge. He stated "In the dawn of life, when memory and imagination have not begun to function, the child only attends to what affects its senses..." (Kramer, 1976).

Development of Modality-Based Instruction

Modality-based instruction is instruction which is based on an assessment of modality strengths and weaknesses, in order to teach children in the modality channel of their strength.

Rousseau believed that if educators trained the body and senses in childhood then the intellect would develop naturally. He also recognized the importance of individual differences within students and advocated that educational experiences should be chosen to accommodate those individual

differences. Rousseau placed a new emphasis upon the process of learning rather than the product (Kramer, 1976).

Pereire, a contemporary of Rousseau, was closely involved with the teaching process. He felt that "all the senses accomplish their functions by virtue of a more or less modified sense of touch" (Lane, 1976).

Because of this belief, Pereire utilized the sense of touch and kinesthetic methods while working with deaf children. Lane described the theory behind Pereire's techniques as "the idea of education based on sense-training, as an instrument in more general learning" (Lane, 1976).

Etienne de Condillac stated that the key to education was directing and developing the sensory experiences of children. He emphasized programs based on sensory experiences could be developed.

John Pestalozzi, the founder of a school for the underprivileged in Switzerland in the 1700's, advocated training and developing each of the senses. Activities were planned and organized to progress from simple and concrete to elaborate and abstract. The principle behind the educational theory espoused by Pestalozzi was the importance of sensory training (Kramer, 1976).

Friedreich Froebel, a follower of Pestalozzi, was credited with creating the first kindergarten. He applied the teachings of Pestalozzi concerning the importance of nature and the development of senses to the education of young children. Froebel believed in the value of play to stimulate learning and heavily utilized sensory experiences (Kramer, 1976). Jean Itard, a colleague of Abbe de Sicard in Paris, believed that education could become more effective by "determining the organic and intellectual PECULIARITIES of each individual and determining what education ought to do" (Lane, 1976). The work of Jean Itard formed the foundation for later educational success (Barbe & Swassing, 1979; Lane, 1976).

Edouard Seguin considered the tactile sense to be the most essential modality, and that all other senses are simply derivatives of touch (Lane, 1976).

In 1886, Charcot reported that each individual has a preferred learning style, either audile (auditory); visile (visual), or tactile (kinesthetic) (Blanton, 1970).

In the early 1900's, Maria Montessori believed that children with handicaps and children who were disadvantaged could benefit from education if they were given a chance. She founded a school for underprivileged children in Rome and called it the Case dei Bambini.

Montessori emphasized the significance of sense education in her book The Montessori Method (Montessori, 1912). The methods and materials Montessori utilized developed each of the educationally relevant senses but capitalized most heavily on the tactile or kinesthetic sense (Kramer, 1976). Grace Fernald utilized the visual, auditory, and kinesthetic modes in teaching reading, beginning with the kinesthetic mode, in support of her multisensory approach to education.

Samuel Orton recognized the important role of learning modalities in every day life, and suggested that teachers should identify the learning strengths of their students and capitalize upon them (Orton, 1937).

In the mid 20th century, Strauss and Lehtinen utilized sensory-based instruction in the education of brain-damaged children. They rationalized that a brain-damaged child must be taught through his/her area of strength to minimize distractions that interfere with learning (Strauss & Lehtinen, 1947). They felt that the visual mode was most important but provided instruction in three modes by integrating kinesthetic with auditory and visual. They also stressed the importance of sensory-motor activities as the basis for building academic skills.

Research On Perceptual Modalities and Academic Achievement

Each person has his/her own unique method of learning (Barbe & Milone, 1980; Barbe & Milone, 1981; Barbe & Swassing, 1979; Barbe & Swassing, 1981; Blanton, 1970; Dunn, Rita & Carbo, 1981; Dunn & Dunn, 1977; Dunn & Dunn, 1979; Dunn & Dunn, 1978; Milone, 1981; Webb & Cross, 1982). Because of these individual differences traditional instructional methods often do not meet the needs of all students (Riessman, 1976). Bracht stated that "...no single instructional process provides optimal learning for all students" (Bracht, 1970). Knowledge of the learning strength of a student will aid the teacher in providing instruction to meet these individual needs (Barbe & Milone, 1980; Barbe & Milone, 1981; Barbe & Swassing, 1979; Dunn, Rita & Carbo, 1981; Dunn & Dunn, 1977; Dunn & Dunn, 1979; Dunn & Dunn, 1978). Modality-based instruction provides the most effective and efficient method of meeting the individual needs of students (Barbe & Milone, 1980; Barbe & Milone, 1981; Barbe & Swassing, 1979; Barbe & Swassing, 1981; Dunn, Rita & Carbo, 1981; Dunn & Dunn, 1977; Dunn & Dunn, 1979; Dunn & Dunn, 1978; Hopkins, 1978).

Walter Barbe, Raymond Swassing, and Michael Milone, Jr., are contemporary educators in support of modality-based instruction. The three modalities they consider

educationally significant are visual, auditory, and kinesthetic. Barbe and Milone proposed that MBI is one of the most significant movements in education today (Barbe & Milone, 1981). Barbe and Swassing advocated modality-based instruction because of its logical approach, the fact that teachers were already implementing it to some degree, and that research supported the concept.

Results of a study by Barbe and Swassing indicated that modality-based instruction complemented the individual differences of students and increased learning rates (Barbe & Swassing, 1979).

Rita and Kenneth Dunn are also proponents of modality-based instruction. They believe that some students learn only through particular methods -- methods that often are not effective for others. When children are taught by methods that match their strongest modality, self-esteem, motivation, and academic success increased (Dunn & Dunn, 1977).

In a study done by Jones, it was found that modality-based instruction contributed to reading success in the elementary grades (Jones, 1972).

A study done by Waters indicated that providing instruction keyed to the learning modalities of students led to greater reading achievement scores than traditional

methods of instruction (Waters, 1973). Mills agreed on three basic approaches for teaching reading -- visual, phonic (auditory), and kinesthetic (Mills, 1970). A study by Olson with 188 seventh graders revealed that learning modalities were related to achievement of reading comprehension skills, listening skills, and language skills (Olsen, 1983).

Other contemporary educators (Sabatino & Hayden, 1970; Berger, 1980; Lyons - Ruth, 1977; Kampwirth, etc.,) also support the practice of modality-based instruction, as this approach to instruction is keyed to the modality strength of a child (Kampwirth & Bates, 1980).

Encoding, storing, and retrieving of those ideas are crucial to learning and consequent achievement. The means by which individuals perceive, conceive, organize and remember are critical to academic progress.

Cognitive or learning styles involve sensorimotor, perceptual, and conceptual levels of functioning. Kagan, et. al., (1963) define cognitive style as "stable individual differences in modes of perceptual organization and conceptual categorization of the external environment".

To examine perceptual and cognitive differences in processing information directs research toward the study of

how individuals receive, perceive, and organize incoming stimuli. The most recent National Assessment of Educational Progress results reveal that many elementary students do not perform adequately on standardized mathematics tests (Dossey, Mullis, Lindquist, & Chambers, 1988; Carpenter, Lindquist, Brown, Kouba, Silver, & Swafford, 1988). There is a great need for identification of the causes of mathematics learning problems and for discussion of teaching strategies to reduce them. The literature recommends the use of concrete manipulatives in elementary mathematics instruction (e.g. National Council of Teachers of Mathematics, 1980, 1987).

CHAPTER III

METHOD

The primary purpose of this study was to determine whether the visual, auditory, and tactual/kinesthetic scores of students in grades six, seven, and eight from four middle schools are significantly related to academic achievement in mathematics concepts and reading comprehension, based on the Iowa Test of Basic Skills (ITBS) scores. The secondary purpose was to determine whether there were grade and gender differences among the modality groups.

Study Population and Sample

The study took place in four middle schools in the Stafford County Public Schools, Virginia. Three groups (grades 6, 7, 8) were identified from the four schools - A. G. Wright Middle School; Drew Middle School; Stafford Middle School; and T. Benton Gayle Middle School, with randomly selected subjects of 25 students at each grade level from all the schools, to bring the total number of the sample to 300. Permission for the experiment was obtained from the Director of Stafford County Middle Schools.

The participation of students was approved by the schools' administration which secured parental approval.

The schools within the research school system reflect a suburban population area. The socioeconomic status of the population ranges from lower middle, middle and upper middle class with an average household income of about \$45,500 a year.

During the month of March 1991 the sample was given the 5-12 version of the Learning Style Inventory Profile (LSI) (Dunn, Dunn & Price, 1975, 1978, 1984, 1986, 1987, 1989) to measure modality preferences and modality strengths. The researcher administered the test in the schools participating in the study, assisted by teachers who received appropriate training in each school.

Instrumentation

The Learning Style Inventory (LSI) is an individually administered questionnaire consisting of 104 items which reduce to 22 learning style subscales. It usually requires less than 25 minutes to complete. The LSI is a comprehensive approach to the identification of how students prefer to function, learn, concentrate and perform during educational practices in the following areas: (a) Environment (sound, temperature, light, and formal/informal

design); (b) Emotionality/psychological needs (motivated/unmotivated, adult motivated, teacher motivated, persistence, responsibility, and the need for either structure or mobility); (c) Sociological needs (learning alone, with peers/pair, with adults, several ways); (d) Physical needs: (perceptual preference(s), requires food intake, time of day (functions best in morning, functions best late morning, functions best afternoon, functions best evening)); and Needs mobility. Questions concerning each of the areas are presented, and selected responses tend to reveal highly personalized preferences. Their preferences represent the way in which the individual prefers to study or concentrate.

For the purpose of this research only the four perceptual preference(s) subscales of visual, auditory, tactual and kinesthetic modalities were studied.

The Learning Style Inventory (LSI) (Dunn, Dunn & Price, 1975, 1978, 1984, 1986, 1987, 1989) is the first comprehensive approach to assessment of an individual's learning style in grades 5 through 12. This instrument is an important and useful first step toward identifying the conditions under which an individual is most likely to learn, remember, and achieve.

Many of the questions in the instrument appear highly subjective and relative. That is precisely why they contribute to an understanding of how each student learns in ways that are different from his or her peers.

Since each individual's learning style is based on a complex set of reactions to varied stimuli, and previously established patterns that tend to be repeated when the person concentrates, the words think, learn, read, write, and concentrate are used interchangeably throughout the Inventory, and it is not necessary for the respondent to differentiate among their meanings. Comparisons of answers to questions that include these words, and to others that seem to ask the same thing in varied ways, contribute to the accuracy of the student's overall profile.

The Inventory does not measure underlying psychological factors, value systems or the quality of attitudes. Rather it yields information concerned with the patterns through which learning occurs. It summarizes the environmental, emotional, sociological, and physical preferences a student has for learning - not why they exist.

Finally, the Inventory does not assess the finer aspects of an individual's skills, such as ability to outline procedures, organize, classify, or analyze new material. Again, it evidences how students prefer to learn,

not the skills they use.

Reliability (Cronbach's Alpha) and validity for the LSI:5-12 were established using 890 randomly selected subjects in the 1975 study. Research in 1988 indicated that 95 percent (21 out of 22) of the reliabilities are equal to or greater than .60. The reported reliabilities are for the visual, auditory, and tactual/kinesthetic scales, respectively.

Further research indicates a high reliability and validity of the LSI Instrument. At the Ohio State University, Kreitner (1981) used learning style theory to explore the modality strengths of 29 musically talented youngsters in one Pennsylvania school system. The Swassing-Barbe Modality Index (SBMI) and the Dunn, Dunn and Price Learning Style Inventory (LSI) were administered to determine: (a) their usefulness in identifying gifted musicians; (b) similarities between the two models; (c) whether characteristics existed among the gifted that might be used to teach other subjects; etc. The data corroborated the findings of other studies that similarly revealed that gifted youngsters prefer kinesthetic, rather than auditory activities (Price, Dunn, Dunn & Griggs, 1981; Wasson, 1980). A strong parallel, or overlap, was revealed between the two learning style models; both agreed that it is better to

build on a student's strengths rather than try to remediate weaknesses. That investigation substantially contributed toward increasing the understanding of varied learning style instruments and further clarified how different models can supplement and reinforce each other.

Variables

The independent variables in this study were: perceptual modality preference/strength, gender, school and grade level. The dependent variables were student achievement scores in Reading Comprehension, Math Concepts, Visualization and Referential as measured by the Iowa Tests of Basic Skills (ITBS).

The Iowa Test of Basic Skills (ITBS) measures student achievement in grades K through 9. Skills are measured in vocabulary, reading, language, work-study, mathematics, social studies and science. The Office of Director of Middle Schools suggested using only Reading Comprehension and Math Concepts as elements of skill achievement, since these are the fundamental skills underlying other achievements. Since Visual modality strength is logically correlated with Visualization (the mind's eye) and reference work (maps and chart reading), they were also examined. From the 14 subtests (or achievement variables) for the Iowa

Test of Basic Skills, only these four achievement variables will be used to define academic achievement in this study.

The following is a description of what had been measured in each of the continuous variables as indicated:

R (Reading Comprehension): A cognitive process of interpreting signs and symbols with understanding of the meaning.

M - 1 (Math Concept): deals with the basic arithmetic skills (+, -, x, %). It is a concept skill classification system

M - 2 (Problem): deals with the application of the basic skills of arithmetic in a problem-solving situation.

W - 1 (Visual display work skill): deals with making interpretation from visual stimuli such as map, chart, graph, and table reading, as well as dictionaries and encyclopedias, by using visual display material skills.

W - 2 (Referential skill): deals specifically with academic reference materials such as dictionaries, encyclopedias, and other general references like books, etc. Activities include alphabetizing words, spelling skills, pronunciation skills, using dictionaries and encyclopedias, guide words, key words, indexes, etc.

* In all the above subscales interpretative skill of visual stimuli (visual stimuli skills) is measured. For all continuous variables responses, covariates and the normalized scores were used for testing to ensure assumptions of ANOVA are met.

Design of the Study

The study was an experimental design. It is descriptive for measuring the effect of learning modality on achievement and to identify other effects related to

modality. The predictor variables were gender (classification variables) and the four modality scores (continuous variables). The response variables were Reading Comprehension, Math Concept, Visualization, and Referential (continuous variables). The design was a MULTIVARIATE RESPONSE ANALYSIS of COVARIANCE with COVARIATE by blocking factor-interactions. The blocking factors were school and grade nested within school.

$$\begin{aligned}
 \underline{A}_{ijkl} = & \underline{b}_0 + \underline{b}_1 \text{ VIS} + \underline{b}_2 \text{ AUD} + \underline{b}_3 \text{ KIN} + \\
 & \underline{SCH} + \underline{GRD}(j(i)) + \underline{GNDR}(k) + \\
 & \underline{b}_1 * \underline{SCH}(i) + \underline{b}_2 * \underline{SCH}(i) + \underline{b}_3 * \underline{SCH}(i) + \\
 & \underline{b}_1 * \underline{GRD}(j) + \underline{b}_2 * \underline{GRD}(j) + \underline{b}_3 * \underline{GRD}(j) + \\
 & \underline{b}_1 * \underline{GNDR}(k) + \underline{b}_2 * \underline{GNDR}(k) + \underline{b}_3 \\
 & * \underline{GNDR}(k) + E_{ijkl}
 \end{aligned}$$

All entries are 4-component vectors corresponding to the correlational response variables.

- A = achievement scores (normalized values)
- b₀ = school mean effect
- b₁ = visual modality effect
- b₂ = auditory modality effect
- b₃ = tactual modality effect
- b₄ = kinesthetic modality effect
- SCH(i) = school effect
- GRD(j(i)) = grade within school effect
- GNDR(k) = gender effect
- * = interaction of modality and blocking effect.
- E_{ijkl} = error or residual for l-th individual of the k-th gender in the j-th grade in th i-th school

Hypotheses

The hypotheses are:

- H1: There is no relationship between perceptual modality preferences and academic achievement.
- H2: There is no relationship between grade, gender and perceptual modality preferences.
- H3: There is no difference between schools in the relationship between modality preference and academic achievement.

Hypothesis H1 was tested by the significance of the model covariate terms for the perceptual learning modalities on the achievement variables. H2 was tested by the significance of the covariate grade and gender by effect interactions in the model. H3 was tested by the significance of the school by covariate terms in the model. The other terms in the model are dictated by good experimental practice, since they may contribute significantly to variance.

Instrument Administration and Data Collection Procedure

The researcher obtained achievement data from counselors and coded the data to keying forms. A sample is provided in Table 3 - 1: A Sample Coding.

TABLE 3 - 1 : A Sample Coding

<u>COD</u>	<u>SEX</u>	<u>SCH</u>	<u>GRD</u>	SS				NCE				RS			
				<u>AUD</u>	<u>VIS</u>	<u>TAC</u>	<u>KIN</u>	<u>R</u>	<u>M-1</u>	<u>W-1</u>	<u>W-2</u>	<u>M-2</u>	<u>W-1</u>	<u>W-2</u>	<u>M-2</u>
001	1	1	6	54	63	32	41	76	72	66	62	64	34	32	22
002	2	1	6	58	49	47	50	88	99	66	69	81	34	70	25
003	1	1	6	51	56	47	46	40	49	57	52	53	30	30	18
004	2	1	6	36	52	59	55	55	64	52	51	44	28	29	14
005	2	1	6	40	60	54	55	47	35	27	48	18	16	22	6
006	2	1	6	54	67	37	33	71	99	84	64	81	39	35	25
007	1	1	6	26	67	54	46	76	68	66	69	70	34	36	23
008	1	1	6	29	60	67	58	63	90	54	57	41	29	32	13
009	1	1	6	61	34	64	55	60	46	64	46	53	33	26	18
010	1	1	6	44	52	59	63	61	54	61	59	57	32	33	20
011	1	1	6	44	49	39	41	52	45	48	54	66	28	30	19
012	2	1	6	29	71	37	26	54	57	66	64	64	34	35	22
013	1	1	6	44	56	52	65	25	51	47	43	51	25	24	17
014	2	1	6	44	26	20	26	45	32	23	50	40	13	29	13
015	1	1	6	58	37	62	48	77	71	73	75	94	34	37	28
016	2	1	6	58	37	52	58	56	48	65	60	45	31	33	15
017	1	1	6	58	37	62	48	90	82	81	66	62	37	35	22
018	1	1	6	33	56	39	43	95	93	99	81	94	44	38	28
019	2	1	6	47	56	44	48	67	53	43	50	43	20	29	14
020	1	1	6	51	41	49	50	58	71	61	62	71	29	34	24
...nth.															

The Learning Style Inventory (LSI:5-12) was administered to selected classes in each grade level in their classrooms in a randomized sequence for each school, during a four day period.

The immediate environmental conditions were observed in order to provide for high standards of the reliability and validity of data so collected. The immediate environment is composed of such factors as sound, light, temperature, and seating design, to avoid possible distractions, as much as possible. Students were seated in accordance with their personal preferences in the same classrooms they regularly met for classes in each grade. In addition there were no exogenous or differential conditions such as industrial or local noise, unusual heat or cold noted during the administration. This means that students were tested under normal/favorable classroom setting preference of a typical school day.

The affected teachers at each school met with the researcher and covered testing objectives, procedures and/or directions and all questions prior to the day of LSI administration. The researcher explained the LSI and purpose of the study prior to administration in each classroom and then monitored the teachers' administration in all the tested classes.

The time provided to complete the inventory was approximately one class period of 45 minutes, although instrument completion generally only required 15 to 20 minutes.

The use of a numerical code provides anonymity of student identity so that student rights to privacy of personal academic records were maintained throughout this study.

The student-completed LSI answer sheets were sent to Price Systems, Inc., Lawrence, Kansas, where they were computer scored for accuracy in measurement.

Although the experimental research on learning styles verifies that students can report their own learning style preferences, the concept of style should be explained to them before they are tested.

Each examining teacher explained to the participating students that the use of an identification instrument is important, basically because teachers cannot correctly identify all the elements of the students' learning style pattern through observing alone.

As a basis for developing understanding of the concept of learning styles preferences, examiners began by explaining the differences in learning styles that exist among all classes, families, and cultures. Examiners told the participating students that their mothers' styles are likely to be different from their fathers' and that their style is probably different from each other's, their sisters' and brothers' styles. In spite of such

differences, there is no good or bad style. Every style is what it is. It is just the matter of what works for whom.

After some discussion, examiners orally summarized the content of "Two-of-a-Kind Learning Styles" (Pena, R., 1989, Grades 5-8) about Global Myrna and Analytic Victor, two middle schoolers who do most leisure time activities together, but who must study separately because their learning styles are so different (see Appendix B).

Examiners also explained that it is important for each person to understand his/her style preferences/strengths. They emphasized that everyone has preferences/strengths, but that each person's are different from their friends' and their relatives', and that the idea of learning about one's preferences/strengths can be introduced through a series of questions, which each person must answer truthfully, or there is no way to learn how each should be taught, do homework, or study efficiently, for best results. Examinees were further informed that there is no academically right or wrong answer for the test questions; rather, the test instrument is based on personal interests and intuition.

Finally, examiners informed examinees that when the results were back from the scoring computer center, they would be able to tell each boy and girl exactly how he/she should study in order to remember best anything that

ordinarily would be difficult.

The Inventory was given in written form. Students were encouraged to answer each question about their preference for work or study conditions as if they were describing how they concentrate best when learning a new/different/difficult information or skill, on a five-point Likert Scale ranging from Strongly Disagree(SD) to Strongly Agree(SA). Students were informed that the initial or general response is desired, and in addition that each person is not necessarily affected by all the areas. Thus, individuals were encouraged to give immediate reactions to each question, to make the instrument more effective in measuring what it is supposed to.

Moments before students began to complete the LSI, examining teachers gave the following directions: "ANSWER THE QUESTIONS AS IF YOU ARE DESCRIBING HOW YOU SEE YOURSELF CONCENTRATE WHEN YOU ARE STUDYING YOUR MOST DIFFICULT SCHOOL SUBJECT."

During the LSI administration at schools, randomly selected classrooms within grade were used instead of randomly selected pupils to minimize disruption to operational schedules. Unfortunately, there was a Chicken Pox epidemic in the region and at one school only about half of the pupils returned permission slips. A test was

performed to make up for the small samples at this school. This resulted in some imbalance in the blocking factors, which reduced the power of the tests of hypotheses, but appeared not to be a dominating issue in the results.

Data Analysis

Data were manually entered to the VPI & SU super computer VTNM1 via full screen edit facility FSEDIT in the Statistical Analysis System, Version 6.0. The scores were outprint to a flat formatted file and printed. The printed file was item by item verified against originals and two cases were deleted before analysis because of missing data in achievement scores.

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) Version 4.0., Procedures Correlation Means, and MANOVA.

Interpretation of Perceptual Preference(s) Scores

For the purpose of this study, perceptual inclinations consisted of the elements of auditory, visual, tactual, kinesthetic, or a combination of the three indicated by the perceptual component of the Learning Style Inventory (LSI) (Dunn, Dunn & Price, 1984). A score of between 20 and 30 on the LSI indicates an extremely negative preference; it shows

a study method severely counterproductive to the way an individual learns best or processes information; 31 to 40 is indicative of a slightly negative preference; it shows a study method mildly counterproductive to the way an individual processes information; 60 to 69 represents a positive preference; it shows a moderately productive indication of the way an individual learner retains information; and, 70 to 80 reveals an extremely positive preference, hence a STRENGTH; it shows a congruence with the way an individual retains information. Scores between 40 and 60 note that the element by itself is not important to the learner (Dunn, 1983). It shows that this modality is neither productive nor counterproductive to the way an individual retains information. If interested in what is being taught, the student will remember a substantive amount; if not, the student will blackout or pay little attention to the information.

Auditory Modality: For the purpose of this study, scores of between 20 and 30 for the auditory element of the LSI will indicate an extremely negative preference. Scores between 31 and 40 will be indicative of a negative preference; 60 to 69 will represent a positive preference, and scores of 70 to 80 will reveal an extremely positive auditory preference - a strength.

Visual Modality: For the purpose of this study, scores of between 20 and 30 for the visual element of the LSI will indicate an extremely negative preference. Scores between 31 and 40 will be indicative of a negative preference; 60 to 69 will represent a positive preference, and scores of 70 to 80 will reveal an extremely positive preference - a strength.

Tactual Modality: For the purpose of this study, scores between 20 and 30 for the tactual element of the LSI will indicate an extremely negative preference. Scores between 31 and 40 will be indicative of a negative preference; 60 to 69 will represent a positive preference, and scores of 70 to 80 will reveal an extremely positive preference - a strength.

Kinesthetic Modality: For the purpose of this study, scores between 20 and 30 for the kinesthetic element of the LSI will indicate an extremely negative preference. Scores between 31 and 40 will be indicative of a negative preference; 60 to 69 will represent a positive preference, and scores of 70 to 80 will reveal an extremely positive preference - a strength.

CHAPTER IV

STATISTICAL ANALYSIS AND FINDINGS

The primary purpose of this study was to determine whether the visual, auditory, tactual and kinesthetic scores of students in grades six, seven, and eight from four middle schools are significantly related to academic achievement in mathematics concepts and reading comprehension, based on the Iowa Test of Basic Skills (ITBS) scores. The secondary purpose was to determine whether there were grade and gender differences among the modality groups.

There were 312 valid cases from 16 classrooms in 4 schools. An objective of the study was to provide Stafford County Middle Schools with useful information on how to apply the learning modality preferences in the sample classrooms. This drives the descriptive results presentation to reflect class by class findings, conclusions and recommendations.

Descriptive Results

The LSI:5-12 instrument was computer-scored for accuracy. The tables are based on standard outputs from Price Systems, Inc., Lawrence, Kansas, and the simple descriptive statistics for the sample from SPSS.

Preliminary investigation showed the following correlations between perceptual learning modality scores, in Table 4 - 1:

Table 4 - 1

Statistical Correlations

AUD	AUDITORY	VISUAL	TACTUAL	KINESTHETIC
VIS	1.000	-0.573*	0.176	0.245
TAC		1.000	-0.138	-0.139
KIN			1.000	0.601*
				1.000

The auditory and visual modalities are significantly negatively correlated; hence, students with high preference for one will tend to have low or medium preference for the other. Tactile and kinesthetic modalities are significantly correlated indicating students high on either are likely to be high on both and similarly for low scores. There are very low correlations between either auditory or visual and either tactile or kinesthetic modalities which is different from previous reported results (Dunn studies).

Classroom Analysis

Tables 4 - 2 to 4 - 13 provide results and class by class analysis of perceptual modality preferences responses, academic achievement variables, and what teacher(s) should do in class based on these results. In interpreting these results, the word "sensitive" refers to the combined high or low modality standardized scores of students since the recommended action for instructional design for both ends of the continuum is the same. So, a standard deviation of the test is about 20. Achievement scores are all normalized percentiles. All the Perceptual Modality scores displayed in the TABLES reflect the total responses by subscale (Aud., Vis., Tac., Kin.) for groups of students having standard scores equal to or GREATER than 60 ($> = 60$ SS), and total scores by subscale for groups of students having standard scores equal to or LESS than 40 ($< = 40$ SS).

The group summaries can facilitate forming groups of individuals with similar preferences for learning and/or studying environments, and have implication for curriculum design. In addition, they indicate which groups (or individual students if referring to the individual profile printout) should be introduced to new material through their Auditory, Visual, Tactile, or Kinesthetic perceptual preferences.

These area summaries ($> = 60$, $< = 40$) indicate the number and percent of the group which scored 60 or higher (positively modality sensitive), or 40 or lower (negatively modality sensitive) for each of the four modality areas. This permits the teacher to identify quickly which elements are most and least important for the class as a whole. This analysis permits objective determinations concerning the most effective classroom designs for providing optimum study and/or instructional environments.

In designing classroom instruction employing the use of Auditory, Visual, Tactual & Kinesthetic modalities refer to the Learning Style Inventory (LSI Manual by Dunn, Dunn and Price, 1975, 1979, 1985, 1987, 1989, pp. 17 & 18) for prescribed guidelines specifications.

For standard scores of 40 or lower ($< = 40$ ss) use resources prescribed under the perceptual preferences that are strong (on the individual student profile printout). If none are 60 or over ($> = 60$ ss), interview the student(s) for other possible factors interfering with the LSI completion, because everyone should have at least one area of perceptual strength from among the four elements.

It should be noted that for those students having standard scores within the range of 41 - 59 ss (modality insensitive/unresponsive range) of the 20 - 80 LSI profile

continuum, perceptual modality is not a problem, as apparently none of the modality elements affects their learning one way or the other, either for stronger or weaker ($> = 60$ ss, or $< = 40$ ss). They can learn through any modality or combination of modalities, as they are neither positively nor negatively affected by modality-based physiological block. The range is a good way to learn, but only if the material to be learned is either interesting or simple.

Table 4 - 2

Drew School Grade 6 Results
N = 13 (8 males, 5 females)

<u>LSI P.Mod</u>	<u>Number of Responses</u>	<u>$> = 60$ SS Percentage</u>	<u>Number of Responses</u>	<u>$< = 40$ SS Percentage</u>	<u>Total Prcntg</u>
Aud	1	8	5	38	46
Vis	6	46	1	8	54
Tac	2	15	4	31	46
Kin	2	15	2	15	30

LSI P.Mod = Learning Style Inventory Perceptual Modalities

SS = Standardized Scores on the Modality Printout

ITBS Achiev	Normalized Average		Percentile (Class)	S D (Class)	S D	
	M	F			M	F
RdC (R)	57	63	59	17	17	17
MtC (m-1)	59	71	64	21	16	28
Vis (W-1)	58	59	58	1	8	21
Ref (W-2)	55	59	57	9	8	9

SD = Standard Deviation Vis = Visualization
 RdC = Reading Comprehension Ref = Referential
 MtC = Math Concept

Summary of Class Profile:

Visual - primary modality of preference, having the highest positive modality response

Tactual/Kinesthetic - secondary modality of preference

Auditory - least important modality of preference

The class is above average in all the achievement scores, with the class average of 60%-ile, and 54% of combined (> = 60 ss + < = 40 ss) highest modality sensitivity to the Visual modality.

Recommendations for Classroom Instruction:

New and/or difficult learning material should be introduced through the Visual modality, and reinforced through the Tactual/Kinesthetic modalities. For details see pages 141-142.

Table 4 - 3

Drew School Grade 7 Results
N = 25 (17 males, 8 females)

<u>P.Mod</u>	<u>Number of Responses</u>	<u>> = 60 SS Percentage</u>	<u>Number of Responses</u>	<u>< = 40 SS Percentage</u>	<u>Total Prontg</u>
Aud	6	24	3	12	36
Vis	2	8	10	40	48
Tac	2	8	7	28	36
Kin	3	12	1	4	16

LSI P.Mod = Learning Style Inventory Perceptual Modalities.

SS = Standardized Scores on the Modality Printout.

<u>ITBS</u> <u>Achiev</u>	Normalized					
	<u>Average</u>		<u>Percentile</u> <u>(Class)</u>	<u>S D</u> <u>(Class)</u>	<u>S D</u>	
	<u>M</u>	<u>F</u>			<u>M</u>	<u>F</u>
RdC (R)	65	65	65	17	18	18
MtC (M-1)	63	53	60	22	20	24
Vis (W-1)	65	56	62	18	17	21
Ref (W-2)	59	61	60	15	14	19

SD = Standard Deviation Vis = Visualization
RdC = Reading Comprehension Ref = Referential
MtC = Math Concept

Summary of Class Profile:

Auditory - primary modality of preference, having the highest positive modality response

Kinesthetic - secondary modality of preference

Visual/Tactual - tertiary modality of preference

The class is above average in all the achievement scores, with the class average of 62%-ile, and 48% of combined ($k > = 60 + < = 40$) highest modality sensitivity to the Visual modality.

Recommendations for Classroom Instruction:

New and/or difficult learning material should be introduced through the Auditory modality, and reinforced through Kinesthetic and Visual/Tactual modalities, as seen fit for best results. For details see pages 141-142.

Table 4 - 4

Drew School Grade 8 Results
N = 16 (5 males, 11 females)

LSI P.Mod	Number of Responses	> = 60 SS Percentage	Number of Responses	< = 40 ss Percentage	Total Prcntg
Aud	5	31	2	13	44
Vis	1	6	6	38	44
Tac	1	6	3	19	25
Kin	1	6	4	25	31

LSI P.Mod = Learning Style Inventory Perceptual Modalities.

SS = Standardized Scores on the Modality Printout.

ITBS Achiev	Normalized Average		Percentile (Class)	S D (Class)	
	M	F		M	F
RdC (R)	49	50	50	15	17
MtC (M-1)	63	40	47	18	10
Vis (W-1)	63	51	55	11	12
Ref (W-1)	59	48	52	11	4

SD = Standard Deviation Vis = Visualization
RdC = Reading Comprehension Ref = Referential
MtC = Math Concept

Summary of Class Profile:

Auditory - primary modality of preference, having the highest positive modality response.

This class has only two extreme sensitivity profiles, with Auditory as the most preferred modality, and the remaining three as the least preferred modalities.

The class is just about average in all the achievement scores, with a class average of 51%-ile, and 44% of combined (> = 60 + < = 40) highest modality sensitivity to both Auditory and Visual modalities.

Recommendations for Classroom Instruction:

New and/or difficult learning material should be introduced through the Auditory modality, and reinforced through the **remaining three elements, as seen fit for best results.** For details see pages 141-142.

Table 4 - 5

Gayle School Grade 6 Results
N = 43 (24 males, 19 females)

<u>P.Mod</u>	<u>Number of Responses</u>	<u>> = 60 SS Percentage</u>	<u>Number of Responses</u>	<u>< = 40 SS Percentage</u>	<u>Total Prcntg</u>
Aud	9	21	9	21	42
Vis	8	19	13	30	49
Tac	7	16	9	21	37
Kin	12	28	7	16	44

LSI P.Mod = Learning Style Inventory Perceptual Modalities.

SS = Standardized Scores on the Modality Printout.

ITBS Achiev	Normalized Average		Percentile (Class)	S D (Class)	S D	
	M	F			M	F
RdC (R)	61	62	62	20	19	21
MtC (M-1)	60	63	61	24	24	24
Vis (W-1)	62	60	61	21	24	17
Ref (W-1)	62	58	61	19	21	17

SD = Standard Deviation Vis = Visualization
 RdC = Reading Comprehension Ref = Referential
 MtC = Math Concept

Summary of Class Profile:

Kinesthetic - primary modality of preference

Auditory - secondary modality of preference

Visual - tertiary modality of preference

Tactual - least important modality of preference

The class is above average in all the achievement scores,
 with a class average of 61%-ile, and 49% of combined (> = 60
 + < = 40)

highest modality sensitivity to the Visual modality.

Recommendations for Classroom Instruction:

New and/or difficult learning material should be introduced through the Kinesthetic modality, and reinforced through the Auditory and Visual modalities. For details see pages 141-142.

Table 4 - 6

Gayle School Grade 7 Results
N = 44 (19 males, 25 females)

<u>P.Mod</u>	<u>Number of Responses</u>	<u>> = 60 SS Percentage</u>	<u>Number of Responses</u>	<u>< = 40 SS Percentage</u>	<u>Total Prontg</u>
Aud	6	14	9	20	34
Vis	6	14	13	18	32
Tac	6	14	11	25	39
Kin	8	18	7	14	32

LSI P.Mod = Learning Style Inventory Perceptual Modalities

SS = Standardized Scores on the Modality Printout

<u>ITBS Achiev</u>	<u>Normalized Average</u>		<u>Percentile (Class)</u>	<u>S D (Class)</u>	
	<u>M</u>	<u>F</u>		<u>M</u>	<u>F</u>
<u>RdC (R)</u>	45	54	52	15	17
<u>MtC (M-1)</u>	58	59	58	19	20
<u>Vis (W-1)</u>	55	53	54	18	21
<u>Ref (W-2)</u>	50	52	51	16	16

SD = Standard Deviation

RdC = Reading Comprehension

MtC = Math Concept

Vis = Visualization

Ref = Referential

Summary of Class Profile:

Kinesthetic - primary modality of preference, having the highest positive modality response.

This class has only two extreme sensitivity profiles with the Kinesthetic as the most preferred modality, and the remaining three elements as the least preferred modalities.

The class is barely about average in all the achievement scores, with the average of 54%-ile, and 39% of combined ($> = 60 + < = 40$) highest modality sensitivity to the Kinesthetic modality.

Recommendations for Classroom Instruction:

New and/or difficult learning material should be introduced through the Kinesthetic modality, and reinforced through the remaining three elements as seen fit for best results. For details see pages 141-142.

Table 4 - 7

Gayle School Grade 8 Results
N = 40 (22 males, 18 females)

LSI P.Mod	Number of Responses	> = 60 SS Percentage	Number of Responses	< = 40 SS Percentage	Total Prctng
Aud	5	13	7	18	31
Vis	6	15	10	25	40
Tac	4	10	12	30	40
Kin	4	10	11	28	38

LSI P.Mod = Learning Style Inventory Perceptual
Modalities.

SS = Standardized Scores on the Modality Printout

ITBS Achiev	Normalized Average		Percentile (Class)	S D (Class)	S D	
	M	F			M	F
RdC (R)	52	56	54	16	9	12
MtC (M-1)	54	54	54	19	18	21
Vis (W-1)	56	54	55	17	20	14
Ref (W-2)	55	55	55	17	19	15

SD = Standard Deviation

Vis = Visualization

RdC = Reading Comprehension

Ref = Referential

MtC = Math Concept

Summary of Class Profile:

Visual - primary (most important) modality of preference,
having the highest positive modality response

The class is slightly above average in all the achievement
scores, with the class average of 55%-ile, and 40% of
combined (> = 60 + < = 40) highest modality to both the
Visual and Tactual modalities.

Recommendations for Classroom Instruction:

New and/or difficult learning material should be introduced through the Visual modality and reinforced through the Auditory and Tactual/Kinesthetic modalities. For details see pages 141-142.

Table 4 - 8

Wright School Grade 6 Results
N = 20 (8 males, 12 females)

LSI P.Mod	Number of Responses	> = 60 SS Percentage	Number of Responses	< = 40 SS Percentage	Total Prcntg
Aud	10	50	3	15	65
Vis	4	20	8	40	60
Tac	6	30	4	20	50
Kin	6	30	1	5	35

LSI P.Mod = Learning Style Inventory Perceptual Modalities

SS = Standardized Scores on the Modality Printout

ITBS Achiev	Normalized Average		Percentile (Class)	S D (Class)		
	M	F		M	F	
RdC (R)	62	59	60	9	12	7
MtC (M-1)	66	64	65	16	22	12
Vis (W-1)	68	62	64	15	19	12
Ref (W-2)	59	63	61	12	12	13

SD = Standard Deviation Vis = Visualization
RdC = Reading Comprehension Ref = Referential
MtC = Math Concept

Summary of Class Profile:

Auditory - primary (most important) modality of preference, having the highest positive modality responses

Tactual/Kinesthetic - secondary modalities of preference, each; and also the least important modalities of preference

Visual - tertiary modality of preference

The class is above average in all the achievement scores, with the class average of 63%-ile, and 65% of combined ($> = 60 + < = 40$) highest modality sensitivity to the Auditory modality.

Recommendations for Classroom Instruction:

New and/or difficult learning material should be introduced through the Auditory modality and reinforced through the Visual and Tactual/Kinesthetic modalities. For details see pages 141-142.

Table 4 - 9

Wright School Grade 7 Results
N = 17 (9 males, 8 females)

<u>LSI P.Mod</u>	<u>Number of Responses</u>	<u>> = 60 SS Percentage</u>	<u>Number of Responses</u>	<u>< = 40 SS Percentage</u>	<u>Total Prontg</u>
Aud	2	12	4	24	36
Vis	2	12	6	35	47
Tac	2	12	4	24	36
Kin	2	12	2	12	24

LSI P.Mod = Learning Style Inventory Perceptual Modalities

SS = Standardized Scores on the Modality Printout

<u>ITBS Achiev</u>	<u>Normalized Average</u>		<u>Percentile (Class)</u>	<u>S D (Class)</u>	<u>S D</u>	
	<u>M</u>	<u>F</u>			<u>M</u>	<u>F</u>
RdC (R)	62	68	65	13	14	13
MtC (M-1)	55	62	58	16	14	17
Vis (W-1)	57	57	57	14	17	9
Ref (W-2)	53	56	55	11	8	14

SD = Standard Deviation Vis = Visualization

RdC = Reading Comprehension Ref = Referential

MtC = Math Concept

Summary of Class Profile:

This class is a peculiar case, with all the number of the group who scored 60 or higher ($> = 60$ ss) perfectly uniformly 2, and the average number of the group who scored 40 or lower ($< = 40$ ss) 4.

The class is above average in all the achievement scores, with the class average of 59%-ile, and 47% of combined ($> = 60 + < = 40$) highest modality sensitivity to the Visual modality, because of $< = 40$ ss high number of responses.

Recommendations for Classroom Instruction:

As none of the total subscale responses is 60 or over ($> = 60$ ss) it is here suggested that classroom teachers interview these students for identification of possible exogenous factor(s) that might have contributed to this rather odd result. This is based on the assumption that everyone should have at least one area of perceptual strength. For details see pages 141-142.

Table 4 - 10

Wright School Grade 8 Results
N = 11 (7 males, 4 females)

<u>P.Mod</u>	<u>Number of Responses</u>	<u>> = 60 SS Percentage</u>	<u>Number of Responses</u>	<u>< = 40 SS Percentage</u>	<u>Total Prcntg</u>
Aud	2	18	2	18	36
Vis	1	9	2	18	27
Tac	1	9	3	27	36
Kin	1	9	0	0	9

LSI P.Mod = Learning Style Inventory Perceptual Modalities

SS = Standardized Scores on the Modality Printout

ITBS <u>Achiev</u>	Normalized Average		Percentile (Class)	S D (Class)	
	M	F		M	F
RdC (R)	36	52	42	14	12 13
MtC (M-1)	38	48	41	11	10 12
Vis (W-1)	39	47	42	12	13 9
Ref (W-2)	42	54	46	10	9 5.

SD = Standard Deviation Vis = Visualization
RdC = Reading Comprehension Ref = Referential
MtC = Math Concept

Summary of Class Profile:

Auditory - primary (most important) modality of preference, having the highest positive modality response class has only two extreme sensitivity profiles, with the Auditory modality as the most preferred modality and the remaining 3 elements as the least preferred modalities. The class is below average in all the achievement scores, with the class average of only 43%-ile and only 36% of combined (> = 60 + < = 40) highest modality sensitivity to both the Auditory and Tactual modalities.

Recommendations for Classroom Instruction:

New and/or difficult learning material should be introduced through the Auditory modality, and reinforced through the remaining 3 elements as seen fit for best results. For details see pages 141-142.

Table 4 - 11

Stafford School Grade 6 Results
N = 30 (15 males, 15 females)

LSI P.Mod	Number of Responses	> = 60 SS Percentage	Number of Responses	< = 40 SS Percentage	Total Prontg
Aud	9	29	6	19	48
Vis	4	13	9	29	42
Tac	8	26	4	13	39
Kin	5	16	7	23	39

LSI P.Mod = Learning Style Inventory Perceptual Modalities

SS = Standardized Scores on the Modality Printout

Achiev. Type	Normalized Percentile		Percentile (Class)	S D (Class)		
	M	F		M	F	
RdC (R)	58	63	60	17	17	16
MtC (M-1)	63	63	63	20	23	17
Vis (W-1)	60	62	61	14	17	12
Ref (W-2)	56	59	58	16	18	15

SD = Standard Deviation

RdC = Reading Comprehension

MtC = Math Concept

Vis = Visualization

Ref = Referential

Summary of Class Profile:

Auditory - primary (most important) modality of preference, having the highest positive modality response

Tactual - secondary modality of preference

Kinesthetic - tertiary modality of preference

This class is well above average in all the achievement scores, with the class average of 61%-ile and 48% of combined ($> = 60 + < = 40$) highest modality sensitivity to the Auditory modality.

Recommendations for Classroom Instruction:

New and/or difficult learning material should be introduced through the Auditory modality, and reinforced through the Tactual and Kinesthetic modalities. For details see pages 141-142.

Table 4 -12

Stafford School Grade 7 Results
N = 27 (13 males, 14 females)

<u>LSI P.Mod</u>	<u>Number of Responses</u>	<u>> = 60 SS Percentage</u>	<u>Number of Responses</u>	<u>< = 40 SS Percentage</u>	<u>Total Prcntg</u>
Aud	6	22	6	22	44
Vis	4	15	9	33	48
Tac	4	15	3	11	26
Kin	5	19	6	22	41

LSI P.Mod = Learning Style Inventory Perceptual Modalities

SS = Standardized Scores on the Modality Printout

ITBS Achiev	Normalized Average		Percentile (Class)	S D (Class)	S D	
	M	F			M	F
RdC (R)	57	56	56	17	18	17
MtC (M-1)	57	60	58	25	24	26
Vis (W-1)	60	61	61	17	18	15
Ref (W-2)	57	55	56	19	19	19

SD = Standard Deviation Vis = Visualization
 RdC = Reading Comprehension Ref = Referential
 MtC = Math Concept

Summary of Class Profile:

Auditory - primary (most important) modality of preference,
 having the highest positive modality response

Kinesthetic - secondary modality of preference

Visual/Tactual - tertiary modalities of preference; also the
 least important modalities of preference

The class is above average in all the achievement scores,
 with the class average of 58%-ile, and 48% of combined (> =
 60 + < = 40) highest modality sensitivity to the Auditory
 modality.

Recommendations for Classroom Instruction:

New and/or difficult learning material should be introduced
 through the Auditory modality and reinforced through the
 Kinesthetic and Visual/Tactual modalities. For details see
 pages 141-142.

Table 4 - 13

Stafford School Grade 8 Results
N = 26 (17 males, 9 females)

LSI P.Mod	Number of Responses	> = 60 SS Percentage	Number of Responses	< = 40 Percentage	Total Prontg
Aud	2	7	6	22	29
Vis	4	15	5	19	34
Tac	8	30	0	0	30
Kin	6	22	1	4	26

LSI P.Mod = Learning Style Inventory Perceptual Modalities

SS = Standardized Scores on the Modality Printout

ITBS Achiev	Normalized					
	Average		Percentile (Class)	S D		S D
	M	F		(Class)	M	
RdC (R)	56	45	52	19	21	10
MtC (M-1)	54	46	51	18	17	20
Vis (W-1)	57	45	53	21	20	20
Ref (W-2)	54	48	52	17	19	11

SD = Standard Deviation

Vis = Visualization

RdC = Reading Comprehension

Ref = Referential

MtC = Math Concept

Summary of Class Profile:

Tactual - primary (most important) modality of preference,
having the highest positive modality response

Kinesthetic - secondary modality of preference

Visual - tertiary modality of preference

Auditory - least ;important modality of preference

The class is just about average in all the achievement

scores, with the class average of 52%-ile, and 34% of

combined (> = 60 + < = 40) highest modality sensitivity to

the Visual modality.

Recommendations for Classroom Instruction:

New and/or difficult learning material should be introduced through the Tactual modality, and reinforced through the Kinesthetic and Visual modalities. For details see pages 141-142.

Tests of Hypotheses:

In every test of effect in the model, the multivariate tests of hypothesis that the effect was non-zero had exact F statistics, and all three (Pillais, Hotellings, and Wilks) criteria had identical F values and achieved significance ("P-value"). Therefore, only the multivariate results for Hotellings criterion are provided in Table 4 - 14. Only those univariate results for the significant or near significant multivariate tests are shown in Table 4 - 15. The criteria for reporting the non-significant visualization effect results were the highly significant and near significant results for two of the four univariate responses as expected: Reading Comprehension and Reference source.

Hypothesis 1: A relationship between learning modality and achievement.

There is marginal evidence of the effect of the Visualization perceived learning modality on achievement in the areas one might guess: Reading Comprehension and Reference sources.

Hypothesis 2 and 3: Relationships between gender, grade, within school and learning modalities.

There is no evidence of effect on either mathematical computation or map/chart reading achievement, and the latter is surprising.

Only one of 12 tests was significant: tactile modality by grade, and none of the associated univariate tests was significant, although mathematical concept achievement was close. Therefore we can conclude that there are no relationships between gender, grade, or school and learning modality.

Table 4 - 14

Multivariate Tests of Effects

<u>EFFECT</u>	<u>HOTELLINGS T2</u>	<u>F</u>	<u>df</u>	<u>P-value</u>	
<u>Hypothesis</u>					
Kin X Gendr	.025	1.71	(4,268)	.149	2
" X Grad	.045	1.51	(8,534)	.150	2
" X Schl	.047	1.04	(12,800)	.413	3
Tac X Gendr	.016	1.05	(4,268)	.381	2
" X Grade	.062	2.08	(8,534)	.036*	2
" X Schl	.043	0.95	(12,800)	.497	3
Vis X Gendr	.005	0.33	(4,268)	.860	2
" X Grade	.020	0.66	(8,534)	.728	2
" X Schl	.054	1.20	(12,800)	.276	3
Aud X Gendr	.004	0.26	(4,268)	.905	2
" X Grade	.032	1.05	(8,534)	.396	2
" X Schl	.039	0.87	(12,800)	.574	3
Gender	.001	0.08	(4,268)	.988	BF
Grade (School)	.177	1.47	(32,1066)	.044*	BF
School	.043	0.96	(12,800)	.484	BF
Kinesthetic	.014	0.96	(4,268)	.430	1
Tactual	.008	0.54	(4,268)	.709	1
Visual	.027	1.84	(4,268)	.122+	1
Auditory	.013	0.87	(4,268)	.483	1

* Significant result

+ Nearly significant

BF = Blocking factor - not of scholarly interest

TABLE 4 - 15

Univariate Response Results

Effect: Tactile By Grade Degrees of freedom: (2,271).

<u>Response</u>	<u>F</u>	<u>P-value</u>	<u>Comment</u>
Read Comp.	0.17	.840	Since none of these is significant, we choose to assume this is a spurious or random result.
Math Conc.	2.16	.117	
Visualiz.	0.52	.553	
Reference	0.74	.478	

Effect: Grade Within School Degrees of freedom: (8,271)

<u>Response</u>	<u>F</u>	<u>P-value</u>	<u>Comment</u>
Read Comp.	2.41	.016	These results show that there are differences between grades within school. Table 4-16 provides the details
Math Conc.	0.80	.607	
Visualiz.	2.06	.040	
Reference	1.72	.095	

Effect: Visualization Degrees of freedom: (1,271)

<u>Response</u>	<u>F</u>	<u>P-value</u>	<u>Comment</u>
Read Comp.	3.08	.080	Reference source is significant and Reading Comprehension is nearly so which suggests further research is required.
Math Conc.	2.27	.133	
Visualiz.	1.08	.300	
Reference	5.63	.018	

Other Results:

Grade within school, a blocking factor was significant. The univariate results were strong for Reading Comprehension and Visualization while Reference source was marginally significant. The detailed results are provided in Table 4 - 16.

TABLE 4 - 16

Normalized Achievement Scores By Grade Within School:

	N	Read C.		Math C.		Visual.		Refere	
		Avg	SD	Avg	SD	Avg	SD	Avg	SD
<u>School:</u> Drew Middle	54	59	18	57	21	59	16	57	13
<u>Grades:</u> 6	13	59	17	64	21	58	14	57	9
7	25	65	17	60	22	62	19	60	15
8	16	50	15	47	18	55	11	52	11
<u>School:</u> Gayle Middle	127	56	18	58	21	57	19	56	18
<u>Grades:</u> 6	43	62	20	61	24	61	21	61	19
7	44	52	15	58	19	54	18	51	16
8	40	54	16	54	19	55	17	55	17
<u>School:</u> Wright Middle	48	58	15	57	17	57	16	55	13
<u>Grades:</u> 6	20	60	9	65	16	64	15	61	12
7	17	65	13	58	16	57	14	55	11
8	11	42	14	41	11	42	12	46	10
<u>School:</u> Stafford Mid.	83	56	18	58	22	58	17	55	17
<u>Grades:</u> 6	30	60	17	63	20	61	14	58	16
7	27	56	17	58	25	61	17	56	19
8	26	52	19	51	18	53	21	52	17

A real difference in an average score is 10 percentage points. This result is not critical to the research hypotheses, but may be useful in benchmarking future research in perceptual learning modalities.

Grades 7 and 8 on Reading , and Grades 6 and 7 against 8 on Math are different at Drew School. No real differences are noted in Visualization or Reference source achievement.

Grades 6 and 7 are different on Reading and Reference source at Gayle School while no other large differences are apparent.

At Wright School, Grades 6 and 7 do not differ, but both have real differences from Grade 8 on all achievement measures,

At Wright School, Grades 6 and 7 do not differ, but both have real differences from Grade 8 on all achievement measures, except Reference source for 7th grades and 8th grades.

At Stafford School Grades 6 and 8 differ on Mathematics Comprehension, while no other real differences are present.

It is very interesting to note that in every case above, younger grade has a higher achievement percentile than the older grade. In fact every 6th grade achievement score is higher than its corresponding 8th grade score.

Description of LSI Perceptual Modality Areas
(From pages 17 & 18 of the LSI Manual)

AUDITORY PREFERENCES

For standard score of 60 or higher, use tapes, videotapes, lectures, discussions, records, radio, stereo, and precise oral directions or explanations when giving assignments, setting tasks, reviewing progress, using resources, or for any performance requiring understanding, evaluation, and/or retention. Reinforce through visual, tactile, and kinesthetic resources.

For standard score of 40 or lower, use resources prescribed under the perceptual preferences that are strong. If none are 60 or more, use several multisensory resources such as videotapes, sound-filmstrips, television, and tactile/kinesthetic materials. Introduce information through student's strongest perceptual preference whatever the score and reinforce through the secondary and then the tertiary perceptual preferences.

VISUAL PREFERENCES

For standard score of 60 or higher, use pictures, filmstrips, films, graphs, single concept loops, transparencies, computer monitors, diagrams, drawings, books, and magazines; provide resources that require reading and seeing; use programmed learning (if student needs structure) and written assignments and evaluations. Reinforce knowledge through tactile, kinesthetic, and then auditory resources.

For standard score of 40 or lower, use resources prescribed under the perceptual preferences that are strong. If none are 60 or more, use several multisensory resources such as videotapes, sound-filmstrips, television, and tactile/kinesthetic materials. Introduce information through students's strongest perceptual preference whatever the score and reinforce through the secondary and then the tertiary perceptual preferences.

TACTILE PREFERENCES

For standard score of 60 or higher, use manipulative and three-dimensional materials; resources should be touchable and movable as well as readable; allow such individuals to plan, demonstrate, report, and evaluate with models and other real objects; encourage them to keep written or graphic records. Reinforce through kinesthetic, visual, and then auditory resources.

For standard score of 40 or lower, use resources prescribed under the perceptual preferences that are strong. If none are 60 or more, use several multisensory resources such as videotapes, sound-filmstrips, television, and real-life experiences such as visits, interviewing, building, designing, and so on. Introduce information through activities such as baking, building, sewing, visiting, or acting; reinforce through visual, auditory, and kinesthetic methods. Introduce information through the secondary and then the tertiary perceptual preferences.

KINESTHETIC PREFERENCES

For standard score of 60 or higher, provide opportunities for real and active experiences in planning and carrying out objectives; visits, projects, acting, and floor games are appropriate activities for such individuals. Reinforce through tactile, visual, and then auditory resources.

For standard score of 40 or lower, use resources prescribed under the preferences that are strong. If none are 60 or more, use several multisensory resources such as videotapes, sound-filmstrips, television, and tactile/manipulative materials. Introduce information through "real life" activities (planning a part in a play or a trip); reinforce through tactile resources such as electroboards, task cards, learning circles, etc.; then reinforce further through visual and auditory resources.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The primary purpose of this study was to determine whether the visual, auditory, and tactual/kinesthetic scores of students in grades six, seven, and eight from four middle schools are significantly related to academic achievement in Mathematics Concepts and Reading Comprehension, based on the Iowa Test of Basic Skills (ITBS) scores. The secondary purpose was to determine whether there were grade and gender differences among the modality groups.

Summary of Findings

The study determined the effects of learning modality on achievement of middle school students. That visual, auditory, tactile, and kinesthetic learning modalities would be correlated with achievement in Mathematics and Reading Comprehension, Visualization and Reference source utilization was hypothesized.

The sample results showed low intermodality correlations where previous research had identified significant correlations. In particular, for the middle

school students, Visual and Auditory modalities and Tactile and Kinesthetic modalities were correlated, while no interrelationships were significant.

The first research question was concerned with the nature of perceptual modality preferences of students in grades six, seven and eight, regarding elements of Visual, Auditory and Tactual/Kinesthetic cognitive skill variables. Strong modality indicators were found for the classrooms of the study, which in turn were recommended as practical guidelines for improving the learning environment in the four study schools.

The second research question examined the relationships between perceptual modality preferences of students in grades six, seven and eight, and their standardized academic achievement scores. More specifically, how was the relationship between perceptual modality preferences in Visual, Auditory and Tactual/Kinesthetic approaches to learning distributed within and among grades six, seven and eight, by grade and gender, for academic achievement. Three research hypotheses were posed to explicate the answers to this research question:

Hypothesis One: There will be no relationship between learning modalities and academic achievement. There was

marginal evidence of the effect of the Visualization modality on achievement in the areas of Reading Comprehension and Reference sources. Otherwise, there were no significant relationships between learning modalities and achievement.

Hypotheses Two and Three: There will be no relationship between grade, gender, and modality preferences. There will be no difference between schools in the relationship between modality preferences and academic achievement. Tests of these hypotheses found no relationships between gender, grade, or school and learning modality. Only one of 12 tests was significant: Tactile modality by grade, and none of the associated univariate tests was significant, although Mathematical Concept achievement was close.

Other results indicated that grade within school, a blocking factor, was significant. The univariate results were strong for Reading Comprehension and Visualization while Reference source was marginally significant. In addition, sixth grade achievement scores were higher than seventh and eighth grade scores in all four schools.

Conclusions

Achievement and perceptual learning modality preferences were not related. These findings differ from those of previous studies in this area basically because this is a correlational study, which compared the modality preference scores and achievement scores without the application of intervening treatments on the sample population. It is not, in the final analysis, a contradictory result to previous research findings of the Dunn, Dunn and Price model, by other researchers, which reported that modality was related to achievement in Reading Comprehension and Mathematical concepts, when complementary and dissonant (matched and mismatched) intervening treatments were used to remediate deficits in prerequisite skills of learning. Of course, the findings could differ when procedures and methodologies differ from each other in any two or more studies. In fact the insignificant correlations of the current study should serve as reinforcing evidence to the findings of previous experimental and related investigations of the Dunn, Dunn & Price model, which were always significant with intervening treatments, and therefore, findings of this study do not necessarily negate the previous significant findings in support of the model.

Visualization achievement as measured by the ITBS was not related to visualization modality as measured by the LSI, when on the surface they are similar concepts. That reference source utilization should be significantly related to visualization is not intuitively obvious, but apparently is so for this sample.

Results showed that there was a uniform decrease across all achievement measures and schools between grades six and eight in the target population. It is impossible to conclude what was responsible for the decrease given the different purpose of the study. The seventh grade results are very "noisy" being both better and worse than the sixth and eighth grade results on various achievement measures at the different schools. The effects of puberty may be playing a strong part in "shaking out" a tendency towards overachievement developed in the elementary schools for example. It is concluded that identifying the effects in the decrease in achievement and finding countermeasures would be worthwhile for the middle school administration and faculty.

There were strong modality indicators for many classrooms. The particular recommendations for applying curriculum innovations to improve learning environment (and hence, achievement) are provided on the individual class

results (Tables 4-2 to 4-13) in Chapter IV.

Recommendations

Learning modality theorists suggest that the modalities for the students should be identified and the ways that they can use the modalities themselves to improve their own learning should be taught to support improvement in their achievement. It appears from the individual class results that learning modality intervention strategies would be helpful for several classes. The recommendations are provided on the Tables in Chapter IV based on guidelines in the LSI manual. Teachers and students should try the interventions suggested as they were presented to the Stafford County Public Schools administration and teachers and students who participated in data collection.

There is a logical inconsistency between visualization modality and achievement results for this sample. More research is required to identify why those middle school students preferring a visually oriented learning environment do not do correspondingly well on strongly visual achievement tasks.

The consistency and size of the decreases in achievement scores between sixth and eighth grades suggest that the effects causing them should be identified and

analyzed to improve achievement performance as soon as possible. This is a future research opportunity.

Based on the findings of this study, the following recommendations are made for future research:

1. This study should be replicated for middle school and junior high students to determine stronger significance of relationships between perceptual modality preferences and academic achievement, by first identifying the student modality preferences; second design the classroom curriculum based on the strongest profile(s) of the group; and third, test to see if modality preference at this time relates better to achievement, by gender, grade and school, a procedure most promising in score growth, and for which the opportunity was not available to the current researcher.

The study could be done longitudinally to determine how modality shifts from one to the other elements are related to achievement.

2. Study could be carried out for grades 3 through 8, to determine how/when the change(s) for modality preference occurs through; i.e., changing from kinesthetic to tactual to visual and to auditory, the order believed in by learning style theorists.

3. In order to develop a strong/useful profile of each modality preference for individuals, a study should be

conducted to assess if other personal attributes of the different modality groups are impacting the profile, by conducting an intensive interview after writing the learning style test. This could include factors like socio-economic status, parent education, parent modality, analytical aptitudes, self-concept, self-esteem, school environment, school attitudes, etc., perhaps longitudinally.

4. Educators should consider whether they are making curriculum decisions based on the student's learning preference's strengths.

5. Look for a tendency in environmental or hereditary factors that might impact any differences or similarities of modality preferences as a profile, and as related to achievement.

6. This study recommends that classroom teachers know and understand their own modality profile strengths before they attempt to assess those of their students.

7. Both achieving and underachieving classes should be selected into the research sample, in order to have a basis for comparisons between achieving and underachieving classes, which could show evidence of relationship(s) between modality preference and achievement.

Discussion

This section is based on the analysis of findings as well as personal observations and impressions from the data collection stage (including testing) to the conclusion of the study.

A quick look across the modality frequency tables 4 - 2 through 4 - 16 shows that there are clearly dominant modality preferences by each classroom group tested, in which grade 6 came out to be the highest in the achievement scores, followed by grade 7 and grade 8, in descending order. A closer look can also tell that preference for grade 6 children goes from kinesthetic to auditory, to visual and tactual in a descending order, but within a low magnitude, almost the reverse of modality developmental order by age level, previously supported by modality theorists that modality shift/change for most children is developmentally: kinesthetic - tactual - visual - auditory (Dunn, personal interview; Weinberg, 1983). It may also mean that the shift ends about grade 8, however further research (longitudinal) will be necessary, to clear up this inconsistency. Looking at the gender modality scores the magnitude of preference differential for males and females appears to be negligible, whereas both sexes appear to favor the auditory modality the most, followed by tactual,

kinesthetic and visual. This confirms a correct hierarchy of modality development for auditory, while distorted for visual modality being the least preferred here.

There could be several reasons again for the inconsistency discussed here - one could be that most children may have harbored test result bias (to avoid identifying some of their personal or academic characteristics), perhaps because they are not sure what it is all about. When this bias happens, it could interfere in identifying their true modality preference. An other could be that these children may not have had sufficient orientation with the concept of learning styles and how it affects school achievement, while one other possibility is that these children are among the group that neither favors nor disfavor learning best in a specific modality, hence indifference. In any case the fact remains that more research will be necessary.

In as far as achievement is concerned, the one important reason for such insignificant relationship(s) between modality preference percentage scores and the national percentile equivalent to normal curve scores on the ITBS is perhaps that such a relationship would probably more often than not occurs when testing took place after a modality based teaching, and not at random. Therefore,

testing after training seems to hold stronger promise for the modality-achievement relationship.

There is also a clear trend in that 6 graders are uniformly high relationship scores in achievement over grades 7 and 8 . The possibility for such inconsistencies remains to be further investigated.

Implications

The knowledge of modality preference takes into account the weaknesses and strengths of each learner's personal style for acquiring meaning from their experiences.

The major implications of this study results would be to assess with depth and thoroughness the assets and liabilities of students, particularly in reading comprehension, and help them become modality oriented through the application of intervening treatments. Wepman (1971) and Lerner (1976) suggest that assessment of modality strengths and weaknesses should include remediation. Kirk (1971) proposed identifying deficit areas, training these areas, and remediating prerequisite skills.

Although studies have indicated a development decision in the relationship between perceptual abilities and reading achievement, Birch and Belmont, 1965; Gruen, 1972; Hartlage, 1975; Miller and McKenna, 1981; Rudnick et al., 1967)

believe that emphasis needs to be directed toward developing a profile of which modalities are dominant and operate at each level for successful achievement, after which successful achievement patterns for perceptual dominance can be noticed.

An implication of this study suggests that facilitation of each individual's growth in modalities other than their dominant one (or for the group with no clearly dominant modality) should be encouraged. Child development research indicates that as an individual matures the modalities become more integrated (Barbe & Swassing, 1979). Instructional goals, therefore, should encourage the development toward sensory integration. Educational opportunities should provide the opportunities for individuals to practice in more than a single modality and encourage the development of strategies to transfer information from one modality to another. This is possible mostly after the emergence of one or more clearly strong modalities.

The results do suggest that complementary treatments should intervene modality profile and academic achievement, for significant relationship between the two. However, more research is necessary in this area before a definitive statement can be made regarding developmental trends in modality, remediation and academic growth.

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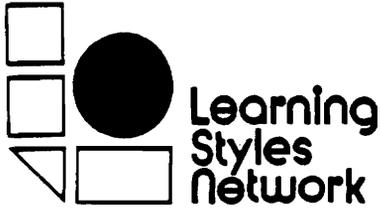
APPENDICES

APPENDIX A
LEARNING STYLE INVENTORY (LSI:5-12) ANSWER SHEET

45. I am happy when I get good grades	50	(A)	(B)	(C)	(D)	(E)
46. I like to learn most by building, making or doing things.	50	(A)	(B)	(C)	(D)	(E)
47. I usually finish my homework	50	(A)	(B)	(C)	(D)	(E)
48. If I could go to school anytime during the day, I would choose to go in the early morning.	50	(A)	(B)	(C)	(D)	(E)
49. I have to be reminded often to do something	50	(A)	(B)	(C)	(D)	(E)
50. It is harder for me to get things done in the late morning compared to the afternoon.	50	(A)	(B)	(C)	(D)	(E)
51. It is easy for me to remember what I learn when I feel it inside me	50	(A)	(B)	(C)	(D)	(E)
52. I like to be told exactly what to do	50	(A)	(B)	(C)	(D)	(E)
53. My parents are interested in how I do in school	50	(A)	(B)	(C)	(D)	(E)
54. I like my teacher to check my school work	50	(A)	(B)	(C)	(D)	(E)
55. I enjoy learning by going places	50	(A)	(B)	(C)	(D)	(E)
56. When I really have a lot of studying to do I like to work alone.	50	(A)	(B)	(C)	(D)	(E)
57. Sometimes I like to learn alone with a friend or with an adult	50	(A)	(B)	(C)	(D)	(E)
58. I can sit in one place for a long time	50	(A)	(B)	(C)	(D)	(E)
59. I cannot get interested in my school work	50	(A)	(B)	(C)	(D)	(E)
60. I really like to draw, color, or trace things.	50	(A)	(B)	(C)	(D)	(E)
61. I remember the things I hear better than when I read about them	50	(A)	(B)	(C)	(D)	(E)
62. I remember things best when I study them in the afternoon.	50	(A)	(B)	(C)	(D)	(E)
63. No one really cares if I do well in school	50	(A)	(B)	(C)	(D)	(E)
64. I really like to shape things with my hands.	50	(A)	(B)	(C)	(D)	(E)
65. When I study I put on many lights	50	(A)	(B)	(C)	(D)	(E)
66. I like to eat, drink, or chew while I study.	50	(A)	(B)	(C)	(D)	(E)
67. When I really have a lot of studying to do I like to work with a group of friends	50	(A)	(B)	(C)	(D)	(E)
68. When it's warm outside I like to go out.	50	(A)	(B)	(C)	(D)	(E)
69. I remember things best when I study them early in the morning	50	(A)	(B)	(C)	(D)	(E)
70. I can sit in one place for a long time	50	(A)	(B)	(C)	(D)	(E)
71. I often forget to do or finish my homework	50	(A)	(B)	(C)	(D)	(E)
72. I like to make things as I learn.	50	(A)	(B)	(C)	(D)	(E)
73. I can think best in the evening.	50	(A)	(B)	(C)	(D)	(E)
74. I like specific directions before I begin a task.	50	(A)	(B)	(C)	(D)	(E)
75. I am most awake around 10:00 in the morning.	50	(A)	(B)	(C)	(D)	(E)
76. The things I like doing best in school I do with friends.	50	(A)	(B)	(C)	(D)	(E)
77. I like adults nearby when I study	50	(A)	(B)	(C)	(D)	(E)
78. My family wants me to get good grades.	50	(A)	(B)	(C)	(D)	(E)
79. Late morning is the best time for me to study	50	(A)	(B)	(C)	(D)	(E)
80. I like to learn most by building, making or doing things.	50	(A)	(B)	(C)	(D)	(E)
81. I often want to start something new rather than finish what I've started.	50	(A)	(B)	(C)	(D)	(E)
82. I keep forgetting to do the things I've been told to do.	50	(A)	(B)	(C)	(D)	(E)
83. I like to be able to move and experience the motion and the feel of what I study	50	(A)	(B)	(C)	(D)	(E)
84. When I really have a lot of studying to do I like to work with two friends.	50	(A)	(B)	(C)	(D)	(E)
85. I like to learn through real experiences	50	(A)	(B)	(C)	(D)	(E)
86. If I could go to school anytime during the day, I would choose to go in the early morning.	50	(A)	(B)	(C)	(D)	(E)
87. I like to have an adult nearby when I do my school work	50	(A)	(B)	(C)	(D)	(E)
88. I can ignore most sound when I study.	50	(A)	(B)	(C)	(D)	(E)
89. If I have something new to learn, I would rather read than talk with someone to learn about it	50	(A)	(B)	(C)	(D)	(E)
90. I study best around 10:00 in the morning.	50	(A)	(B)	(C)	(D)	(E)
91. I like school most of the time	50	(A)	(B)	(C)	(D)	(E)
92. I remember things better when people tell them to me rather than when I read about them.	50	(A)	(B)	(C)	(D)	(E)
93. I often eat something while I study	50	(A)	(B)	(C)	(D)	(E)
94. I enjoy being with friends when I study.	50	(A)	(B)	(C)	(D)	(E)
95. It's hard for me to sit in one place for a long time	50	(A)	(B)	(C)	(D)	(E)
96. I remember things best when I study them before evening.	50	(A)	(B)	(C)	(D)	(E)
97. I think my teacher wants me to get good grades	50	(A)	(B)	(C)	(D)	(E)
98. I like to do things with adults.	50	(A)	(B)	(C)	(D)	(E)
99. I really like to build things	50	(A)	(B)	(C)	(D)	(E)
100. I can study best in the afternoon.	50	(A)	(B)	(C)	(D)	(E)
101. Sound bothers me when I am studying	50	(A)	(B)	(C)	(D)	(E)
102. When I really have a lot of studying to do I like to work with two friends.	50	(A)	(B)	(C)	(D)	(E)
103. When I can I do my homework in the afternoon	50	(A)	(B)	(C)	(D)	(E)
104. I love to learn new things.	50	(A)	(B)	(C)	(D)	(E)

APPENDIX B

**TWO-OF-A-KINE LEARNING STYLES
(INTERPERSONAL STYLE DIFFERENCES)**



The Center for the Study of Learning and Teaching Styles

Beyoncé C. Gato

Professor Rita Dunn, Ed. D., Director
Angela Klavas, Assistant Director

TWO-OF-A-KIND LEARNING STYLES



By Rosy Peña

School of Education and Human Services, St. John's University,
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Co-sponsored by the National Association of Secondary School Principals and St. John's University

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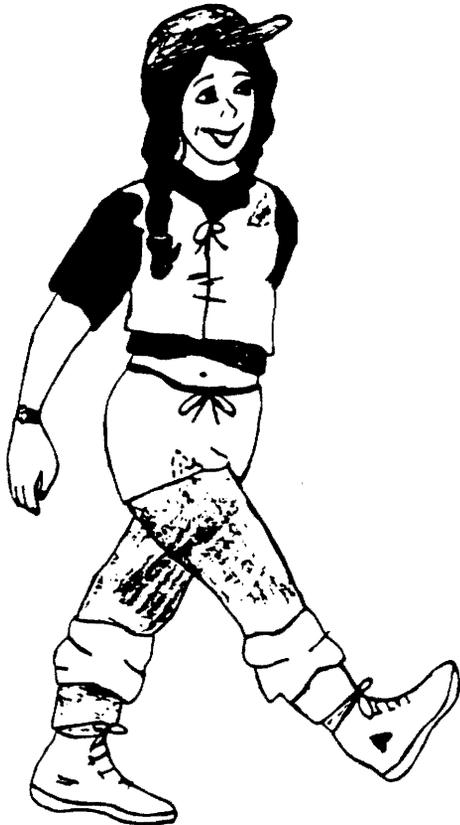
"With all my love to Mom and Dad"

TWO-OF-A-KIND LEARNING STYLES

Two of the coolest ninth graders on campus are Myrna and Victor. They seem to enjoy being themselves and letting others be themselves. These easy-going students are also locker mates who share bus seats to and from school. Except for gym class, they have identical class schedules. We often tease them about getting sick of each other. But they absolutely deny it and have been doing so for years. Do you have a friend like this?



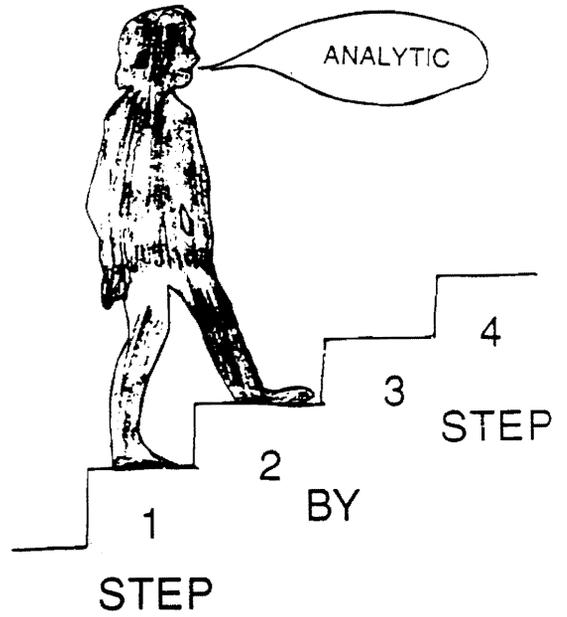
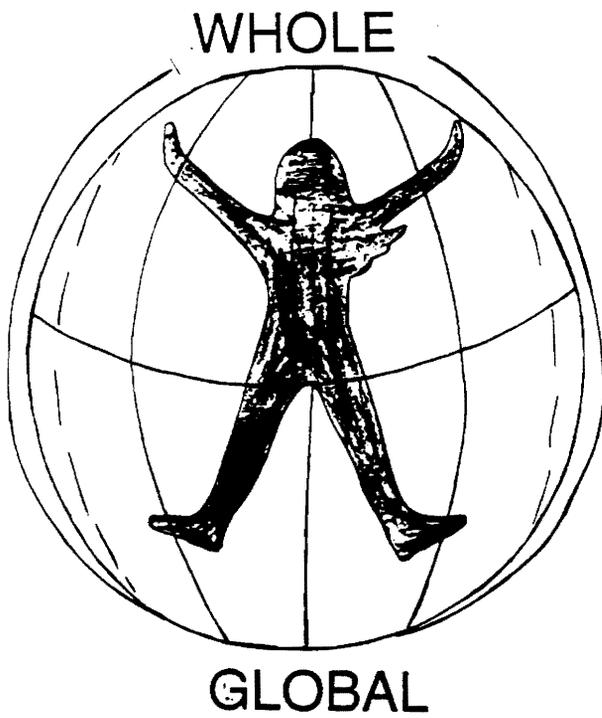
Seeing them separately, you wouldn't exactly guess that they are such good buddies. You see, they are very different from each other. Myrna is witty, carefree, and independent . . . like a nice rebel. And Victor is very shy, responsible, and organized. He is keen on following a daily routine, but Myrna finds that dull and prefers to do something different every day. What are you like?



Outside the classroom, Myrna and Victor have many things in common, such as their taste in music and jeans, the sports they like, their pizza worshipping, the movies they enjoy, and the politicians they favor. But inside the classroom, it is a totally different story.



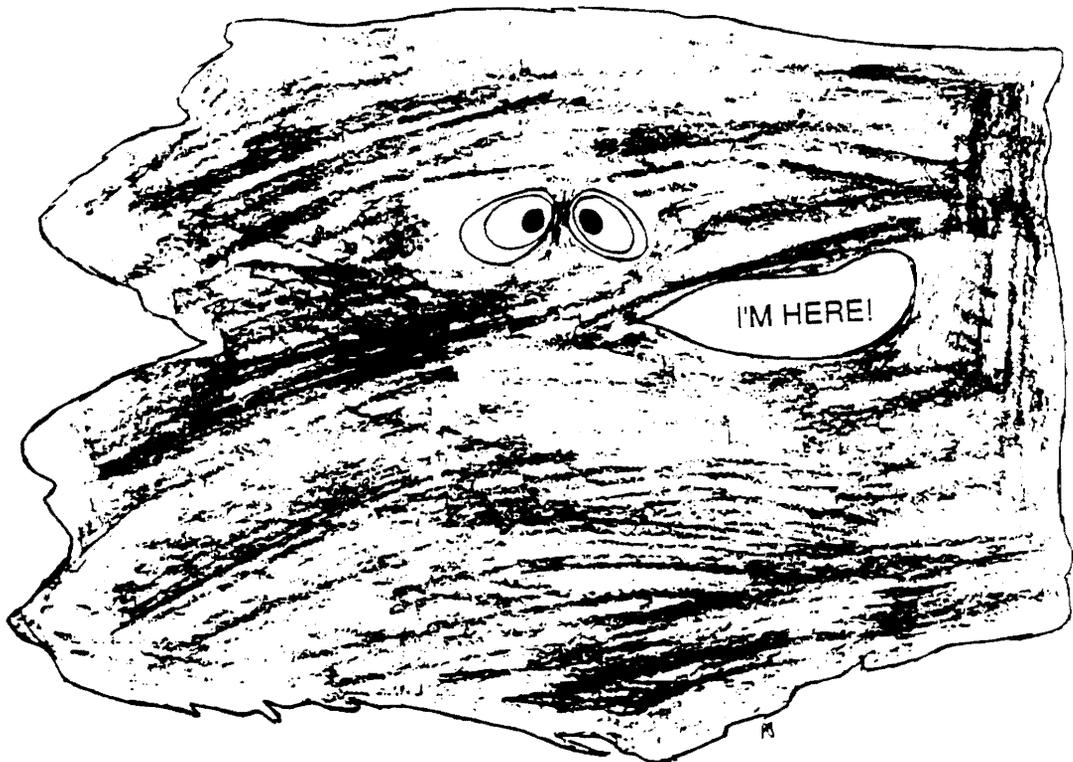
When it comes to LEARNING STYLES or the way in which we are better able to concentrate, Myrna and Victor are two unique characters - like lava and snow! She is a GLOBAL learner and he is an ANALYTIC learner. Each one learns better under certain conditions.



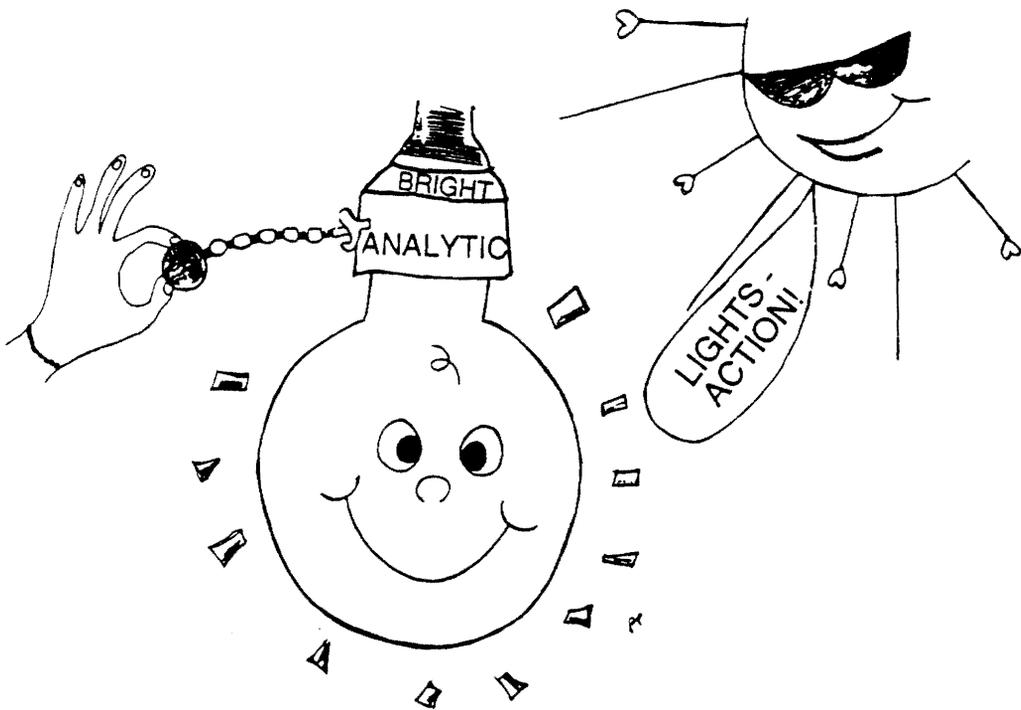
Let's start with Sound, which GLOBAL Myrna welcomes but ANALYTIC Victor does not. She works much better in a noisy room than in a quiet one. At home, music is a must! At school, she relies on classroom pitter patter. But noise gets Victor climbing the walls. He finds it difficult to concentrate when it's noisy because he requires silence! What do you prefer?



Then there is Light. GLOBAL Myrna could survive in a pit; ANALYTIC Victor flourishes in sunlight. She prefers dim light because bright light makes her restless and less able to concentrate. She also works best in the early evening. When do you do your best when your work is hard?



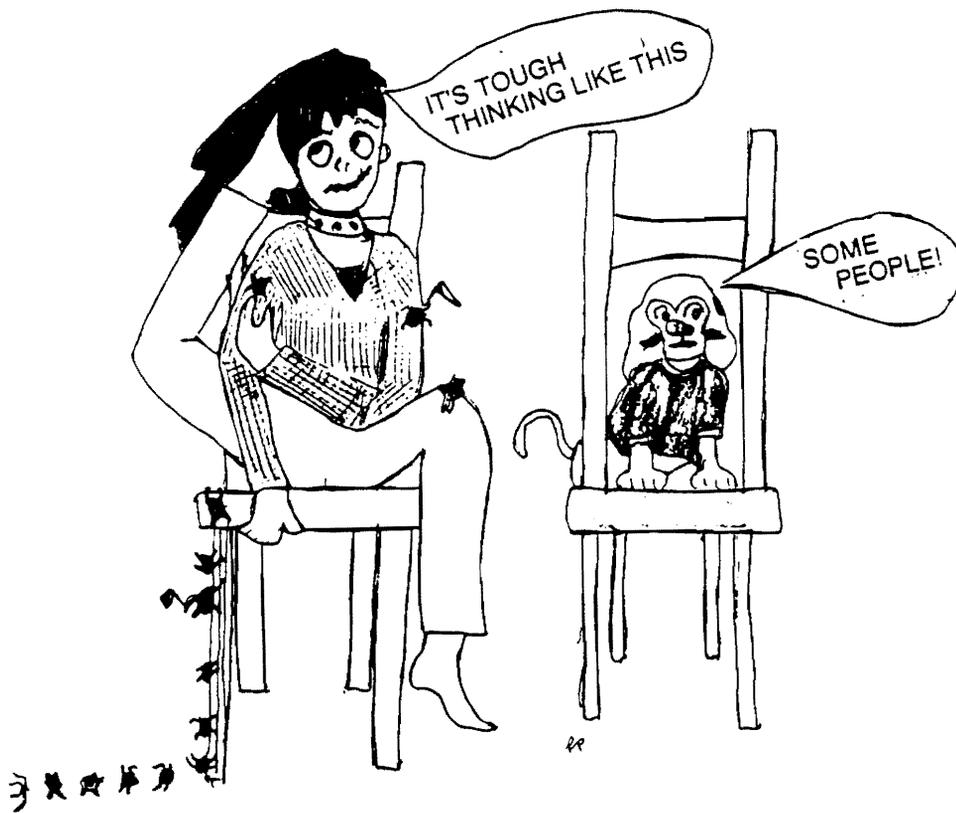
ANALYTIC Victor, who is a morning person, loves bright lights. That is why he sits up front where the lights are brighter, rather than in the dim back corner where GLOBAL Myrna sits. In which part of the room do you usually sit? Do you concentrate better under dim or bright lights?



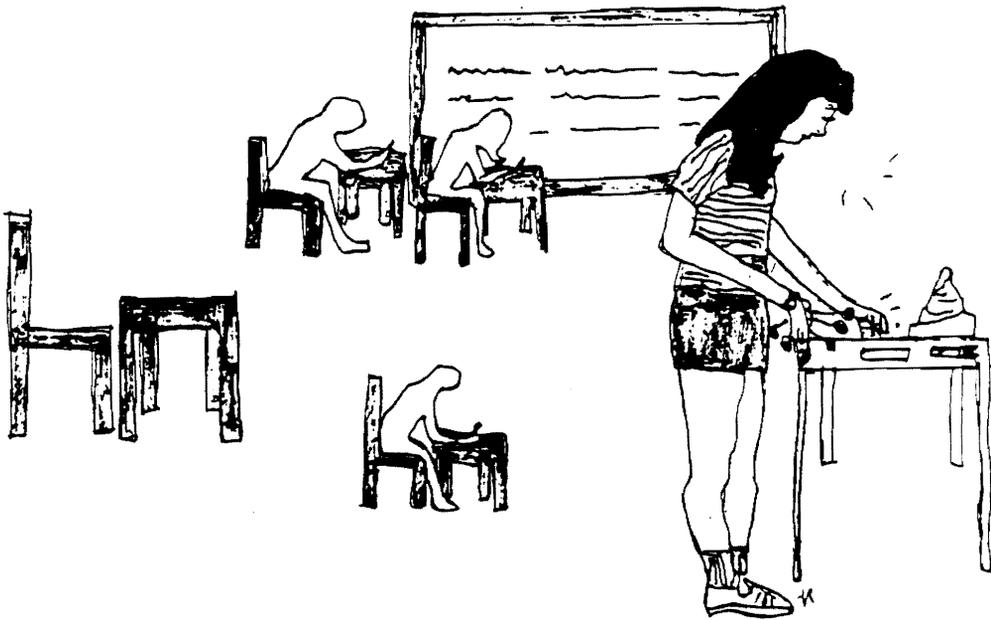
Another difference between their **LEARNING STYLES** is that **GLOBAL Myrna**, when studying, prefers to lounge on the bed with a bowl of munchies beside her and her feet bare. With dim lights, the music, the munchies and her relaxed dress code, you would think that she was throwing a party. Are you able to work well like this?



At school she prefers to sit on the rug or to recline on a cushion as she works. But if she has no choice, she simply will slouch on a chair with her feet propped up on the desk-bottom in front of her. Hard furniture makes her cranky and uncomfortable. You would think that she has ticks by the way she twists and twitches as she sits. How does hard furniture make you feel?



GLOBAL Myrna finds it quite difficult to sit still for more than a few minutes. You'll often find her pacing about the room, making stops when something catches her eye. This does not lower her grades because it's part of her personality and she is used to it. Can you sit still for a long time?



ANALYTIC Victor enjoys the traditional hard furniture. At home, as in school, he has a desk and a chair for working. GLOBAL Myrna has a stereo system and a pillow instead. He uses his bed strictly for resting and the rug for stepping on. Unlike Myrna, he usually remains seated for as long as it takes to complete an assignment, which could be hours! Does either of these students sound like you? If so, how?



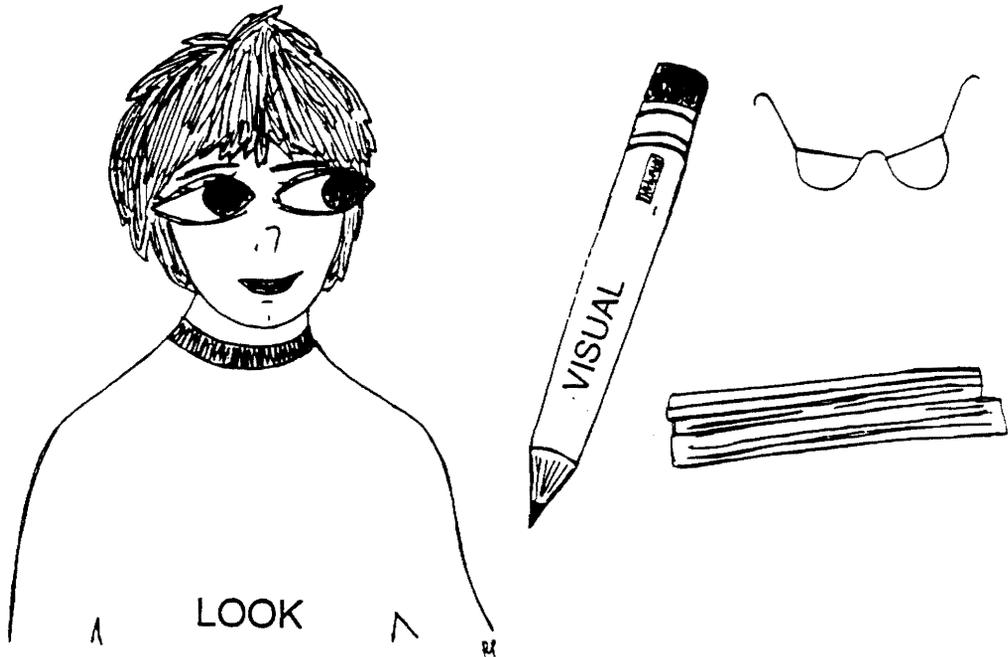
Another difference between their LEARNING STYLES is that GLOBAL Myrna prefers to read as she walks about. But such Movement would only make ANALYTIC Victor dizzy, and who knows what else?!



GLOBAL Myrna is a terrible notetaker who rarely takes written notes. You see, she is an Auditory learner. She needs to hear things in order to understand them. She takes mental notes and makes tape recordings of her lectures. In fact, when studying, she just plays back her memory and her cassettes. And it works!



ANALYTIC Victor is not an Auditory learner; he is Visual. He needs to see things in order to understand them. That is why he takes a lot of good notes. When studying a lesson, he looks back at his notes, which usually are highlighted in different colors. Do you need to see things; hear things; touch things? What do you do in order to understand?



When studying together, ANALYTIC Victor lectures to GLOBAL Myrna. She, in turn, dictates the lesson to him so that he can have it on paper. So while she has a large supply of cassettes and swabs for her Auditory learning, he has plenty of paper and pencils for his Visual learning. She specializes in government and language arts; he in algebra and physics. What is your specialty?



ANALYTIC Victor, who makes good use of his pocket planner, prefers structure and organization when learning. That is, he works at his best once the teacher has instructed him STEP-BY-STEP. He usually writes an outline and uses it when working. Have you ever written an outline . . . and used it?



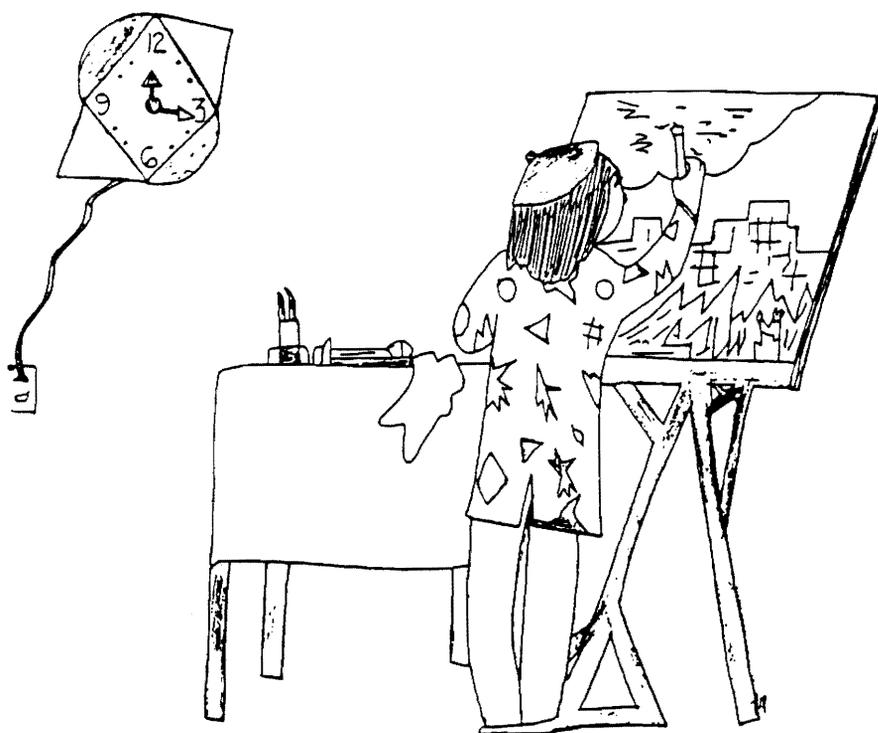
But GLOBAL Myrna, independent and inventive, prefers to be told or shown what is expected and given a choice concerning how to do it. She works her way through an assignment with little help from the teacher. She writes an outline only when asked to do so. Somehow, she comes up with new ways of tackling tasks. Do you need step-by-step instruction, or would you rather create your own steps?



When it comes to room temperature, GLOBAL Myrna and ANALYTIC Victor are like the North and South Poles. She works better in a low room temperature or in a "cold" room, but he would get a year's supply of goose bumps if left there too long. She dresses lightly - muscle shirts, shorts, and open shoes. He keeps a worn-out sweater in his locker for daily use. He frequently visits the restroom because the classroom seems too cold. Are you a North or South Pole? In what kind of clothes do you feel most comfortable?



Teachers and students often have praised ANALYTIC Victor for his Persistence. He usually completes assignments on time and follows class rules. Once he starts working on a project, he won't put it down until it is complete. He works on one thing at a time and hardly takes a break. When working, how often do you take breaks?



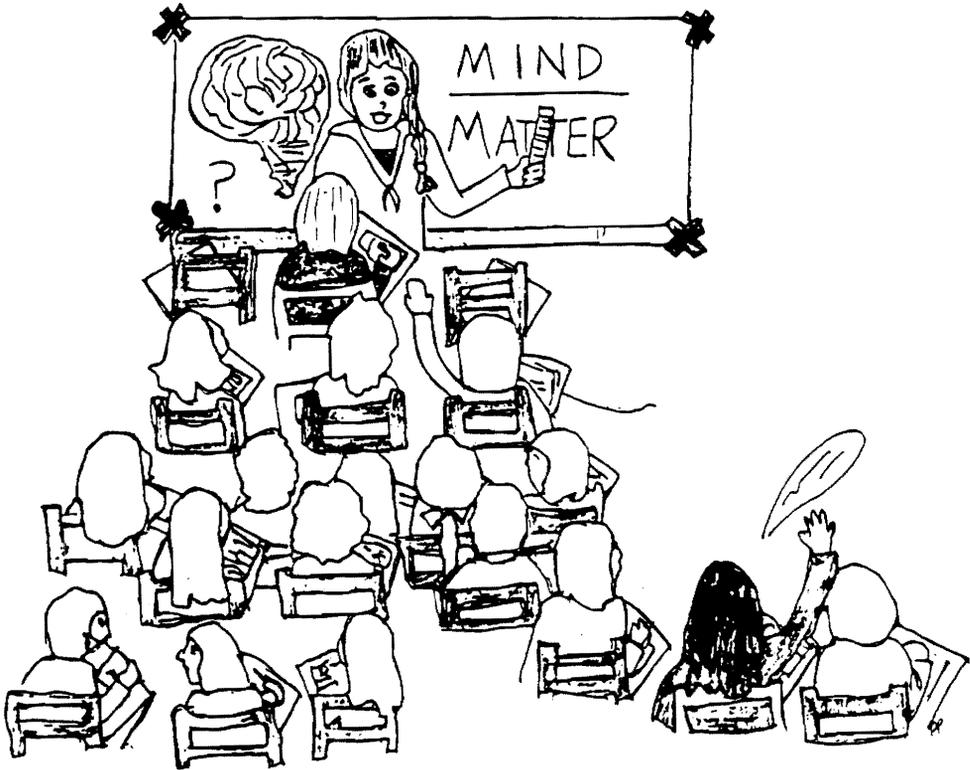
Unlike ANALYTIC Victor, GLOBAL Myrna is very sweet on time and breaks. She works on several things at once and often stops and starts again in between. Not surprisingly, you will find her writing an English composition, listening to the radio, and watching television - all at once! This really keeps her motor running. What keeps your motor running?



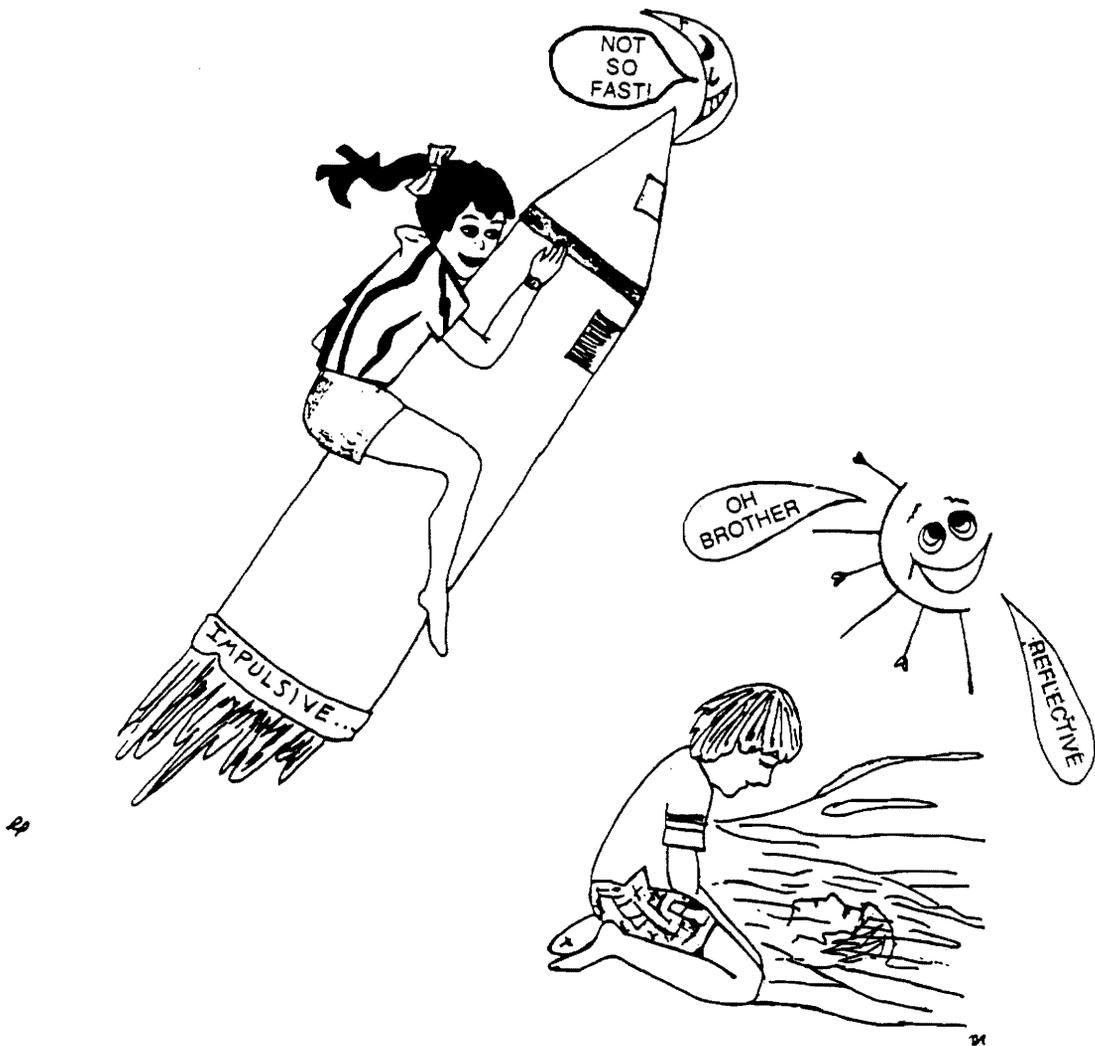
Some people learn best in groups, some alone, and others in both ways. GLOBAL Myrna prefers to study in a group; she likes team work. And she is often the spokesperson for that group. She is assertive, witty, and likes a room full of friendly faces. Do you prefer studying with others when you are trying to learn difficult material?



On the other hand, ANALYTIC Victor prefers to work alone and does so quietly. That is why he sits up front, across from the teacher and beside "invisible" students. While working, he shuts off the rest of the world. But GLOBAL Myrna sits in the back surrounded by classmates. She prefers to mingle with friends as she concentrates. Are you a group person or a loner? Either way is okay.

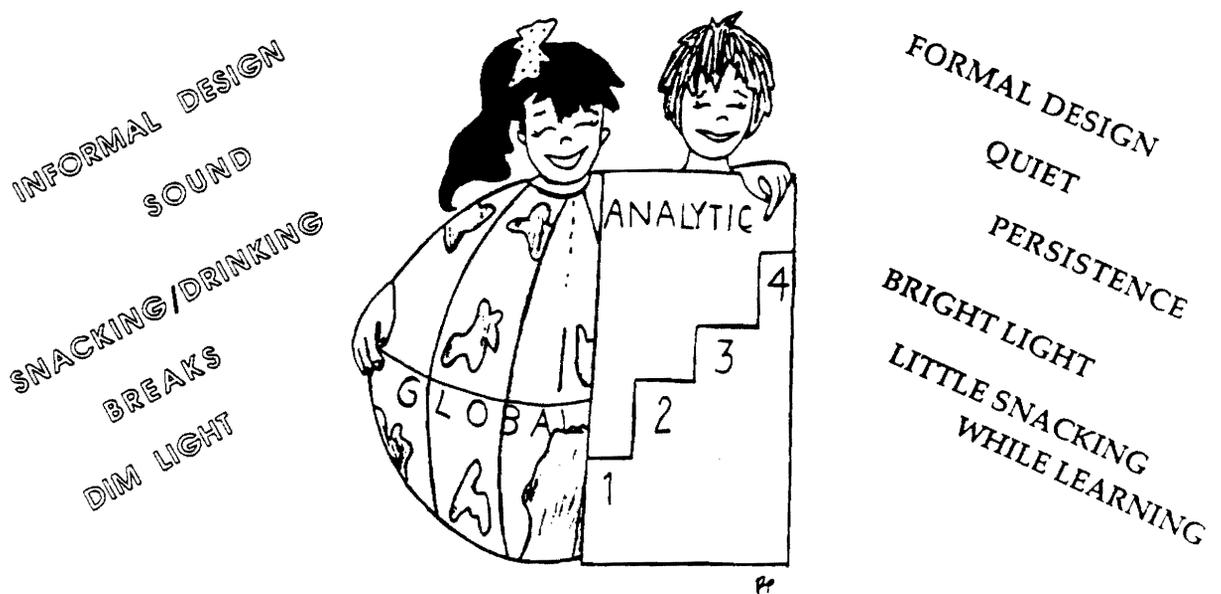


A final LEARNING STYLE difference between GLOBAL Myrna and ANALYTIC Victor is seen when they are questioned. GLOBAL Myrna answers immediately, often in detail. You see, she is Impulsive or quick-to-act. But ANALYTIC Victor is Reflective. He thinks things through carefully before acting. So he usually answers after a long pause. His answers are short and to-the-point. When questioned, do you usually respond quickly or slowly?



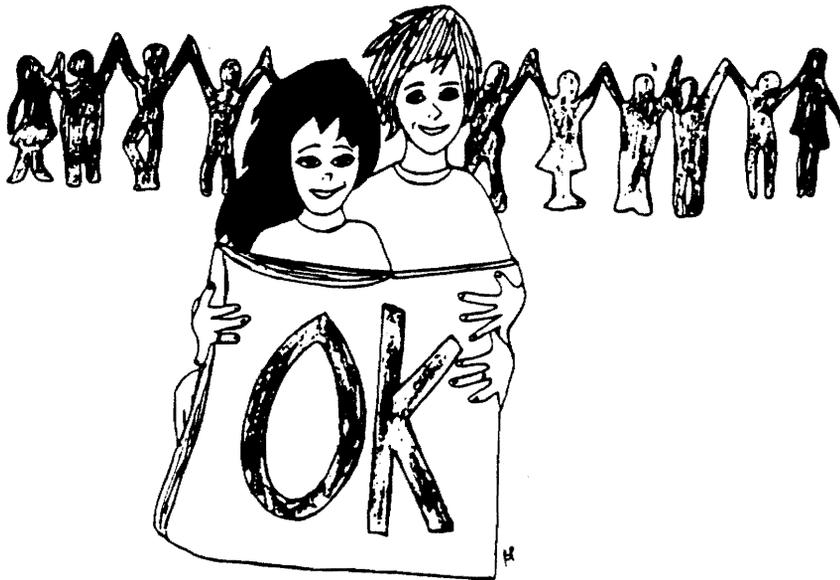
GLOBAL Myrna and ANALYTIC Victor certainly have unique LEARNING STYLES. She is GLOBAL or holistic, learning facts only after she understands the whole concept. And he is ANALYTIC, taking things in pieces, step-by-step. Each one works best under certain conditions. Let's name some of these conditions.

ARE YOU A GLOBAL OR ANALYTIC LEARNER?
OR A LITTLE OF BOTH?



- MOBILITY • KINESTHETIC • AUDITORY • VISUAL • TACTUAL •
- TEMPERATURE • RESPONSIBILITY • STRUCTURE • MOTIVATION •
- TEACHER MOTIVATED • PARENT MOTIVATED •
- SELF MOTIVATED • ALONE • IN GROUPS •
- WITH A TEACHER • IMPULSIVE/REFLECTIVE •

Although they have their differences, GLOBAL Myrna and ANALYTIC Victor are very close friends. That is because they respect their differences and really care about each other. Neither tries to change the other - or to change for him or her. You see, they feel good about themselves and they like to pass their "okay" attitudes onto everyone. Hope you've caught it! Perhaps that is why they are two of the coolest ninth graders on campus. They each study difficult material through their own LEARNING STYLE.



Many people are neither Global nor Analytic. They have one or more characteristics of each type. Do you fall into this last group? Would you like to know? Ask your teacher to give you a Learning Style Inventory and you'll find out . . .



You and I are alike
yet as different as can be.
What is one thing to you,
may be another to me.
To you the day is cloudy,
To me it's sunshine bright.
To you the movie is boring,
To me it's out of sight!
But I respect your differences;
You surely respect mine.
Perhaps that's why we're good friends,
at any given time.

APPENDIX C
CORRESPONDENCE

Professor Rita Dunn, Director
Learning Styles Network
The Center for the Study Of
Learning and Teaching Styles
School of Education & Human Resources
St. John's University
Grand Central & Utopian Parkways,
Jamaica, New York 11339

***ATTN: Dr. Dunn

Dear Dr. Dunn:

It was very rewarding for me to participate in the Learning Styles Workshop you conducted in the Spring of 1989, in Fairfax, Northern Virginia.

Currently I am doing my dissertation research in the area of Learning Styles, specifically the perceptual modalities of visual, auditory, tactual and kinesthetic, for which I need to use the Dunn, Dunn & Price Learning Style Inventory, and the "Two-Of-A-Kind Learning Styles" reading for the purpose of data collection. I will appreciate your permission for the use of these items to complete my studies.

Thank you very much for your assistance and cooperation.

Sincerely ,

Beyene G. Ogate,
VPI & State University



The Center for the Study
of Learning and Teaching Styles

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PROFESSOR RITA DUNN, Ed. D., Director

Angela Klavas, Ed. D., Assistant Director
Joanne Ingham, Ed. D., Director of Adult Learning
and Corporate Training

June 20, 1991

Mr. Beyene G. Ogato
VPI & State University
Northern Virginia Graduate Center
Falls Church, VA. 22047-1287

Dear Mr. Ogato:

This letter herein grants you permission to use the Dunn,
Dunn & Price Learning Styles Inventory and "Two-Of-A-Kind
Learning Styles" to complete your doctoral studies.

Sincerely,

Professor Rita Dunn, Director

School of Education and Human Services, St. John's University
Grand Central and Utopia Parkways, Jamaica, New York 11439

(718) 990-6161, x 6335

Co-sponsored by the National Association of Secondary School Principals and St. John's University

April 12, 1990

Mr. Richard Price
Middle Education Director
Stafford County Schools
1729 Jefferson Davis Highway
Stafford, VA 22554

Dear Mr. Price:

Thank you very much for discussing my possible dissertation study with Dr. Tom Gatewood and me. As you requested, I have enclosed a description of the study I propose to do. After you have read it, I would like to meet with you to discuss the feasibility of conducting the study in the Stafford County Schools.

Thank you very much for your interest and I will call you within the next two weeks.

Sincerely,

Beyene Ogato

Stafford County Public Schools

1729 JEFFERSON DAVIS HIGHWAY
STAFFORD, VIRGINIA 22554-9209
703-669-3141

May 22, 1991

Mr. Beyene Ogato
Northern Virginia Graduate Center
2990 Telesar Court
Falls Church, Virginia 22042

Dear Mr. Ogato,

The Stafford County Public School Division is most interested in the pursuit of research and learning and will be glad to work with you. Your research topic is one of interest to us and we will be looking forward to the results.

Please contact me so that an appropriate test schedule may be worked out. I look forward to working with you.

Sincerely,

E. Richard Price, Director of
Instructional Support Services

ERP/nmc

February 20, 1991

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To: Principals

School: _____

From: Beyene G. Ogato

Subject: Information on the doctoral research study

Pursuant to our conversation on 2/22/91 I would like to thank you for your participation in the Learning Styles research study project, and I expect this information interesting and useful to you as we work together.

The Dunn, Dunn and Price Learning Styles Inventory (LSI:5-12) will be the instrument utilized to identify perceptual modality preferences, and the Iowa Test of Basic Skills (ITBS) to assess academic achievement. Demographic data such as gender and grade level will be collected.

Permission letters are enclosed to be sent to the parents of 75 randomly selected sixth, seventh, and eighth grade students in your school. A coded list of these students are also enclosed. Please encourage the children to return these letters by 2/27/91, in order to allow for the testing on _____

I will arrive at your school and wish to begin testing at _____ a.m., per our schedule. Administration will be 15 to 20 minutes. I will highly appreciate your cooperation in providing the assistance of 3 testing teachers, to administer the tests simultaneously at all the three grade levels, and as quickly as possible, to minimize inconvenience to students, teachers and principals. A list of children to be tested will be given to the testing teachers through your office. Specific instructions regarding the purpose and objectives of the project, with reference to the participating students, will also be provided. These will be read to the students by the examining teachers.

The results will be confidential, and students will be identified by code numbers when findings are reported. I will also provide your school with copies of each child's test results before reporting to my dissertation committee.

If you have any questions or concerns regarding the logistics of this study testing, please contact me at (301) 270-1612.

Many thanks again for the opportunity to study with you, and will see you within the next six weeks, with the test results!

Sincerely yours,

Beyene G. Ogato
VPI & State University

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Dear Parent:

In cooperation with the Middle Schools of the Stafford County Public School System, I am conducting a research study focused on determining the manner in which each child learns most efficiently for optimum achievement. Through the identification of children's learning preferences and strengths, the educational program for all children can be improved. That is, this study will aid educators in providing appropriate curriculum designs to increase the academic achievement of school children.

The Learning Style Inventory (LSI:5-12) will be given to children in grades six, seven, and eight in order to identify the extent to which these children learn best, by determining the extent to which they utilize the senses of hearing, seeing, and touching & movement, in studying new and/or difficult school subjects.

It is extremely important for as many students as possible to be included in this study. A few _____th graders are being selected to participate in this study. They will be given a 15 to 20 minute test which identifies perceptual modality preferences (styles of learning). There are no academically right or wrong answers to the test questions, and therefore the test is based on personal opinion.

The test results will be compared with the results of the Iowa Test of Basic Skills (ITBS), regularly given at the Stafford County Middle Schools District. Please review this request and consider the study an opportunity for us to be able to determine how children learn best. Based on the following terms and conditions, your consent, which allows your child to participate in this study project will be appreciated greatly:

1. All information regarding the test results will be kept confidential, and students will be identified by code numbers (not names), when the findings are reported. The results will be given to the principal, before anyone else, following the conclusion of the study.
2. No identifying information about your child will be included in any reports of the study.
3. You may request a copy of the results of the study.
4. I will neither use nor retain the test data for any purpose or duration of time other than the completion of this study.

We would like your child _____ to participate in the study. Your permission for his/her participation is kindly requested. If you permit your child to participate in the study, please sign the statement below and return this letter to the school by 2/27/91. If you have questions, please feel free to discuss it with the school principal.

Thank you for your support.

Sincerely yours,

Beyene G. Ogato
VPI & State University

To _____ Middle School, Stafford County.

I give my permission for my child _____ to participate in the Learning Modality Preferences and Academic Achievement Assessment project, conducted by Beyene G. Ogato of Virginia Polytechnic Institute and State University, in cooperation with the Stafford County Middle Schools, based on the terms and conditions of this letter.

Signature of Parent/Guardian

APPENDIX D
CURRICULUM VITA

**The vita has been removed from
the scanned document**