To the Graduate Council:

I am submitting herewith a dissertation written by Marsha Gayle Butler-Tindell entitled "A Study of Relationships Among Perceptual Modality Dominance and Choice of College Major." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Education.

Dr. Russell French, Major Professor

We have read this dissertation
and recommend its acceptance:

Accepted for the Council:

Associate Vice Chancellor
and Dean of the Graduate School

"A Study of Relationships Among Perceptual Modality Dominance and Choice of College Major"

A Dissertation

Presented for the Doctor of Philosophy

Degree

The University of Tennessee, Knoxville

Marsha Gayle Butler-Tindell

December, 1994

DEDICATION

This dissertation is dedicated to my grandfather, Luther Wright. After graduating from high school in 1932, he overcame many obstacles to further his college education. While never completing a "full year" college at a time, Luther spent 8 years teaching fall semesters at Laurel Hill School in order to earn the $25 fee for undergraduate spring and summer tuition at Morehead Teachers College. After obtaining both a Bachelors and eventually a Masters degree in mathematics he returned to Johnson County, Kentucky to spend 41 years of service as both a teacher and an administrator in the Johnson County School System. His stern and disciplined approach to education is still remembered and respected as he continues to impact his community. This dedication to hard work and his example of personal character is something I have always admired. He has always filled our family with love and laughter.

These are the lessons he has passed on to me.

I Love You Papaw!

ACKNOWLEDGMENTS

Special thanks to Dr. Russell French, my major professor for his patience and assistance over the years and over the miles. I would also like to thank my other committee members, Dr. Glennon Rowell, Dr. W. Lee Humphreys, Dr. Don Dickinson and Dr. Charles Chance for their encouragement through this process.

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Most importantly, I would like to thank my parents, Paul and Alethea Ann Butler for your constant support and encouragement during this "never ending" process: (Yes, dad...It's <u>really</u> finished!) You have always taught me that if "I think I can", anything is within reach. Well, like that "little engine that could", it's off to another adventure! You'll never know how much I appreciate knowing you're always there for me.

"For I know the plans I have for you declares the Lord, plans to prosper you and not to harm you, plans to give you hope and a future."

Jeremiah 29:11

ABSTRACT

This study focused on the relationships among advanced students' perceptual learning style(s) and their college major. The Multi-Modal Paired Associates Learning Test, Revised (MMPALT-II) was used to assess seven individual perceptual modalities: print, aural, interactive, visual, haptic, kinesthetic and olfactory.

A total of 40 subjects participated in this study, 10 from each of the following academic programs: Architecture, Engineering, Social Work, and Human Performance and Sports Studies. All subjects had obtained senior status and were expected to graduate shortly.

Deans and/or Department Heads representing each of the four majors studied were interviewed and asked to predict the dominant perceptual learning styles of students in their academic areas. These predictions were used to answer the question, "Are the patterns of dominance exhibited by seniors in a given major what we expect?"

This study resulted in the following findings:

1. All seven perceptual styles identified by French did manifest themselves in this selected adult university student population. However, olfactory was not a dominant learning mode for any of the students tested.

2. There were measurable variations in the perceptual learning styles of this university student population.

3. College seniors in a given major within this university population did exhibit similar patterns of perceptual learning style dominance as measured by the MMPALT-II, but there were also differences in styles among them.

4. College administrators representing the academic majors studied were sometimes, but not always able to correctly predict the dominant styles of successful students in their programs.

Implications for advising, academic counseling and instruction are discussed.

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CHAPTER 1
INTRODUCTION

IMPORTANCE OF LEARNING STYLES

Many educators agree that the primary goal of the educational system is to maximize the learning potential of students. Part of the goal of American higher education is to assist students in learning in a way that is the least frustrating and complicated for them, while preparing them for a career in which they will excel (James & Galbraith, 1984). Our current educational system faces change as it attempts to focus on the individuality of the student and to provide opportunities for students to be successful both during their college careers and beyond.

One way to provide this kind of education is to determine the most favorable conditions of learning for each individual student by determining his or her dominant "learning style(s)." By determining a student's areas of strength, or predominant learning style(s) , we can aid students in excelling and in utilizing their areas of dominance. Alton Grun (1986) supports this concept by stating that individuals who work principally in their dominant style, while developing other styles, will be more involved and will experience more success in their academic work. James (1990) suggests that forcing students to operate in their "weakest" learning style(s) can create a very frustrating and stressful situation. According to Hand (1990), we must not only help students become aware of these individualized styles, but also help them develop strategies for dealing with the diverse demands of school.

Educators must look at how students develop strategies for dealing with frustrating areas of learning, especially in areas where they are forced to perform utilizing styles that are their weakest.

CONCEPTUALIZATION OF LEARNING STYLES

Much research is found in the general area of "learning styles". However, the term "learning style" is currently used by educators and researchers to describe various concepts.

Cornett (1983) suggests that the broad field of learning styles can be viewed as having three aspects: the cognitive, the affective, and the physiological.

The cognitive aspect, as defined by Cornett, focuses on the way individuals decode, encode, process, store and retrieve the information they take in. Some individuals perform these functions in an abstract fashion where others are more concrete (James & Blank ,1991). Some individuals process data randomly whereas others process information on a sequential basis. (Cornett, 1983).

The affective aspect includes the emotional and personality characteristics of the individual. Cornett suggests that affective styles affect attention span, level of motivation, risk taking, sociability, interests, and other

related elements. These individual differences in the affective aspect of learning style may manifest themselves in how students are affected by praise and reinforcement and in whether a student prefers to work within a group or alone.

Physiological style, the third aspect of learning style suggested by Cornett, deals with sensory perception, physical environmental conditions and need for bodily intake.

According to Cornett, individuals vary widely in their ability to receive information through print, auditory , kinesthetic, and olfactory channels. Cornett's placement of these channels is not congruent with the conceptualizations of other researchers who deal with perceptual modality apart from the physiological .

In another conceptualization, Curry (1987) suggests that virtually all learning style instruments fall into one of three categories: the "Instructional Preference" category focusing on teaching and learning settings; "Information Processing" often referred to as the cognitive processing theory; and "Cognitive Personality" or the personality dimensions that affect the learning process.

Claxton and Murrell (1987) developed four categories of learning style assessment : (a) basic characteristics of personality; (b)social interaction models describing student behaviors and interactions in the classroom

setting; (c) learning environment and instructional preference models and (d) information processing models describing how people receive and process information.

French (1975a), Schaiper (1983), and Cherry (1981) represent yet another way of conceptualizing styles. According to French, there are four dimensions of one's overall learning style: perceptual, cognitive, emotional, and social (1975a). These perceptual styles focus on the manner in which an individual extracts information from the environment through the senses. According to Schaiper (1983), Cherry(1981), and James (1986), all individuals do have dominant perceptual learning styles, and when allowed to operate in these styles, they feel a sense of comfort and control. It has also been determined that individuals are often pressed to use styles that are not their strengths.

French (1975) conceptualized seven perceptual learning styles: print, aural, visual, interactive, haptic, kinesthetic, and olfactory. Following are descriptions of each modality .

1. Print Learner- A person who is print-oriented often learns well through reading and writing. Print refers only to "printed or written words."

2. Aural Learner - A person who is aurally-oriented generally learns well through listening.

3. Interactive Learner - Individuals who learn well through verbalization usually are interactive learners.

4. Visual Learner - A person who is visually-oriented learns well through visual stimuli and visual representations. Visual refers to visual depictions excluding the printed presentation.

5. Haptic Learner - Individuals who learn well through the sense of touch and feel are generally haptic learners.

6. Kinesthetic Learner - Individuals who learn through the sense of movemement are kinesthetic learners.

7. Olfactory Learner - Individuals who learn well through the senses of smell and taste are olfactory learners.

ASSESSMENT OF LEARNING STYLES

The seven modalities described previously are referred to as perceptual modality elements which make up one aspect of an individual's total perceptual learning style. The assessment of these perceptual modality elements has provided much controversy among researchers. One main concern with many perceptual instruments is the failure to measure a wide range of modality preferences. Scarbrough (1976) concluded in her dissertation that the "Investigation into learning styles preference has been hampered by the lack of appropriate instruments." Many of the perceptual assessment instruments deal with only a limited number of modalities with most measuring three or fewer modalities. Barbe, Swassing, and Milone (1979) state that "classroom teachers are in need of a tool that is practical and yet provides them with information that can serve as the basis for planning instruction around multiple modality strengths."

Another controversy in the field of perceptual learning styles concerns the validity of information gained in self report instruments. Barbe and Milone state in 1982 that much research has shown that what we think is true is not always the case and that if learners are not aware of their strengths and weaknesses, then diagnostic instruments that utilize actual learning tasks may be more beneficial to researchers in the field. They feel that actual assessment of learning styles and careful observation should be stressed.

Much research has been done utilizing the Multi Modal Paired Associates Learning Test, Revised (MMPALT-II). This assessment addresses the two problems debated in the literature: testing of a range of modalities and in-mode rather than paper and pencil testing. MMPALT-II uses an in-mode, paired associates based testing of the seven perceptual modalities conceptualized by French (1975a, 1975b). Each of the seven subtests measures a subject's ability to recall and discriminate among information presented through each of the seven perceptual modalities. For each modality, 10 pairs of stimuli are presented to the subject using the particular modality being tested. After the 10 pairs of stimuli for a modality are presented together, then only one member of the stimulus pair is presented and the subject has 10 seconds to recall from memory the correct paired stimulus presented earlier. Each subtest yields a raw score ranging from 0-10 indicating the number of correct stimuli recalled.

The MMPALT-II has already been used in research conducted by Gilley (1975 / 1976), Cherry (1981 / 1982), Schaiper (1987 / 1988), James (1984), Galbraith (1984), and Blank (1991). Gilley (1975 / 1976) developed and tested the original MMPALT, an objective system for measuring six of the perceptual modalities conceptualized by French (1975a, 1975b). He utilized the MMPALT to test third grade students. Cherry expanded the MMPALT-II to include the olfactory element and tested a diverse population of 96 adults. He also developed a self reporting instrument to correlate subjects' perceptions of their perceptual strengths and weaknesses. Cherry finds only low correlations between subjects self-reported perceptual styles and strengths

and weaknesses as measured by the MMPALT-II. Schaiper further modified the MMPALT-II with his study of 53 university students. Galbraith and James (1984) also furthered the research with this instrument using a population of adults ranging from university students to senior adults.

This study will focus on the presence of these seven modalities among college students within different academic majors.

PROBLEM STATEMENT

Even after the development of a body of learning style theory and a fair amount of research, we still have little information about the role, if any, that learning style plays in a person's educational choices and/or selection of a career or vocation. Are persons with particular styles likely to be more successful and comfortable in certain careers or vocational areas? Do persons with certain styles demonstrate superior academic performance in certain academic majors? Do they tend to persevere in those academic majors? If we can learn more about the relationships of specific learning styles to various subjects, disciplines, and educational majors, perhaps we can better counsel persons in their educational decisions. The problem under investigation in this study is the relationship between perceptual learning style and a college student's academic major.

STATEMENT OF PURPOSE

The specific purpose of this research was to examine the relationships between an advanced student's perceptual learning style(s) as measured by the MMPALT-II and his or her college major. For purposes of the study, advanced students were defined as seniors within two semesters of graduation. This population was selected because they could also be defined as successful students, ones who have survived their university experience and mastered enough knowledge and skills for a degree in their chosen professional fields.

Four questions will serve to organize this study:

1. Do the seven perceptual styles identified by French manifest themselves in this selected adult university student population?

2. Are there measurable variations in the perceptual learning styles of this university student population?

3. Do college seniors in a given major exhibit similar patterns of perceptual learning style dominance as measured by the MMPALT-II?

4. Are the patterns of dominance exhibited by seniors in a given major what we expect?

PREDICTIONS

In order to respond to question four, "Are the patterns of dominance exhibited by seniors in a given major what we expect?", predictions were created as a result of individual interviews with deans and/or department heads from each program of study represented by subjects. Procedures for the MMPALT-II were explained and a general overview of perceptual learning styles was presented to the deans/department heads, leading to discussions of expected style dominance in each major. The following four predictions were derived as a result of these discussions.

1. Students with a major in architecture will show dominance as measured by the MMPALT-II in the haptic and visual modalities.

2. Students with a major in social work will show dominance as measured by the MMPALT-II in the interactive and aural modalities.

3. Students with a major in engineering will show dominance as measured by the MMPALT-II in the interactive and print modalities.

4. Students with a major in human performance and sports studies will show dominance as measured by the MMPALT-II in the kinesthetic and haptic modalities.

Findings pertaining to these predictions will be presented as responses to question four.

SIGNIFICANCE OF THE STUDY

If the results of this study show a relationship between perceptual learning styles and choice of college major, then there are a number of implications for student advising, academic counseling, and instruction. Further, this study provided individual subjects with specific information regarding their level of strength or weakness in each of the seven perceptual modalities as measured by the MMPALT-II. Dominant, moderate and limited capacity modes were identified. Subjects were able to discuss their profiles with an evaluator, and they were given information on the application of their perceptual profiles in their future learning endeavors.

Testing results for all participating students were given to the deans and/or department heads of all participating majors for use in their individual programs and departments. These deans and/or department heads were eager to see the results and consider their implications.

PROCEDURES

Selection of Subjects

A total of 40 subjects participated in this study, 10 from each of the following academic programs: architecture, engineering, social work, and

human performance and sports studies. These disciplines were chosen as representatives of four colleges at the University of Tennessee in Knoxville. All of these programs are "Professional Majors" preparing students for specific career directed fields. Each program focuses on training students for specific career objectives in their field; thus a high percentage of their graduates pursue careers resulting directly from their programs of study. Eligible students were contacted by department heads and lists of interested students were obtained. These students were contacted by phone by the investigator. Students were presented with the goals and objectives and procedures of the study and then given the opportunity to volunteer for the project. Upon volunteering to participate, these students signed informed consent forms and agreed to take the MMPALT-II on a designated date, and to have their results published in this study under concealed names.

Data Collection

The MMPALT-II (Multi -Modal Paired Associates Learning Test - Revised) was administered to each student. This instrument uses a paired associates testing procedure involving seven different subtests, each measuring a subject's ability to discriminate and recall information in each of the seven perceptual learning styles based on French's 1975 theory. All information is presented in the modality being tested. Ten stimulus-response pairs are utilized in the measurement of each perceptual style. First, the stimulus-response pairs are presented for seven seconds, then only the stimulus items are presented in a different order. The subject being tested

has ten seconds to recall the correct response member of the pair. Information is recalled through the mode being tested; for instance, some information is recalled pictorially whereas other information is recalled aurally. An added factor in the assessment is discrimination. Subjects must be able to discriminate among pairs of letters (print), pairs of sounds (aural), pairs of pictures (visual), pairs of speech (interactive), pairs of objects (haptic), clusters of movement (kinesthetic), and pairs of odors (olfactory).

Participation in the styles measurement process involved the scheduling of students for a 2 hour testing period. During this time, students were given a 20 minute introduction to the concept of perceptual learning styles and a demonstration of the testing procedures (See Appendix B). Subjects were then tested in a group for dominance in print, visual, and aural modalities. This procedure required approximately 20 minutes for testing in all three modalities, followed by 15 minute individual tests in haptic, interactive, kinesthetic, and olfactory capacities. A 20-minute informal interview concluded the testing period. In the interview, subjects obtained their modality strengths and weaknesses and discussed with the investigator the application of this information to future learning endeavors.

MMPALT -II Scoring Procedure

The MMPALT-II identifies the relative strengths and weaknesses of the subject in each of seven elements of perceptual style: print, aural, interactive, visual, haptic, kinesthetic, and olfactory. The test consists of pairing ten sets

of stimulus and response items for each element and is scored on the number of correctly paired responses. The seven scores (one for each element tested) for each subject are arranged from high to low to produce an ordering of the subject's perceptual learning modes. A score of 8, 9, or 10 is considered a dominant style; scores of 5, 6, or 7 are considered moderate capacity; and scores of 0-4 show limited capacity in that mode.

LIMITATIONS OF THE STUDY

1. The sample was restricted to 40 volunteer students enrolled in specific courses and majors at the University of Tennessee in the spring of 1993.

2. Although precautions were taken to balance the level of difficulty across the seven tests which constitute the MMPALT-II and to ensure that tests were administered in exactly the same way, absence of imbalance and absolute parallelism in administration cannot be verified.

3. The MMPALT-II is based on a paired associates testing procedure. This process measures a person's ability to remember and/or discriminate among data presented within a particular framework. The procedure may not measure all factors which constitute one's perceptual learning style.

ASSUMPTIONS OF THE STUDY

A brief history of the development of the MMPALT-II is necessary to provide the important information related to the assumptions underlying this study. In collaboration with French, Gilley (1975/1976) developed, tested and validated the original Multi-Modal Paired Associates Learning Test (MMPALT). Before Gilley used the instrument, he made revisions based upon feedback from a panel of experts in psychology, reading, special education, science, curriculum, educational administration, educational media, and physical education. The MMPALT was then revised by Cherry in 1981 after consultation with Gilley and French (MMPALT-II). All modifications were consistent with Paired-Associates learning theory and were based on the recommendations of Gilley. Schaiper utilized the same instrument in his study of college students with some minor changes in the olfactory and haptic portions of the test. These minor modifications, made because of a lack of availability of items, were made after consultation with Cherry and French. This researcher utilized the Cherry instrument with minor modifications in the visual and olfactory tests. Changes in the olfactory test were made because of difficulty in item availability. Changes in the visual test were made because of similarity between two previously paired items. Both changes were made based on consultation with Schaiper, Cherry, and French.

Basic assumptions of this study are:

1. The MMPALT-II is a valid and reliable instrument for testing perceptual modality learning style dominance.

2. The seven individual tests that make up the MMPALT-II are equivalent in difficulty.

3. Changes made in the testing protocol made by this researcher did not bias results of the study.

4. Test administrators did nothing to bias the results of this testing procedure.

5. The use of volunteer subjects did not distort or damage the findings of this study.

DEFINITION OF TERMS

Subject - Any of 40 University of Tennessee students participating in this study who were successful in their academic program as defined by gaining senior status and obtaining a minimum average GPA of 2.0.

Learning Style - The qualitative individual differences that characterize an individual's unique process of learning.

Learning Modality -The particular manner in which each person receives, processes and recalls information from the outside world.

Mutiple Dominance - Situations in which two or more modality elements exhibited scores of 8, 9, or 10 in an individual's profile.

Perceptual Learning Style - The manner in which each person extracts information from the environment by the senses.

Print Learner - A person who often learns well through reading and writing. Print refers only to the "printed or written words."

Aural Learner - A person who generally learns well through listening.

Interactive Learner - A person who learns well through verbalization.

Visual Learner - A person who is visually-oriented learns well through visual stimuli and visual representations. Visual refers to visual depictions excluding the printed information.

Haptic Learner - Individuals who learn well through touch and grasping are generally haptic learners.

Kinesthetic Learner - A person who is kinesthetically-oriented learns well while moving.

Olfactory Learner - Individuals who learn well through the senses of smell and taste.

MMPALT II - The Multi Modal Paired Associates Learning Test -Revised. (Developed by Ed Cherry and Russell French in 1981). A seven-set, paired associates learning test designed to order the perceptual modality strengths and weaknesses of each subject.

ORGANIZATION OF THE STUDY

Chapter one provides the background for the study and specifies the purpose of the study. The limitations and assumptions of the study are included as well as definitions of terms.

Chapter two presents a review of the related literature in the field of learning styles and perceptual modalities. Assessment instruments are discussed as well as related research with child and adult populations.

Chapter three details the procedures utilized in this study. The MMPALT-II is described as well as the procedures of subject selection, training of evaluators, administration of testing procedures, and data analysis.

Chapter four presents the findings of this study. Both individual and group data are presented.

Chapter five discusses the implications of the investigation. The conclusions are outlined, and recommendations for future research are presented.

CHAPTER 2
REVIEW OF THE LITERATURE

The purpose of this chapter is to review the theory and research related to the present study. This chapter is divided into five sections : 1) a discussion of the concept and importance of learning theory, 2) a review of methods of learning assessment and research, including perceptual learning styles, 3) controversies about perceptual learning style Instruments, and 4) a review of research utilizing the MMPALT-II.

LEARNING THEORY

There are several theories of learning. Some are consistent with the concept of learning style, and others are not. In order to establish a theoretical basis for learning style research, two learning theories are discussed here, one that is consistent with the learning style concept and one that is not.

The behaviorist approach to learning emphasizes the importance of environmental determinants in shaping behavior. In 1913, John B. Watson published a landmark paper titled "Psychology as a Behaviorist Views It." He writes, "The time seems to have come when psychology must discard all reference to consciousness when it need no longer delude itself into thinking that it is making mental states the object of observation" (pp. 158-159). B.F. Skinner (1954) insists that psychologists analyze in a rigorous and scientific

way how environmental events influence and determine observable behaviors. Skinner's ideas stress the study of observable behaviors, the importance of environmental reinforcements, and the exclusion of mental processes. These views do not deny the role of heredity, but they argue that whereas one cannot do much about manipulating heredity, the environment can be altered to change behavior. They emphasize the study of learning and the conditions that govern whether learning will occur. Changing environments by changing stimuli or the consequences that follow behavior can profoundly change an organism's behavior.

This approach presents a mechanistic picture of human beings as well ordered machines that respond automatically to external stimuli. Stimuli are put in, and appropriate responses, learned from past experience, spill out. Therefore, the role of a learner is nothing more than a passive responder to the stimuli presented.

Meyer (1979) defines learning style in the following way :

> Style is a replication of patterning, whether in human behavior or in the artifacts produced by human behavior, that results from a series of choices made within some set of constraints (p.3).

French (1975) defines learning style as the way(s) in which a human being acts upon his or her environment.

When the behavioral view of learning is compared to these definitions of learning style, inconsistencies are clearly apparent. The behavioral view is not compatible with the concept of learning styles.

A way to view the process of learning that is consistent with the concept of learning style is through cognitive theory. According to Gagne' (1983) cognitive theory recognizes that the external world delivers information to the learner. The cognitive orientation focuses on the mental activities of the learner that lead to a response. Frey (1989/1990) states that according to this framework, learning is not an automatic process. It requires mindfulness. Letteri (1985) explains this mindfulness as a sustained and conscious effort on the part of the individual. Frey refers to this cognitive orientation as acknowledging two operations: 1) actively selecting stimuli and 2) organizing material. Cognitive theory conceptualizes learning as an active and goal-oriented process that is dependent on the mental activities of the learner. Current theories of cognition identify three functions that must be performed if learning is to occur: 1) collection of new information, 2) combination of disparate pieces of new information, and 3) relation of new to old information. This approach views the learner as an active participant in the learning process, one who makes meaning of his or her environment and responds in a way different from others who respond to the same environment.

Messick (1969) refers to cognitive style as the characteristic manner in which a person receives, processes, stores and retrieves information. Cognitive styles are consistent individual differences in ways of mentally

organizing and processing both information and experience. Styles are like generalized habits of thought, the enduring structural basis for behavior. Messick (1984) conceptualizes styles as characteristic self-consistencies in information processing that develop around underlying preferences or individual tendencies. Furthermore, cognitive styles tend to be pervasive and to overlap cognitive, intellectual, personality, and interpersonal domains.

When looking at the cognitive perspective on learning, we can see the role of a person and his or her unique way of acting upon the environment, therefore providing a clear consistency between recent learning theory and the concept of learning style. The term recent implies that cognitive theory, while having deep historical roots, has come into its own fairly recently. Learning style research is a product of the past 25 years. It appears that current learning style theory, research and application could not move forward until long-held tenets of behaviorism were replaced with a new learning paradigm.

LEARNING STYLE

Much of the research found on learning style is in direct context of the instructional process. Alton F. Grun (1986) states that "Learning is a complex interactive process involving a combination of student and teacher activity within a specific learning environment to promote the acquisition of knowledge and understanding, to develop certain skills, and to achieve other related learning objectives."

One of the central elements in the student/teacher interaction process is the individual student and his or her learning style. However, one of the problems in facilitating learning is that educators do not realize or understand the significance of learning style as an indicator of individual differences, nor do they know how to adapt to different learning styles (Keefe, 1979).

According to Grun (1986), part of the problem is that much of the research focuses on the assumption that learning is primarily related to instruction. Therefore, if instruction is basically organized and presented in a clear manner, at least from the perspective of the teacher, then learning should naturally take place. If the learning does not happen, the earlier generation tended to blame the student while the current perspective is to hold the teacher, administrator, or school responsible for the lack of learning. We have now begun to focus on the individualization and diagnosis of the student's needs and personal styles of learning.

Keefe (1979) supports this shift of focus from instruction to diagnosis by stating:

> Learning style diagnosis opens the door to placing individualized instruction on a more rational basis. It gives the most powerful leverage yet available to educators to analyze, motivate, and assist students in school. As such, it is the foundation of a truly modern approach to education. This current diagnostic approach to learning styles focuses on the assistance to the individual student in finding an academic environment that best promotes his or her achievement.

In Schools without Failure (1961) Glasser addresses the idea of problems in learning when he assumes that students experience difficulties in learning because they are not fully involved in learning activities, they find little relevance in the curriculum, and they are not challenged to think critically and creatively. This view assumes that we make meaning through involvement in our learning process. The conditions identified by Glasser lead typically to academic performance that is often acceptable but below student capabilities or performance that is unacceptable and thus failing. The term "involvement" in this view is somewhat nebulous and can be sharpened through conceptualizations of learning styles and their applications in the learning process.

From Glasser's perspective, the matching of learning style and academic discipline would provide relevance and increase the likelihood of personal involvement. Also, by developing supporting learning styles, different forms of information processing are promoted.

According to Alton Grun (1986), Glasser's studies also show that each individual has a dominant and distinct learning style along with other supporting learning styles and that individuals working principally in their dominant style while developing other styles, will be more involved, will find material more relevant, and will use their critical and creative faculties more effectively; for example, they will experience more success in their academic work.

Claxton and Murrell (1987) find that from the perspective of students, knowledge of learning style increased their success in courses. The experience of learning how to learn was an empowering one that helped students become lifelong learners. Thus, these authors recommend that institutions

> Establish curricular experiences that focus on helping students learn how to learn. Orientation activities...can be geared to helping students better understand how learning occurs... Learning style inventories and other processes can be used to help make them aware of their own preferences and strengths. Attention should also be given to helping students develop strategies for succeeding in courses... (p. 78).

Those recommendations clearly support the diagnosing the learning styles of entering freshman and, subsequently, providing them with instruction in how to study using their respective preferences and strengths Certainly, the findings of the researchers cited above suggest the potential role of learning style assessment and application in building student success in college.

This research is also taken further to incorporate learning styles into a student's choice of academic discipline or major. According to Kolb's theory of learning styles, academic performance is enhanced when the individual's learning style matches the academic subject. Also, additional learning styles can be enhanced through guided instruction. Moreover, when there is a match between learning style and academic discipline, individuals will become more fully adapted to the learning environment, not only academically, but also psychologically.

The literature is clear that we must understand these unique differences in people and utilize them for the benefit of the student. Grun (1986) supports this notion again by stating, "Learning style differences seem relatively important, and it seems reasonable to argue that learning styles do play an important role in understanding differences in performance among individuals and provide at least a limited means for predicting performance." His research with 165 male and female students showed that 'Learning styles were found to be related to academic major or subject areas, to academic performance ... and potentially to careers."

METHODS OF LEARNING ASSESSMENT AND RESEARCH

Researchers have attempted to categorize learning styles and the instruments which measure them into a toponymy, making the research somewhat more manageable. Cornett (1983) suggests that the broad field of learning style can be viewed as having three aspects. These include (1) the cognitive which focuses on the way individuals decode, encode , process, store and retrieve information; (2) the affective, including the emotional and personality characteristics of the individual; and (3) the physiological, dealing with sensory perception, physical environmental conditions, and the need for bodily intake.

Curry (1987) suggests that virtually all learning style instruments fall into one of three categories: the "Instructional Preference" category focusing on teaching and learning settings; those that focus on "Information

Processing," often referred to as the cognitive processing theory; and those that deal more with "Cognitive Personality" or the personality dimensions that affect the learning process.

Claxton and Murrell (1987) developed four categories of learning models: (a) basic characteristics of personality; (b) social interaction models which describe students' behaviors and interactions in the classroom setting; (c) learning environment and instructional preference models and (d) information processing models describing how people take information in and process it.

For this study, the Claxton and Murrell model will be used to examine learning style assessment and research methodologies.

Personality Models

One of the most frequently used personality instruments is based on Jung's theory of psychological types. The Myers Briggs Type Indicator (MBTI) (Myers, 1962) assesses four dimensions of personality, including extroversion/introversion, sensing/intuition, thinking/feeling, and judgment/perception. Based on results from the MBTI, Lawrence (1984) reports that students' performance increased in accordance to type, suggesting that type was an aptitude.

According to Nelson (1992), the work of Witkin in higher education is familiar to many in the field. This work focused on the field dependence/field independence dimension of learning. His research not only distinguishes the differences in one's perceptual abilities, but also establishes the relationship of perception to social interactions. His research in field independence/dependence examined students' selections of majors and careers as well as the variable of gender. Witkin's Ground Embedded Figure Test (1976) assesses the individual's ability to perceive accurately an object without the influence of the surrounding field.

However, contradictory results have been obtained when studies examined the effect of matching teaching methods to the student's field dependence/independence style. MacNeil's (1980) studies of 64 undergraduate recreation majors assigned to instruction according to these preferences do not support greater learning from the experience. Adams and McLead (1979) report similar results when replicating the study with prospective elementary teachers. Six years later, however, positive effects of these tests were reported when these methods were matched to materials in an English-as-a-second-language class in the studies of Abraham (1985).

Kagan's (1965) model also falls into the personality category of learning style assessment. His conceptualization of reflection versus impulsivity led to a Matching-Figures Test and an Identical-Pictures Test. Reflections of the student's conceptual tempo, for example, selection of

choices rapidly or after careful examination and selection, are the focus of study.

In summarizing research based upon these models and instruments, Nelson (1992) states:

> Once more, however, Kagan's instrument revealed only two dimensions and may have provided insufficient information concerning learning style to be helpful in the learning process. Thus, these major personality models --- those of Witkin, Myers and Kagan --- yielded few consistent positive effects when tested in experimental research designs concerned congruence between those dimensions of individual style and instructional methods or resources.

Social Interaction Models

Probably the most influential theorists in this category of learning are Dunn and Dunn. Extensive research has been conducted by researchers at more than 65 institutions of higher learning. This model describes several cognitive, affective, and physiological dimensions of student learning styles. This model is based on a broadened definition of learning style as the "way individuals concentrate on, absorb, and retain new or difficult information or skills...they are not the materials, methods, or teaching strategies that students use to learn" (Dunn, 1983, p.496).

The Learning Style Inventory (Dunn, Dunn, & Price 1979) is a self-reporting instrument for students in grades three through twelve. The LSI has been used with a variety of elementary, junior high, senior high, and college

students. Many of those studies examine student performance in situations that either matched or mismatched with their learning styles. In the environments where style and environment matched, their achievement was significantly higher than the situations where a mismatch of environment and style occurred. Beaty, 1986; Bruno, 1988/1989; Buell and Buell, 1987; Clark-Thayer, 1987; Cook, 1989; Dunn, Deckinger, Withers & Katzenstein, 1990; Dunn, Dunn, and Freeley, 1984; Freeley, 1984/1985; and Ingham, 1989/1990 have all utilized this Dunn and Dunn model in research at the post secondary institutional level.

The Productivity Environmental Preference Survey is also utilized by Dunn and Dunn. While most of the research with the Productivity Environmental Preference Survey has been done with primary and secondary school populations, research at the post secondary level has increased.

Reichmann and Grasha (1974) also developed a social-interaction model at the University of Cincinnati. Individuals were classified as avoidant or participant, competitive or collaborative, and dependent or independent on attitude toward learning, views of instructors and peers, and reactions to classroom procedures (Nelson, 1992/1993). Andrews (1981) utilized the Grasha-Reichmann Student Learning Styles Scales and found that a peer-centered format of learning was viewed as being most beneficial for those students who were collaboratively-oriented. He found that competitive students perceived that they learned best in instructor-centered sections. All data demonstrated that students perceived themselves as learning best in

settings which were the same as their predominant pattern of behavior. Sapp, Elliott and Bounds (1983) utilized the Grasha-Riechmann Learning Styles Inventory Scale to identify the predominant learning styles of undergraduate students. Predominant styles were participant, collaborative and dependent. They suggested that teaching strategies matching these styles should be used in college. Many researchers, however, question the validity of such self-reporting instruments.

Instructional Preference Models

A fourth categorization surveys the instructional preference of students. Canfield's Learning Style Inventory (1980) investigates a students' need for personal relationships with instructors and peers, their goal-setting orientations, their desire for organization and detail as well as their perceptions concerning competition and authority.

Hill's (1971) concept of cognitive style mapping also held possibilities for improving student achievement. According to Nelson (1992/1993), this concept includes :

> 1) theoretical and qualitative symbols which were considered basic to the acquisition of knowledge and its meaning;
>
> 2) cultural determinants which affected the meaning of symbols to particular individuals;
>
> 3) modalities of influence which reflected how the individual made inferences;
>
> 4) memory concern;

5) cognitive style, which encapsulated the first four elements;

6) teaching, counseling, and administrative style; and

7) systematic analysis decision making.

Studies by Fourier (1980), Fillipo and Terrell (1984), and Rice (1984/1985) using Hill's (1971) Cognitive Style Mapping instrument demonstrated possibilities for practical improvement in student achievement. However, further studies suggest that the instrument and/or model is impractical and ineffective.

Curry (1987) deemed both the Canfield and Hill instruments unreliable and invalid. As early as 1983, Curry states:

> Should any investigators wish to utilize the learning cognitive style as a construct, they would be well advised to carefully consider the most appropriate level of learning/cognitive style for their application. Should they be interested in predicting behavior at the level of choices between learning formats then utilization of one of the instructional preference...learning/cognitive style instruments would be most appropriate...It would be unwise to utilize an instrument that is measuring constructs at one level if the purpose is to predict behavior conveyed by another level (p.17)

According to Nelson (1992/1993), Curry clearly indicates that the incorrect utilization of instrumentation would confound experimental results and fail to impact on student achievement. She further states that "Apparently, they were correct, for many experimental studies which utilized an instructional preference model produced statistically increased

achievement when resources and environments were complementary to students' identified characteristics (Dunn, Beaudry, and Klavas, 1989)."

Information Processing Models

Within this category of learning style models, Pask (1975) seeks to distinguish between serialists (those focusing on information low in the hierarchical structure and then developed their understanding through logical, well-defined steps) versus the holists (those utilizing a global approach to learning by developing a broad framework for understanding into which they could insert details and information). Pask held that serialists could be considered operation learners and procedure builders while the holists were description builders and comprehension learners (Nelson, 1992/1993). According to Jonassen and Grabowski (1993), Pask utilized his Clobbits Test (1975) to distinguish between learners who are serialist or holist. Information is presented on cards about a taxonomy of Martian animals. The cards are divided into five categories which differ in the number of hypotheses that can be tested about the complexity of the information presented on the cards. Subjects are unconstrained in the selection of cards, and scoring is based on the number of simple propositions and complex propositions.

Siegel and Siegel (1965) also fit into this category by conceptualizing an educational set or a continuum of learner preferences ranging from complex to simplistic thinking. Siegel and Siegel's Educational Set Scale consists of 31 triads of typical topics studied in college. Subjects are asked to

consider each set of three topics and rank them according to which would be the most interesting to study. These topics are chosen and weighted to represent varying levels of concreteness or abstractness. A person consistently choosing more conceptual topics would be considered more cognitively complex.

A third model in the information processing category is that of Schmeck (1981) who focuses on deep-elaborative versus shallow-reiterative information processors. In this conceptual framework, deep-processing learners focus more on the meaning of material, whereas shallow processors spend more time memorizing information rather than spending time really thinking about it. No assessment instrument or procedure has been created for this model.

Kolb defines learning styles as one's preferred method for perceiving and processing information. He utilizes four learning modes, two perception modes and two processing modes. Kolb differentiated four basic ways of relating to the world as four types of learning styles: divergers, assimilators, convergers, and accommodators. Kolb (1976) described learners as (a) divergers,who absorb information concretely through feelings (apprehension) and transformi it through thought (intention); (b) convergers, who absorb information through abstract conceptualization (conceptualizing) and utilize it through active experimentation (extension); (c) assimilators, who absorb information through abstract experiences (conceptualizing) and process it through reflective observation (intention) and (d) accommodators, who absorb

information through concrete experience (apprehension) and process it through application (extension). Using the Learning Style Inventory, created to identify these learner types, he found that college students move from a reliance on concrete experience to a sense of greater use of abstract conceptualization. At the same time, their focus on reflective observation moves to one of active experimentation. Kolb and Goldman (1973) found that students who planned graduate study in their major field had learning styles that matched those of their respective field; those whose learning styles were not matched tended to choose careers outside of their field of study. Matched students indicated greater commitment to their chosen career than did mismatched students.

French (1975a, 1975b) proposes that each individual's learning style is composed of a combination of learning modalities. These modalities include, but are in no way limited to, the perceptual, cognitive, emotional and social modes. The subunits, or elements of modality, serve to identify specifically the possible approaches within that area. The perceptual modality relates to the means through which information is extracted from the environment by an individual through the senses. These means make up the seven elements of perceptual style conceptualized by French (1975). They are Print, Aural, Interactive, Visual, Haptic, Kinesthetic, and Olfactory. This study focuses on the presence of the seven perceptual modalities conceptualized by French in selected groups of advanced, undergraduate college students.

Characteristics of French's Seven Perceptual Modalities

Visual

Arnheim (1954) focuses on visual perception in Art and Visual Perception. He states "Seeing something means assigning it a place in the whole: a location in space, a score on the yardstick, or size or brightness or distance" (p.2). In a later book, Visual Thinking, Arnheim (1969) states:

> In vision and hearing, shapes, colors, movements, sounds, are susceptible to definite and highly complex organization in space and time....Active selectivity is a basic trait of vision, as it is a trait of any other intelligent concern; and the most elementary preference to be noted is that for changes in the environment. The organism to whose needs vision is geared is naturally more interested in changes than in immobility (pp. 18, 20).

Bissell, White and Zivin (1971) referr to the visual modality as "the spatial modality.... Regarding mental images of forms and spatial relations.... The visual modality functions when a person pays attention to, thinks about and remembers visual components of his environment."

Smith (1964) in the book Spatial Ability speaks of the "importance of shape or form."

Lowenfeld (1952) provides descriptive details which portrayed the visual "type" of learner. He states:

> ...the visual type, the observer, usually approaches things from their appearance. He feels as a spectator...The visual

> penetration deals mainly with two factors: first, with the analysis of the characteristics of shape and structure of the object itself; and second, with the changing effects of these shapes and structures determined by light, shadow, color, atmosphere and distance.

Lowenfeld (1939) contrasted the visual "type" with the haptic type in the following way:

Haptic

Lowenfeld (1952) states, "Haptic perception, then is to the highest degree bound to the self, intensely subjective.... The haptic type on the other hand is primarily concerned with his own body sensations and with the tactual space around him (pp. 86,87)." Lowenfeld also states that the origin of the term haptic "derives from the Greek word 'haptikos' and means able to lay hold of."

Bruno (1988/1989) described a variety of learning activities for the haptic learner at the Conference on Student Learning Styles and Brain Behavior. Elementary students in particular seem to benefit from hands-on materials. Bruno states:

> Because tactual (haptic) resources are naturally responsive to students' tactual senses, and because they are different from general class discussions or the lecture method, learning circles, task cards and innovative electroboards will be appreciated and used. More important, students will learn from them (p.26).

Print

Reporting a study with first and second grade pupils, Hammill (1972) states,

> Correlational research does not support the proposition that visual perception ability and reading comprehension are related to a practical and meaningful degree...Reading comprehension and visual perception as measured and as trained are relatively unrelated abilities (pp. 555,556).

Dechant and Smith (1979) view reading itself as a perceptual process. They states "Reading is a perceptual process, a conceptual and thinking process... conceptual thought is required to react with 'meaning' "(p.25).

Aural

Bissell, White and Zivin (1971) states, "this verbal modality is at work when an individual attends to the spoken word " (p.131). They also describes certain abilities associated with highly verbal children.

Interactive

Joyce and Weil (1972) describe various "human interaction oriented models of teaching" that may utilize the interactive modality to a greater degree than is normally occurring in schooling. They state, "These models place a heavy emphasis on social relations either as a goal or as an educational means, or both" (p.29).

Verbal children generally structure the world in terms of language categories and perform well in concrete-formation tasks requiring

categorization on the basis of functional similarities. Verbal children excel in situations where the goal is functional categorization.

Kinesthetic

Barsch (1968) states that kinesthetic opportunities are present at all ages. He also states that a good child kinesthesizer will become a good adult kinesthesizer. Kinesthesia may become a major mode of learning for some people who find their greatest efficiency derived from "getting the feel of it," "putting it through their muscles," or "working it through in motion" (p. 229).

Olfactory

According to James and Galbraith (1985), individuals who learn best through the senses of smell and taste are olfactory learners. People who vividly associate some information with a particular smell or taste probably fall within this learning style.

Controversies Regarding Instruments

As previously mentioned, one of the main issues regarding many perceptual instruments is the failure to measure a wide range of modality preferences. Scarbrough (1976/1977) concludes in her dissertation, "Investigation into learning styles preference has been hampered by the lack of appropriate instruments." Schaiper (1983/1984) states, "The focus of much of the perceptual modality research has been hampered by the study of a very limited number of modalities or channels." Holland (1982) states

"Diagnosis of learning styles is far from perfect and requires continued refinement of diagnostic instruments and procedures." Barbe, Swassing and Milone (1979) state their objections to current tests and inventories:

> Most of the instruments deal with only one modality.... Extensive time and training are necessary for the administration of many of them.... Classroom teachers are in need of a tool that is practical and yet provides them with information that can serve as the basis for planning instruction around modality strengths (p. 34).

The point is reinforced by examining a range of perceptual style studies and instruments. Carbo (1983), Dunn (1979, 1981,1983), Gregorc (1982), Hill (1980, 1981, 1982) and Kolb (1976) have all utilized self report instruments related to perceptual style. According to Schaiper (1983 / 1984), only the Carbo, Dunn, and Hill instrumentation included a large number of modalities. All of the other instruments focused on perceptual modalities in a limited way.

The Swassing-Barbe Modality Index measures three modalities : visual, auditory and kinesthetic. Swassing and Barbe (1979) conclude

> Students vary with respect to their modality strengths. The most frequent modality strengths are visual or mixed; each accounts for about 30 percent of the population although mixed modality strengths are more frequent among adults than children. About 25 percent of the population are auditory, and the remaining 15 percent are kinesthetic (p. 378).

However, these conclusions are based on assessments in only three areas. Reinert (1976) utilized the Edmonds Learning Style Identification

Exercise (ELSIE). It measures four modalities: visual, print, aural and kinesthetic. The administration time is about 30 minutes. Reinert studied 180 students and concludes "The study itself shows clearly that differences between individuals are far more extensive and much deeper than we have frequently imagined" (p. 168).

A second controversy in the field of learning styles concerns the validity of information gained in self report instruments. Dunn (1983), one of the main supporters of instruments of a self reporting nature, claims that these are very accurate methods of identifying perceptual learning styles. She concludes that, "Indeed, at college, secondary and elementary levels, students can identify their learning styles" (p.62). Opponents of the self report method are Barbe and Milone (1982). They feel that actual assessment of perceptual learning styles and careful observation should be stressed. Barbe states,

> Our research, and that conducted by others, has shown that what we think is true is not always the case, and that assessing student learning styles is a necessary prelude to designing an appropriate curriculum. (p. 54)

Cherry found that ninety-one percent of his adult population demonstrate low, slight, negligible or negative correlations between the MMPALT-II results and his self-report instrument. He found the highest correlation to be .57 and only adults with over 16 years of formal education demonstrate scores this high. The MMPALT-II instrument used in this study differs from many of the instruments for measuring perceptual styles in that

(1) it covers seven perceptual styles rather than 2-4, and (2) it is not a paper-pencil, self-report instrument.

Thirdly, an ongoing controversy focuses on the ability to modify learning styles. Kolb proposed that additional learning styles can be enhanced through guided instruction. However, Kolb concluded in his research on the learning styles of college students that individual styles can be modified and, in fact, can change over time. According to Kolb's theory of learning styles, academic performance is enhanced when the individual's learning style matches the academic subject. Moreover, when there is a match between learning style and academic discipline, individuals will become more fully adapted to the learning environment not only academically but also psychologically. These conclusions, however, are based on results obtained from the Learning Style Inventory, a paper-pencil test.

On the other side of the controversy are French and associates who contend that weaker perceptual styles can never be elevated to dominant status. Their views are based on research conducted in experiential modes of testing with primary focus on the Multi-Modal Paired Associates Learning Test, Revised.

The issues need resolution, but the current study can offer only implications.

Research Based on the MMPALT-II

Gilley (1975 / 1976) developed and tested the original MMPALT, an objective system for measuring six of the perceptual modalities conceptualized by French (1975a, 1975b). He utilized the MMPALT to test third grade students. Cherry expanded the MMPALT to include the olfactory element (MMPALT-II) and tested a diverse population of 96 adults. Schaiper further modified the MMPALT-II in his study of 53 University students. Galbraith and James (1984) furthered the research with this instrument with a population of adults ranging from university students to senior adults. The results of these studies are revealing.

Cherry's study revealed that the primary learning modality in his adult population was visual. He concludes that :

> Adults investigated in this study varied in their perceptual learning styles... Teacher training programs should place emphasis on visual and haptic teaching strategies, but they should also prepare teachers to identify and react to a much broader range of individual differences. (pp. 103, 112)

He also developed a self-reporting instrument Perceptual Modality Preference Survey to correlate subjects' perceptions of their perceptual strengths and weaknesses. Cherry found only low correlations between subjects self-reported perceptual styles and actual strengths and weaknesses measured by the MMPALT-II.

Schaiper (1983 / 1984) tested 53 university students majoring in some field of human services. He utilized the MMPALT-II to determine perceptual learning style profiles for each student and concluded that all seven modalities conceptualized by French (1975a, 1975b) were found in the university population and that individual styles did vary among individuals. He found visual style as dominant with print and interactive skills also showing strength in his population. Schaiper also administered the Perceptual Modality Preference Survey (PMPS). He found low to slight correlations between self report instrumentation and empirical testing utilizing the MMPALT-II.

Galbraith and James (1984) utilized the MMPALT-II to test 319 adults, 240 of whom were ages 20 through 49, and 70 of whom were over 50 years of age. They concluded that the older age group had lower mean scores than the younger age group. Visual was the dominant style of the older group, followed by interactive and aural.

Akins (1983), focused on the measurement of the employees of a Dale, Oklahoma Public School. He used the MMPALT-II to test 45 school employees, 15 males and 30 females ranging in age from 18 to 62 years. He again found the visual modality to be strongest with haptic and interactive being secondary styles. He found no significant difference in style by position held or by sex. He also administered the self-report PMPS and found no correlation between the self-reports instrument and the MMPALT-II results.

Hutchison (1992) measured the effect of instructional method, dominant perceptual modality element, and perceptual modality elements on undergraduate college student learning of basic social work knowledge. He found that the print and aura elements of the MMPALT-II showed evidence that perceptual dominance in these areas affected student learning performance. It was also concluded that perceptual modality dominance is a valid measure to predict student learning performance on a memory level task.

Grady (1992/1993) administered the MMPALT-II and three other learning style instruments to 100 vocational-technical adult students. The purpose of this study was to validate the constructs of perceptual learning style through examining evidence of convergent and discriminant validity of these four instruments designed to measure auditory, visual, print and kinesthetic/haptic perceptual learning styles. This study provided no supporting evidence for the validity of the constructs of perceptual learning style or for the four measures used to assess perceptual learning styles.

Coolidge-Parker (1989 / 1990) measured the preferred learning styles of court reporting students and court reporters with emphasis on the aural and haptic elements in court reporting. Subjects were administered the MMPALT-II and the Productivity Environmental Preference Survey (PEPS). On the MMPALT-II, both groups scored highest on the visual element and lowest on the kinesthetic element. Both groups indicated, however, that the kinesthetic element was their highest perceived preferred element as measured by the

PEPS. Statistical analyses were conducted to determine if there were significant differences between the performance of the two groups. This study showed that the two types of instruments administered did measure two different aspects of learning.

Nix (1983/1994) measured the perceptual learning styles of US. Coast Guard Institute personnel in Stillwater, Oklahoma. The MMPALT-II was used to determine the perceptual learning style profiles of 45 volunteers assigned to the Institute. Nix also administered the PMPS and found no correlations existed in results from the two instruments. He found no significant differences between officers, enlisted or civilian personnel and no significant differences related to sex. The dominant perceptual learning style within this sample was visual, with interactive being second.

Brown (1984/1985) focused on the perceptual learning styles of older adults. He administered the PMPS and the MMPALT-II to each of 50 older adults. He found that all modalities were present in older adults and that no significant differences were present according to age, sex, educational level, or learning location. Visual and interactive modalities were dominant in this population. There was no significant correlation between the self-reported styles and the PMPS and the results of the MMPALT-II.

Rice (1984/1985) studied 40 members of the Oklahoma Association of Youth Services. They were given the MMPALT-II and the PMPS tests. No two subjects were found to have identical scores or ranks among styles on

the MMPALT-II assessment. The dominant learning modality was visual with print and interactive being second and third, respectively. Significant differences did result by sex on the haptic element, and there were significant differences on both instruments by marital status. There were significant differences in PMPS scores by smokers; both the haptic element and the olfactory element showed a significant difference in ratings among this subgroup.

Russell (1984/1985) measured the perceptual learning styles of Federal Aviation Administration Supervisors. Forty-three volunteers were tested utilizing the MMPALT-II and the PMPS. No two subjects were found to have identical scores or rank-order patterns on the MMPALT-II. The dominant perceptual learning style for this sample was visual; the secondary styles were haptic and aural. No significant differences appeared between males and females, for the three age groupings, or for the three educational groups. There were negligible or low correlations existing between the MMPALT-II and the PMPS.

James and Blank (1991a) tested 480 adults utilizing the MMPALT-II. These adults held educational levels ranging from less than high school to graduate degrees. All educational levels scored highest in visual and lowest in olfactory and many of the mean sub scale scores differed significantly among the various educational level groups.

In summary, there is a body of learning theory that supports the notion that human beings differ in learning styles. There are many conceptualizations of learning styles and a number of instruments which have been used to assess the presence of styles within and across groups of learners. The area of perceptual style is one that has received much attention and which appears to be valuable in assessing learners and instructors in their attempts to maximize student achievement.

Controversies in the assessment of learning styles focus on the range of styles measured by an instrument and the validity of paper-pencil assessments (assessments of preference). The MMPALT-II which is used in this investigation is an instrument that (1) measures seven perceptual styles; (2) uses authentic, empirical assessment methodology; and (3) has been used in a number of studies to develop useful information about individuals and groups of learners.

CHAPTER 3
PROCEDURES

CHOOSING AND SCHEDULING SUBJECTS

A total of 40 subjects participated in this study, 10 from each of the following academic programs: architecture, engineering, social work, and human performance and sports studies. These disciplines were chosen as representatives of four colleges at the University of Tennessee in Knoxville. All of these programs are "Professional Majors" preparing students for specific career directed fields. Each program focuses on training students for specific career objectives in their field; thus a high percentage of their graduates pursue careers resulting directly from their programs of study. These majors were selected because there appeared to be more likelihood that many "majors" are not specific enough to draw person with particular styles or to demand the use of particular styles.

Following is a description of each academic program as stated in the 1992-93 Undergraduate Catalog.

Architecture

> The School of Architecture offers a program of professional studies which prepares its graduates for the practice of architecture. While emphasizing knowledge and skills required by architects in guiding the processes of building, the School especially emphasizes the development of that critical judgment which particularly distinguishes the architect from other professionals who serve the building industry. Therefore, the student must address the cultural, social, philosophical and ethical issues that appropriately concern the architect in performance of the art of building.

Engineering

It is the purpose of the College of Engineering to educate men and women to the high levels of technical competence and social understanding that will enable them to fulfill their responsibilities as professional engineers. Graduates of the B.S. curricula offered by the college may enter directly into a position in industry, government, or private practice, or may pursue advanced study in graduate school. Their professional activities include research, development, design, operations analysis, construction, production supervision, and technical sales. Many practice their profession in Tennessee, but engineering knows no geographical bounds, and graduates of the college serve throughout the nation and in other countries as well.

Social Work

Social work is a helping profession which focuses on providing skilled intervention in the prevention and amelioration of individual and societal problems. It is a challenging and rewarding career involving the application of knowledge, skills, and professional values to assist individuals, families, groups, and communities in reaching their potentials. The primary objective of the undergraduate social work program is to prepare students for beginning social work practice. It is the purpose of the College to provide an education which fosters growth in both individual and career development. The program prepares students for social work careers in such diverse areas as schools, youth programs., family service agencies, nursing homes, courts, mental health centers, and welfare agencies. The degree provides graduates a competitive advantage in many jobs, the possibility of up to one year's standing in some master's degree programs in social work, and the potential to be licensed in a number of states throughout the nation.

Human Performance and Sports Studies

The Department of Human Performance and Sports Studies has varied programs of study all made cohesive because of the common academic core of human movement expressed in the forms of sport, dance and exercise. The Department is responsible for providing instruction, research, and service through the integration of the several disciplinary areas as they relate to the enhancement of the human

> experience and to an improved quality of life. The primary function of the Department is to provide a quality education to both undergraduate and graduate students that will allow them to pursue sport and exercise and dance related careers in agency, business, educational, hospital or industrial settings. In reaching this purpose, the Department is responsible for adding to the body of knowledge through research and writing, disseminating this information through quality teaching and presenting before academic bodies, and providing academically oriented service to students, the College, the University, professional organizations, and the greater state, nation, and worldwide communities.

An initial interview was conducted with each of the department heads and/or deans in the four academic areas. These interviews included a brief overview of the purpose of this research as well as a formal interview process to determine the type of student in each academic area (See Appendix A). This formal interview contained five areas of discussion. First, both formal and "implied" entrance requirements were discussed. Secondly, factors that make up or describe the "typical" student in their disciplines were addressed. Thirdly, the concept of "success" in the academic area as related to obtaining senior status was discussed. Finally, the career paths and the success levels of students pursuing these career paths were discussed. At the conclusion of this formal interview, deans and/or department heads were given an explanation of French's seven perceptual learning styles as well as a brief overview of the MMPALT-II testing procedures. They were then asked to predict the dominant perceptual learning styles of students in their academic area.

Students were chosen upon recommendation from department heads and/or deans of each program of study. Initial contact with students was

made by the department, and an informational letter was distributed to provide a brief explanation of the testing procedure (Appendix A). All students were full time University of Tennessee students who had attained senior status in one of the participating academic disciplines. All eligible students were initially contacted by the department heads. Lists of interested students were obtained, and students were contacted by phone by the investigator. The testing procedure was again communicated to students; all questions about the procedure were answered, and students were scheduled for testing.

Of the 40 subjects tested, 14 were males and 26 were females. All were between 19 and 21 years of age with the exception of two aged 28 and 34. Thirty-nine of the subjects were Caucasian students with residence in the United States. One student was from Puerto Rico.

All testing took place on Saturday, April 17, 1993, in the Claxton Education Building Reading Center on the campus of the University of Tennessee, Knoxville. (The original testing date, March 13, 1993 was rescheduled due to a blizzard that hit the Knoxville area on March 12, 1993.) Students were scheduled over the phone according to their personal preferences with no regard to their academic discipline. A post card reminding them of their scheduled time and testing location was distributed 10 days prior to testing.

TRAINING OF EVALUATORS AND TESTING ASSISTANTS

A total of 11 volunteers participated in administrative roles for testing. Volunteers included 5 primary evaluators and 6 testing assistants. Primary evaluators were responsible for actual administration of testing procedures, one assigned to each testing area. These evaluators were all graduate students at the University of Tennessee in the College of Education. All testing assistants were students of this investigator at Pellissippi State Technical Community College and obtained course credit for participating in this study. One testing assistant was assigned to each testing area to assist the primary evaluator with scoring and escorting students to and from testing areas. One testing assistant was utilized to assist the investigator with overall coordination of the testing area.

All volunteers were trained in their individual duties. Testing assignments were mutually decided upon according to individual preferences. Individual training for primary evaluators lasted 45 minutes to 1 hour. All testing procedures were reviewed and a simulation was conducted. Testing assistant training lasted 20-30 minutes. A brief review of the testing procedure was given, and individual testing responsibilities were discussed.

The training process was validated in three ways. During testing, this investigator periodically observed each evaluator conducting actual measurements. At various breaks during testing, the investigator discussed

the testing procedure with the evaluators as well as testing assistants. Feedback was also solicited from subjects. No major problems in the performance of the evaluators or the testing assistants occurred.

UTILIZATION OF THE MMPALT-II

Gilley (1975 / 1976) originally developed and validated the original MMPALT consisted of six modality elements: print, aural, visual, interactive, haptic, and kinesthetic. This paired-associates measurement system was revised four times over a period of six months. All revisions were made under the guidance of a panel of experts in psychology, reading, special education, science, curriculum, educational administration, educational media and physical education. In 1981, Cherry refined the MMPALT (MMPALT-II) with the addition of the olfactory element. His study established concurrent validity of the MMPALT-II through statistical comparison of his adult population (adults with less than 12 years of education) with that of the Gilley population (elementary aged high achievers). The correlation between the two populations was .89 and was considered to be evidence of concurrent validity (Hutchison, 1992). No construct validity studies have been conducted at this time.

The MMPALT-II measures modality dominance through a paired associates, performance based testing procedure. For example visual dominance was measured through the visual mode by examining 10 pairs of images: a common object and an abstract symbol. For the recall portion of the

test, only the abstract symbols were presented and subjects were asked to recall through the visual image the appropriate common object. This testing procedure demonstrated face validity (the extent to which items on a test appear to be meaningful and relevant).

James & Blank (1991) have provided much of the information concerning the subtest reliability of the MMPALT-II. In their most recent study of 480 adults ranging in age from 19 to 86, subtest reliability was calculated through test-retest procedures. The reliability for each of the subtests was as follows: Print r=0.85; Aural r=0.80; Interactive r-0.65; Visual r=0.87; Haptic r=0.74; Kinesthetic r=0.67; and Olfactory r=0.73. Simplicity, efficiency, and the moderate testing time required are additional benefits of this instrument as are the capability of the test battery to measure seven styles and its in-mode (rather than paper-pencil) methodology.

ORGANIZATION OF TESTING

As previously stated, all testing took place in the University of Tennessee Reading Center in the Claxton Education Building (Appendix B). This facility was chosen because of easy access, privacy, and, primarily, the construction of the center. The reading center has 5 small private rooms designed for testing. Each contains a small table and chairs and is highly insulated to reduce outside noise. Each is equipped with a two way intercom system, and one-way glass viewing panels allowing this investigator to oversee periodically the procedures taking place during testing. Three large

rooms provided space for print/visual/aural testing and kinesthetic testing as well as a waiting area for students as they arrived at the site.

Upon arrival, the scheduled group of four students was greeted in area A by a testing assistant and assigned a name tag and subject number. Students were asked to read the Perceptual Modality Learning Style Information sheet provided (Appendix B), to complete the student information portion of the consent form (Appendix B), and to sign the form as consent for participation in this study. Students were then escorted to Area B for Print, Visual and Aural testing. This investigator gave a brief introduction to perceptual learning styles and an explanation of the testing procedures (Appendix A). All questions were answered at that time, and then students were tested by the primary evaluator for visual, print and aural dominance. These tests can be conducted in group settings.

Students were then individually escorted to individual testing in area C. Each student received testing in the kinesthetic, olfactory, haptic and interactive areas. The order of testing in this area was assigned randomly. At the completion of all four students, tests in each of the four individual areas, students were taken to Area D. Here they were given their test results and a brief explanation of their perceptual learning style profiles, and then their questions about the testing process were answered . Students were then allowed to leave the testing area with copies of their profiles for their further use.

Eighteen students were not present on this original testing date due to rescheduling because of weather. The investigator personally tested these subjects at a later date. Testing procedures were duplicated for those individuals assuring test consistency and environmental continuity.

PROCEDURES

The procedures used for the MMPALT-II are based on a Paired-Associates method of testing. In this procedure, subjects are expected to perform recall "In-Mode" and discrimination "In-Mode" between pairs of words (Print), image (Visual), sounds (Aural), movements (Kinesthetic), verbalizations (Interactive), objects (Haptic), and smells (Olfactory). Following are the individual testing procedures for each modality element. These procedures, used by Cherry and Schaiper, were duplicated by this researcher.

1. A process was developed to introduce all measurement procedures to the subjects prior to actual testing.

2. Each measurement procedure consisted of one set of ten stimulus-response pairs and one trial.

3. Print, visual, and aural measurements were completed in a group testing procedure, using 35mm slides, an audio tape recording, and written response sheets.

4. Pairs of aromas for the olfactory testing were arranged so that uncommon aromas were presented first, while more familiar aromas made up the second item in each pair.

5. When stimulus-response pairs were presented to the subjects, a consistent spacing of 5-7 seconds between each pair was maintained. Each subject was given approximately 10 seconds to respond in the stimulus only portion on the presentation.

Recommendations were made by Cherry that the method of presenting slides in the visual and print modes be altered. Cherry had utilized two slide trays and projectors to project the nonsense word on the upper half and the common word on the lower half of the screen. This method proved to be cumbersome and difficult to perform. Cherry's recommendation was that the nonsense word be on the left half and the common word be on the right half of the same slide. This enabled the researcher to utilize a single slide projector and to display the pairs in a more efficient manner. These modifications were made by Schaiper in 1983.

Cherry also recommended a change in the haptic measurement. Objects representing various shapes, sizes and textures are used in this test. Cherry recommended the use of more abstract objects to facilitate a greater degree of discrimination within the measurement of the haptic mode. Schaiper incorporated this change, and this investigator used the Schaiper procedure.

Print

In the print measurement, each subject saw pairs consisting of a printed nonsense word and common noun projected onto a screen. After reviewing all ten pairs of nonsense and common words, the subject was

expected to recall the appropriate common noun upon reviewing the nonsense word with which it was paired. The-ten word pairs utilized in this study were the same as those used in the original Cherry instrument (Appendix B).

A graphic artist prepared the slides used in the assessments. Bold black print was used with a white background. One slide projector was utilized to project the slides onto the screen which was placed eight feet from the subjects. The slides were arranged in one slide tray with the nonsense word on the left half of the slide and the common noun on the right half of the same slide for the pairs portion of the presentation. All slides were arranged in the original order used by Cherry. Subjects were presented each word pair for 7 seconds. A second set of slides was utilized to present the nonsense words individually for the recall portion of the presentation. Upon presentation of each nonsense word, the subject then had 10 seconds to recall through print mode the common word with which each nonsense word was paired and record this word on a response sheet.

Visual

In the visual measurement, each subject saw pairs of images representing an abstract symbol and a common object projected onto a screen. For the recall or stimulus only presentation, a separate set of slides was utilized to present only the images of the abstract symbols. Subjects were asked to recall through visual image the appropriate common object and then record the name of the common object on a response sheet. The same

procedures as previously noted for the print measurement process were used (Appendix B).

Upon recommendation of Cherry, Schaiper, and French, the visual images were redesigned to create a clearer image. Also the original pairings of the sunglasses and the infinity sign and of the umbrella and the asterisk were reassigned due to a possible relationship between the nonsense and the common symbols. All modifications were approved by French, and this experimenter's doctoral committee prior to the actual testing of subjects.

Aural

In the aural measurement, each subject listened to an audio tape of pairs consisting of a spoken nonsense word and a common noun. Upon hearing the nonsense word again, the subject attempted to recall through aural mode the common noun with which it was paired and record that common noun on the response sheet. The nonsense words and common nouns used in the study were the same ones used in the Cherry study (Appendix B).

Kinesthetic

In the kinesthetic portion of the instrument, each subject was blindfolded and guided physically through pairs of body movements. The subject actually performed through kinesthetic mode the second movement in each pair when again guided and/or physically directed through the first

movement of each pair. All procedures for this measurement were identical to those utilized in the Cherry study (Appendix B).

Interactive

This procedure involved the learner's ability to acquire information through questioning and discussion. This measurement encouraged verbal communication as the subject made connections between pairs of nonsense and common nouns. In the pairs presentation, the subject was required to verbalize and repeat out loud both the nonsense and the common word in each pair. The subject was then asked to verbalize and to associate the two words. Upon hearing only the nonsense word again, the subject was expected to recall through interactive mode the common one with which it was paired. The nonsense and the common nouns utilized in this study were the same as those used in the Cherry study (Appendix B).

Haptic

The hapticity measurement involved the manual manipulation of objects by a blindfolded subject. The subject was presented with each pair of objects. The subject was able to feel, hold, and manipulate the objects for seven seconds. Each pair consisted of a common and a nonsense object. During the recall portion of the measurement, the subject received the nonsense object to feel, hold, or manipulate for 10 seconds. The subject was then expected to recall through haptic mode the common object with which the nonsense object was paired and then verbally identify that nonsense

object. All objects utilized were the same ones used in the Schaiper study (Appendix B).

Olfactory

In the olfactory measurement, the subject was presented with pairs of aromas. Each aroma was smelled separately. The subject was blindfolded while the evaluator placed a small open glass vial containing the aromas under the nostrils of the subject for a few seconds. The evaluator then replaced the cap on the first vial, removed the cap from the response vial, and repeated the process. The name of the response aroma was verbally identified as the subject smelled it unless the aroma was identified by the subject first. After all ten pairs were presented, the subject was allotted ten seconds to smell the aroma, identify the response aroma through olfactory mode, and state the name of the appropriate response aroma.

Special identical glass vials with screw-on caps were purchased for this measurement. Cotton balls were placed in the bottom of each vial, and a few drops of the liquid aroma were placed in each individual vial. This process increased the aromatic qualities of the chemical and prevented accidental spilling. Code labels were placed on each vial, and the vials were kept in a divided container for each manipulation. All aromas were certified safe by an organic chemist and were the same as those used in the Schaiper study (Appendix B).

TREATMENT OF DATA

These descriptive data were hand scored and summarized into tables. Scores by subject were determined and evaluated for variability of style and all subjects' scores were then categorized by perceptual style. Individual subjects' sores were summarized in terms of dominant or secondary styles. Rank ordering of styles and scores was summarized according to academic major. Dominant, moderate, and limited styles were also designated for each academic grouping.

After completing the charts and tables indicated in the preceding paragraph, results were synthesized to produce responses to the four research questions (see chapter 1) and the predictions generated for research question 4.

CHAPTER 4
FINDINGS

The MMPALT-II individual data were hand scored (Table 1), and rank orders were determined for each individual subject (Table 2). The four research questions were used as the organizers for this chapter. Those questions also provided the general criteria for data analysis.

MMPALT-II individual data are used to address the first study question: Do the seven perceptual styles identified by French manifest themselves in this adult university population? Schaiper (1983/1984), Gilley (1975/1976) and Cherry (1981/1982) concluded that individuals do receive and process information differently. A wide range of score difference was evident in all three of these studies. Therefore, it was assumed that a wide range of score difference would indicate the existence of the same perceptual style elements in this university population. Presentation of these results constitutes the second section of this chapter.

The third section of this chapter addresses the second study question: Are there measurable variations in the perceptual learning styles of this university student population? It was assumed in this study that variability in score ranges and variability in highest ranked style elements are both indicators of perceptual modality learning style differences among individuals and groups.

The fourth section of this chapter addresses the third study question: Do college seniors in a given major exhibit similar patterns of perceptual learning style dominance as measured by the MMPALT-II? The intent of this question was to focus attention on similarities in perceptual learning styles that might exist in the groups being investigated.

The fifth section focuses on the fourth study question: "Are the patterns of dominance exhibited by seniors in a given major what we expect?" The intent of this question was to study the relationship between academic majors and patterns of perceptual learning styles exhibited by advanced students within each major. Both group data and predictions obtained from Deans and/or Department Heads in each academic area are investigated.

MANIFESTATION OF STYLE

1. Do the seven perceptual styles identified by French manifest themselves in this selected adult university student population?

An examination of both the scores (Table 1) and rank orders (Table 2) obtained from the MMPALT-II revealed two facts. First, no two subjects had identical scores. Second, those scores showed different patterns of dominance, moderate capacity, and limited capacity within style elements.

The following results are presented in Table 1 and Table 2:

TABLE 1 : MMPALT-II RAW SCORES BY SUBJECT

	Perceptual Learning Styles						
SUBJECT	PRINT	AURAL	INTERACTIVE	VISUAL	HAPTIC	KINESTHETIC	OLFACTORY
AR-00	3	4	2	6	8	3	0
AR-01	5	7	7	7	9	1	0
AR-02	9	8	9	10	6	4	2
AR-03	8	7	7	8	7	3	0
AR-04	9	9	8	10	10	4	2
AR-05	6	7	8	10	8	1	1
AR-06	2	4	7	9	5	1	2
AR-07	4	5	9	9	10	1	2
AR-08	4	6	6	10	6	2	1
AR-09	5	5	6	10	7	1	0
EN-10	1	3	1	2	3	3	2
EN-11	8	4	2	6	3	3	0
EN-12	7	4	10	9	9	8	0
EN-13	8	7	8	10	4	1	1
EN-14	6	7	8	10	6	4	2
EN-15	9	5	6	10	7	1	0
EN-16	8	6	6	10	6	2	1
EN-17	8	7	7	8	7	3	0
EN-18	10	9	8	9	7	6	0
EN-19	10	5	9	9	6	1	2
HP-20	10	10	9	10	4	9	3
HP-21	8	9	8	5	5	7	2
HP-22	9	9	8	8	3	3	0
HP-23	7	10	8	4	2	7	2
HP-24	8	10	9	5	3	8	1
HP-25	9	9	8	6	4	7	0
HP-26	10	10	10	8	1	9	1
HP-27	9	10	7	7	1	10	2
HP-28	8	9	7	8	3	10	3
HP-29	10	8	8	7	2	9	1
SW-30	10	10	8	3	4	4	1
SW-31	6	7	6	8	2	2	0
SW-32	5	9	8	10	4	2	5
SW-33	2	10	9	2	7	6	3
SW-34	7	2	4	8	3	2	2
SW-35	4	9	8	5	5	4	4
SW-36	3	7	6	7	4	5	2
SW-37	4	8	8	4	4	2	2
SW-38	5	9	9	5	2	1	3
SW-39	3	10	8	3	2	0	0

AR = Architecture, EN = Engineering, HP = Human Performance and Sports Studies, SW = Social Work
Dominant Style = 8, 9 or 10; Moderate Capacity = 5, 6 or 7; Limited Capacity = 0, 1, 2, 3 or 4

TABLE 2 : MMPALT-II SCORES AND RANK ORDERINGS BY SUBJECT

SUBJECT	PRINT		AURAL		INTERACTIVE		VISUAL		HAPTIC		KINESTHETIC		OLFACTORY	
	*Rank	Score	*Rank	Score	*Rank	Score	*Rank/	Score	*Rank	Score	*Rank	Score	*Rank	Score
AR-00	(4.5)	3	(3.0)	4	(6.0)	2	(2.0)	6	(1.0)	8	(4.5)	3	(7.0)	0
AR-01	(5.0)	5	(3.0)	7	(3.0)	7	(3.0)	7	(1.0)	9	(6.0)	1	(7.0)	0
AR-02	(2.5)	9	(4.0)	8	(2.5)	9	(1.0)	10	(5.0)	6	(6.0)	4	(7.0)	2
AR-03	(1.5)	8	(4.0)	7	(4.0)	7	(1.5)	8	(4.0)	7	(6.0)	3	(7.0)	0
AR-04	(3.5)	9	(3.5)	9	(5.0)	8	(1.5)	10	(1.5)	10	(6.0)	4	(7.0)	2
AR-05	(5.0)	6	(4.0)	7	(2.5)	8	(1.0)	10	(2.5)	8	(6.5)	1	(6.5)	1
AR-06	(5.5)	2	(4.0)	4	(2.0)	7	(1.0)	9	(3.0)	5	(7.0)	1	(5.5)	2
AR-07	(5.0)	4	(4.0)	5	(2.5)	9	(2.5)	9	(1.0)	10	(7.0)	1	(6.0)	2
AR-08	(5.0)	4	(3.0)	6	(3.0)	6	(1.0)	10	(3.0)	6	(6.0)	2	(7.0)	1
AR-09	(4.5)	5	(4.5)	5	(2.5)	6	(1.0)	10	(2.5)	6	(6.0)	2	(7.0)	0
EN-10	(6.1)	1	(2.0)	3	(6.5)	1	(4.5)	2	(2.0)	3	(2.0)	3	(4.5)	2
EN-11	(1.0)	8	(3.0)	4	(6.0)	2	(2.0)	6	(4.5)	3	(4.5)	3	(7.0)	0
EN-12	(5.0)	7	(6.0)	4	(1.0)	10	(2.5)	9	(2.5)	9	(4.0)	8	(7.0)	0
EN-13	(2.5)	8	(4.0)	7	(2.5)	8	(1.0)	10	(5.0)	4	(6.5)	1	(6.5)	1
EN-14	(4.5)	6	(3.0)	7	(2.0)	8	(1.0)	10	(4.5)	6	(6.0)	4	(7.0)	2
EN-15	(2.0)	9	(5.0)	5	(4.0)	6	(1.0)	10	(3.0)	7	(6.0)	1	(7.0)	0
EN-16	(2.0)	8	(4.0)	6	(4.0)	6	(1.0)	10	(4.0)	6	(6.0)	2	(7.0)	1
EN-17	(1.5)	8	(4.0)	7	(4.0)	7	(1.5)	8	(4.0)	7	(6.0)	3	(7.0)	0
EN-18	(1.0)	10	(2.5)	9	(4.0)	8	(2.5)	9	(5.0)	7	(6.0)	6	(7.0)	0
EN-19	(1.0)	10	(5.0)	5	(2.5)	9	(2.5)	9	(4.0)	6	(7.0)	1	(6.0)	2
HP-20	(2.0)	10	(2.0)	10	(4.5)	9	(2.0)	10	(6.0)	4	(4.5)	9	(7.0)	3
HP-21	(2.5)	8	(1.0)	9	(2.5)	8	(5.5)	5	(5.5)	5	(4.0)	7	(7.0)	2
HP-22	(1.5)	9	(1.5)	9	(3.5)	8	(3.5)	8	(5.5)	3	(5.5)	3	(7.0)	0
HP-23	(3.5)	7	(1.0)	10	(2.0)	8	(5.0)	4	(6.5)	2	(3.5)	7	(6.5)	2
HP-24	(3.5)	8	(1.0)	10	(2.0)	9	(5.0)	5	(6.0)	3	(3.5)	8	(7.0)	1
HP-25	(1.5)	9	(1.5)	9	(3.0)	8	(5.0)	6	(6.0)	4	(4.0)	7	(7.0)	0
HP-26	(2.0)	10	(2.0)	10	(2.0)	10	(5.0)	8	(6.5)	1	(4.0)	9	(6.5)	1
HP-27	(3.0)	9	(1.5)	10	(4.5)	7	(4.5)	7	(7.0)	1	(1.5)	1 0	(6.0)	2
HP-28	(3.5)	8	(2.0)	9	(5.0)	7	(3.5)	8	(6.5)	3	(1.0)	10	(6.5)	3
HP-29	(1.0)	10	(3.5)	8	(3.5)	8	(5.0)	7	(6.0)	2	(2.0)	9	(7.0)	1
SW-30	(1.5)	10	(1.5)	10	(3.0)	8	(6.0)	3	(4.5)	4	(4.5)	4	(7.0)	1
SW-31	(3.5)	6	(2.0)	7	(3.5)	6	(1.0)	8	(5.5)	2	(5.5)	2	(7.0)	0
SW-32	(4.5)	5	(2.0)	9	(3.0)	8	(1.0)	10	(6.0)	4	(7.0)	2	(4.5)	5
SW-33	(6.5)	2	(1.0)	10	(2.0)	9	(6.5)	2	(3.0)	7	(4.0)	6	(5.0)	3
SW-34	(2.0)	7	(5.0)	2	(3.0)	4	(1.0)	8	(7.0)	3	(5.0)	2	(5.0)	2
SW-35	(6.0)	4	(1.0)	9	(2.0)	8	(3.5)	5	(3.5)	5	(6.0)	4	(6.0)	4
SW-36	(6.0)	3	(1.5)	7	(3.0)	6	(1.5)	7	(5.0)	4	(4.0)	5	(7.0)	2
SW-37	(4.0)	4	(1.5)	8	(1.5)	8	(4.0)	4	(4.0)	4	(6.5)	2	(6.5)	2
SW-38	(3.5)	5	(1.5)	9	(1.5)	9	(3.5)	5	(6.0)	2	(7.0)	1	(5.0)	3
SW-39	(3.5)	3	(1.0)	10	(2.0)	8	(3.5)	3	(5.0)	2	(6.5)	0	(6.5)	0

* Rank Within Profile
AR = Architecture, EN = Engineering, HP = Human Performance and Sports Studies, SW = Social Work
Dominant Style = 8, 9 or 10; Moderate Capacity = 5, 6 or 7; Limited Capacity = 0, 1, 2, 3 or 4

Print

1. Twenty subjects demonstrated dominance (8, 9, or 10) in the print style. Of these twenty subjects, six had a score of 10, six subjects had a score of 9 and eight subjects had a score of 8.

2. Ten subjects demonstrated moderate capacity (5, 6,or 7) in the print style. Of those ten subjects, three had a score of 7, three subjects had a score of 6, and four subjects had a score of 5.

3. Ten subjects demonstrated limited capacity (0, 1, 2, 3, or 4) in the print style. Of those nine subjects, four had a score of 4, three subjects had a score of 3, two subjects had a score of 2, and one had a score of 0.

Aural

4. Twenty subjects demonstrated dominance (8, 9, or 10) in the aural style. Of these twenty subjects, eight had a score of 10, nine had a score of 9, and three subjects had a score of 8.

5. Fourteen subjects demonstrated moderate capacity (5, 6, or 7) in the aural style. Of these fourteen subjects, eight had a score of 7, two had a score of 6, and four subjects had a score of 5.

6. Six subjects demonstrated limited capacity (0, 1, 2, 3, or 4) in the aural style. Of these six subjects, four had a score of 4, one subject had a score of 3, one had a score of 2, and none had scores of 1 or 0.

Interactive

7. Twenty-four subjects demonstrated dominance (8, 9, or 10) in the interactive style. Of those twenty-four subjects, two had a score of 10, seven had a score of 9, and fifteen subjects had a score of 8.

8. Twelve subjects demonstrated moderate capacity (5, 6, or 7) in the interactive style. Of those 12 subjects, six had a score of 7, and six had a score of 6 .

9. Four subjects demonstrated limited capacity (0, 1, 2, 3, or 4) in the interactive style. Of those 4 subjects, one subject had a score of 4, two had a score of 2, and one subject had a score of 1.

Visual

10. Twenty-three subjects demonstrated dominance (8, 9, or 10) in the visual style. Of those twenty-three subjects, eleven had a score of 10, five had a score of 9, and seven had a score of 8.

11. Eleven subjects demonstrated moderate capacity (5, 6, or 7) in the visual style. Of those eleven subjects, four had a score of 7, three subjects had a score of 6, and four subjects had a score of 5.

12. Six subjects demonstrated limited capacity (0, 1, 2, 3, or 4) in the visual style. Of those six subjects, two had a score of 4, two had a score of

3, and two subjects had a score of 2. No one scored 1 or 0 in the visual style.

Haptic

13. Six subjects demonstrated dominance (8, 9, or 10) in the haptic style. Of those six subjects, two scored a 10, two subjects scored a 9, and two subjects had a score of 8.

14. Fourteen subjects demonstrated moderate capacity (5, 6, or 7) in the haptic style. Of those fourteen subjects, six scored a 7, five scored a 6, and three subjects scored a 5.

15. Twenty subjects demonstrated limited capacity (0, 1, 2, 3, or 4) in the haptic style. Of those twenty subjects, seven had a score of 4, six had a score of 3, five subjects had a score of 2, and two subjects had a scores of 1.

Kinesthetic

16. Seven subjects demonstrated dominance (8, 9, or 10) in the kinesthetic style. Of those 7 subjects, two had a score of 10, three subjects had a score of 9, and two subjects had a score of 8.

17. Six subjects demonstrated moderate capacity (5, 6, or 7) in the kinesthetic style. Of those subjects, three had a score of 7, two subjects had a score of 6, and one subject had a score of 5.

18. Twenty-seven subjects demonstrated limited capacity (0, 1, 2, 3, or 4) in the kinesthetic style. Of those subjects, five had a score of 4, six subjects had a score of 3, six subjects had a score of 2, nine had a score of 1, and one subject had a score of 0.

Olfactory

19. No subject demonstrated dominance (8, 9 or 10) in the olfactory style.

20. One subject demonstrated moderate capacity (5, 6 or 7) in the olfactory style. That subject had a score of 5.

21. Thirty-nine subjects demonstrated limited capacity (0, 1, 2, 3 or 4) in the olfactory style. Of these thirty-nine subjects, one had a score of 4, four subjects had a score of 3, thirteen subjects had a score of 2, eight subjects had a score of 1, and thirteen subjects had a score of 0.

In summary, the seven perceptual modalities conceptualized by French did manifest themselves in this university population. More students (twenty-four) demonstrated dominance in the interactive modality than any other modality. The visual was second with twenty-three students demonstrating dominance in that modality. Twenty students demonstrated dominance in both the print and aural modalities. Seven students demonstrated dominance in the kinesthetic modality, and six students showed dominance in the haptic modality. However, no subject demonstrated dominance in the olfactory modality.

VARIABILITY OF STYLE

2. Are there measurable variations in the perceptual learning styles of this university population?

The concept of style variability within the university student population was addressed by examining variations in individual perceptual learning styles. Three types of data were utilized in this investigation. The first were rank orderings by subject. This information is found in Table 2. The second were score ranges within each style element (modality). This information is summarized in Table 3. The third type of data used was the number of dominant, moderate capacity, and limited capacity styles among the various subjects. This information is summarized in Table 4. Those summaries were used to determine the variability within each perceptual style element .

When viewing the score ranges for each style element, the following information should be kept in mind. Each perceptual style has a potential scoring range of eleven numerical values, from 0-10. All seven modalities contained scores in at least six of the ten numerical values. The summary of MMPALT-II scores reveals the following facts:

1. One hundred percent of the eleven-point scoring range was used for the kinesthetic modality.

TABLE 3 : SUMMARY OF MMPALT-II SCORES BY MODALITY ELEMENT

	LIMITED SCORES				MODERATE SCORES				DOMINANT SCORES			
Modaltiy	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**SCORE RANGE**
PRINT	0	1	2	3	4	4	3	3	8	6	6	(1-10)
AURAL	0	0	1	1	4	4	2	8	3	9	8	(2-10)
INTERACTIVE	0	1	2	0	1	0	6	6	15	7	2	(1-10
VISUAL	0	0	2	2	2	4	3	4	7	5	11	(2-10)
HAPTIC	0	2	5	6	7	3	6	5	2	2	2	(1-10)
KINESTHETIC	1	8	7	6	5	1	2	3	2	3	2	(0-10)
OLFACTORY	13	8	13	4	1	1	0	0	0	0	0	(1-5)

TABLE 4 : NUMBER AND IDENTIFICATION OF DOMINANT, MODERATE AND LIMITED STYLES BY SUBJECT

SUBJECT	Number of Dominant Styles	Dominant Styles	Number of Moderate Styles	Moderate Styles	Number of Limited Styles	Limited Styles
AR-00	1	H	1	V	5	PAIKO
AR-01	1	H	4	PAIV	2	KO
AR-02	4	PAIV	1	H	2	KO
AR-03	2	PV	3	AIH	2	KO
AR-04	5	PAIVH	0	- -	2	KO
AR-05	3	IVH	2	PA	2	KO
AR-06	1	V	2	IH	4	PAKO
AR-07	3	IVH	1	A	3	PKO
AR-08	1	V	3	AIH	3	PKO
AR-09	1	V	4	PAIH	2	KO
EN-10	0	- -	0	- -	7	PAIVHKO
EN-11	1	A	1	V	5	AIHKO
EN-12	4	IVHK	1	P	2	AO
EN-13	3	PIV	1	A	3	HKO
EN-14	2	IV	3	PAH	2	KO
EN-15	2	PV	3	AIH	2	KO
EN-16	2	PV	3	AIH	2	KO
EN-17	2	PV	3	AIH	2	KO
EN-18	4	PAIV	2	HK	1	O
EN-19	3	PIV	2	AH	2	KO
HP-20	5	PAIVK	0	- -	2	HO
HP-21	3	PAI	3	VHK	1	O
HP-22	4	PAIV	0	- -	3	HKO
HP-23	2	AI	2	PK	3	VHO
HP-24	4	PAIK	1	V	2	HO
HP-25	3	PAI	2	VK	2	HO
HP-26	5	PAIVK	0	- -	2	HO
HP-27	3	PAK	2	IV	2	HO
HP-28	4	PAVK	1	I	2	HO
HP-29	4	PAIK	1	V	2	HO
SW-30	3	PAI	0	- -	4	VHKO
SW-31	1	V	3	PAI	3	HKO
SW-32	3	AIH	2	PO	2	HK
SW-33	2	AI	2	HK	3	PVO
SW-34	1	V	1	P	5	AIHKO
SW-35	2	AI	2	VH	3	PKO
SW-36	0	- -	4	AIVK	3	PO
SW-37	2	AI	0	- -	5	PVHKO
SW-38	2	AI	2	PV	3	HKO
SW-39	2	AI	0	- -	5	PVHKO

P = Print, A = Aural, I = Interactive, V = Visual, H = Haptic, K = Kinesthetic, O = Olfactory
AR = Architecture, EN = Engineering, HP = Human Performance and Sports Studies, SW = Social Work
Dominant Styles = 8, 9 or 10 ; Moderate Capacity = 5, 6 or 7 ; Limited Capacity = 0, 1, 2, 3 or 4

2. Ninety percent of the eleven-point scoring range was used for print, interactive, and haptic modalities.

3. Eighty-two percent of the eleven-point scoring range was used for aural and visual modalities.

4. Forty-six percent of the eleven-point scoring range was used for olfactory modality.

In summary, the kinesthetic modality showed the greatest variation across the 40 subjects tested with one-hundred percent of the eleven-point scoring range demonstrated. Three additional modalities (interactive, visual, and haptic) occupied ninety-percent of the possible scoring range positions.

Three categories were used to identify MMPALT-II strengths. In interpreting the MMPALT-II results, great strength in and dependence on a modality are used as criteria for dominance. The term "dominant" was used to identify modality elements with scores of 8, 9, or 10 (MMPALT-II). In this study, the term "primary" was used to identify an individual's strongest modality, even if that modality was not dominant. The term "secondary" was used to identify the second ranked style of those subjects with a single dominant strength. Because of tied scores, it was possible for subjects to have equally high rankings in two or more styles. The term "multiple" is used to identify situations in which two or more modality elements exhibited scores of 8, 9, or 10 in an individual's profile.

Variability, in terms of subjects' strengths across the respective seven style elements, is depicted in Table 4. An examination of that table reveals that all seven of the perceptual style elements were ranked as either a dominant, moderate, or limited style for someone. In order for a style to be considered dominant, it must have a score of 8, 9, or 10. For moderate capacity, a score of 5, 6, or 7 is required in that modality. For limited capacity, a score of 0, 1, 2, 3, or 4 is required. Table 4 summarizes findings in regard to modality dominance .

1. Three of the subjects (AR-04, HP-20, and HP-26) were dominant in 5 modalities. Of these three subjects, none demonstrated moderate capacity in other modalities, and all scored limited capacity in 2 modalities All three of these subjects showed dominance in four common areas: print, aural, visual, and interactive. It should be noted that while multiple dominance has often been found in other subjects, dominance in as many as five modalities appears to be somewhat rare.

2. Seven subjects (AR-02, EN-12, EN-18, HP-22, HP-24, HP-28, and HP-29) were dominant in 4 modalities. Of these seven subjects, three subjects showed moderate capacity in 1 modality and limited capacity in 2. Another subject showed moderate capacity in 2 modalities and limited capacity in 1 modality. The remaining subject in this group showed moderate capacity in no modalities and demonstrated limited capacity in 3 modalities.

3. Nine subjects (AR-05, AR-07, EN-13, EN-19, HP-21, HP-25, HP-27, SW-30, and SW-32) were dominant in 3 modalities. Of these nine subjects, three demonstrated moderate capacity in two modalities and limited capacity in 2 modalities. Two of these subjects demonstrated moderate capacity in 1 modality and limited capacity in 3 modalities. One subject showed moderate capacity in 3 modalities and limited capacity in 1 modality. The remaining subject showed moderate capacity in 0 modalities and limited capacity in 4 modalities.

4. Eleven subjects (AR-03, EN-14, EN-15, EN-16, EN-17, HP-23, SW-33, SE-35, SW-37, SW-38, and SW-39) were dominant in 2 modalities. Of these eleven subjects, five subjects showed moderate capacity in 3 modalities and limited capacity in 2 modalities. Four of these subjects showed moderate capacity in 2 modalities and limited capacity in 3 modalities. The two remaining subjects showed moderate capacity in 0 modalities and limited capacity in 5 modalities.

5. Eight subjects (AR-00, AR-01, AR-06, AR-08, AR-09, EN-11, SW-31, and SW-34) were dominant in 1 modality. Of these eight subjects, three subjects showed moderate capacity in 1 modality and limited capacity in 5 modalities. Two of these subjects showed moderate capacity in 3 modalities and limited capacity in 3 modalities. Two subjects within this group showed moderate capacity in 2 modalities and limited capacity in 4 modalities, and the remaining subject demonstrated moderate capacity in 4 modalities and limited capacity in 2 modalities.

6. Two subjects (EN-10 and SW-36) did not show dominance in any modality. Of those two subjects, one subject demonstrated moderate capacity in 4 modalities and limited capacity in 3 modalities. The other subject demonstrated moderate capacity in 0 modalities and limited capacity in 7 modalities. It should be noted that this last student was an international student whose native language was Spanish.

In summary, these forty university students demonstrate measured variability in style in all seven perceptual style elements. The number of dominant modalities demonstrated by this student population ranged from 0-5. Subjects demonstrated a range of moderate capacity styles from 0-4 and a range of limited capacity styles from 1-7, with one student demonstrating limited capacity in all 7 modalities.

PERCEPTUAL LEARNING STYLE PATTERNS BY MAJOR

3. Do college seniors in a given major exhibit similar patterns of learning style dominance as measured by the MMPALT-II?

This section utilized data obtained from Table 1. Data from all four subject groups were analyzed and produce the following findings.

1. MMPALT-II scores revealed that eighty percent of architecture students demonstrated dominance in the visual modality. Fifty percent

showed dominance in the haptic modality. Forty percent demonstrated dominance in the interactive modality. Thirty percent showed dominance in the print modality. Twenty percent showed dominance in the aural modality and no student showed dominance in either the kinesthetic or olfactory modalities.

2. A majority of engineering students (eighty percent) showed dominance in the visual modality. Seventy percent showed dominance in the print modality. Fifty percent showed dominance in the interactive modality; Twenty percent showed dominance in the kinesthetic modality. Ten percent showed dominance in the aural and haptic modalities, and no student showed dominance in the olfactory modality.

3. Human performance students showed dominant styles in aural modality with one hundred percent having scores in the "dominant" range. Print was second with ninety percent of scores in the "dominant" range . Eighty percent of human performance students showed dominance in the interactive modalities, and fifty percent showed dominance in the kinesthetic modality. Forty percent showed dominance in the visual style. No student showed dominance in the olfactory modality.

4. Social work students showed dominant styles in aural and interactive modalities with seventy percent in "dominant" range in each style. Forty percent demonstrated dominance in the visual style with no student showing dominance in haptic, kinesthetic, or olfactory styles.

In summary, architecture students demonstrated highest dominance in the visual and haptic modalities. The highest areas of dominance for engineering students were in the visual and print modalities while human performance students were most dominant in aural and print modalities. The dominant modalities for social work students were aural and interactive with seventy percent demonstrating dominance in both styles.

EXPECTATIONS OF STYLE PATTERNS

4. Are those patterns of dominance exhibited by seniors in a given major what we expect?

During an initial interview, deans and/or department heads were asked to predict the dominant perceptual learning styles of students in their program area. These predictions were obtained after an explanation of the perceptual learning styles used in this study and a review of the MMPALT-II testing procedure. Data pertaining to the predictions are presented in Table 1.

Note: A prediction was considered to be confirmed when 50 percent or more of the subjects in a particular major demonstrated dominance in the predicted modality.

Architecture

The Dean of the Architecture College predicted that architecture students would show dominance in the haptic and visual modalities. Data showed the highest scoring modality for architecture students was visual with eighty percent of architecture students demonstrating dominance in the visual modality. The second highest scoring modality was haptic with fifty percent showing dominance.

In summary, it was predicted that architecture students would demonstrate dominance in haptic and visual modalities. The patterns of dominance exhibited by seniors in architecture matched the prediction.

Engineering

It was predicted by the Dean of the Engineering College that engineering students would show dominance in interactive and print modalities. Data showed the highest ranking dominant score to be visual with eighty percent of engineering students demonstrating dominance. The second highest ranking dominant score was print with seventy percent of students demonstrating dominance. Fifty percent of engineering students showed dominance in interactive modalities. Only ten percent of these students demonstrated dominance in the aural style.

In summary, it was predicted that engineering students would show dominance in interactive and print modalities. These predictions were only partially confirmed.

Human Performance and Sports Studies

The Department Head of the Human Performance and Sports Studies program predicted that these students would show dominance in kinesthetic and haptic modalities. MMPALT-II data showed high rankings in aural with one hundred percent of human performance students showing dominance in this modality. Ninety percent of students showed dominance in the print modality, and eighty percent demonstrated dominance in the interactive modality. Only fifty percent of human performance students demonstrated dominance in the kinesthetic modality, and no student demonstrated dominance in the haptic style.

In summary, it was predicted that human performance students would show dominance in kinesthetic and haptic modalities. These predictions were fulfilled.

Social Work

It was predicted by the Department Head of Social Work that these students would show dominance in interactive and aural modalities. MMPALT-II data showed high rankings in both the aural and interactive

modalities with seventy percent of social work students demonstrating dominance in the aural modality and seventy percent showing dominance in the interactive modality. Thirty percent demonstrated dominance in the visual modality; ten percent showed dominance in the print modality. No student showed dominance in the haptic, kinesthetic, or olfactory modalities.

In summary, it was predicted that social work students would show dominance in the aural and interactive modalities. These predictions were supported by MMPALT-II data.

SUMMARY

In summary, subjects of the investigation generated scores other than 0 in all seven modality areas although no one scored high in the olfactory modality. Thirty eight students demonstrated dominance in at least one modality, and thirty of these students were dominant in more than one. An extensive range of scores in each modality was exhibited. One or more subjects demonstrated dominance in every modality except the olfactory. There were similarities in the score patterns of subjects representing each academic major investigated, and college administrators representing these majors were able to predict correctly the dominant styles of students in two of the four programs investigated. In the remaining two programs, administrators correctly predicted one area of dominance found in at least 50 percent of the majors.

CHAPTER 5
CONCLUSIONS , DISCUSSION, IMPLICATIONS and RECOMMENDATIONS

SUMMARY

This study focused on the measurement of the perceptual learning styles of advanced university students and the relationship of those styles to their choice of college major. The measurement of these styles was based on the seven learning modalities originally conceptualized by French. These included visual, print, aural, interactive, haptic, kinesthetic, and olfactory learning modalities. In collaboration with French, Gilley developed, tested, and validated the original Multi-Modal Paired Associated Learning Test (MMPALT). This version of the MMPALT measured six of the seven modalities conceptualized by French. The MMPALT was then revised by Cherry in 1981 after consultation with Gilley and French. This revised instrument (MMPALT-II) included the testing of the olfactory modality. Schaiper utilized the same instrument in his study of university students with some minor modifications in the olfactory and haptic portions of the test. This version of the MMPALT-II has also been used by Galbraith and James (1984), Akins (1983/1984), Nix (1983/1984), Brown (1984/1885), Rice (1984/1985), Russell (1984/1985), and James and Blank (1991a, 1991b) to study various populations from youths to older adults. This researcher utilized the Cherry instrument with minor modifications in the visual and olfactory tests. These modifications were made based on consultation with Schaiper, Cherry, and French.

Procedures

The MMPALT-II was administered to 40 advanced University of Tennessee students. The sample was composed of 10 students from each of the following academic programs : architecture, social work, engineering, and human performance. Eligible students were contacted by department heads, and lists of interested students were obtained. These students were contacted by phone by the investigator. Students were presented with the goals, objectives, and procedures of the study and then given the opportunity to volunteer for the project.

MMPALT-II individual scores were hand scored, and both individual and group data were compiled into tables. First, individual modality scores were summarized by subject (Table 1). Second, rank orders and scores by subject were determined and evaluated for variability of style (Table 2). Third, individual subject scores were analyzed in terms of dominant, moderate capacity, and limited capacity to use the modality (Table 4). Results of the test (rank orders of modality dominance) were also analyzed by academic major (Table 1).

After completing the charts and tables indicated in the preceding paragraph, results were synthesized to produce responses to the four research questions (see Chapter 1), and predictions were generated for research question 4.

CONCLUSIONS PERTAINING TO THE RESEARCH QUESTIONS

1. Do the seven perceptual styles identified by French manifest themselves in this selected adult university student population ?

This question is answered in the affirmative because all seven styles were measurable within this subject population. Of the 40 subjects tested, all generated scores other than zero in at least five of seven modality areas. However, no subject scored in the dominant range (8, 9 or 10) in the olfactory modality.

CONCLUSION: It can be concluded that the seven perceptual styles identified by French did manifest themselves in this selected adult university student population. However, olfactory was not a dominant learning mode for any of the students tested.

2. Are there measurable variations in the perceptual learning styles of this university student population?

This question is answered in the affirmative because no two subjects had the same scores. Additionally, one or more subjects demonstrated dominance in every modality except the olfactory, and all but two subjects demonstrated dominance in at least one modality.

CONCLUSION: It can be concluded that there were measurable variations in the perceptual learning styles of this university student population.

3. Do college seniors in a given major exhibit similar patterns of perceptual learning style dominance as measured by the MMPALT-II?

This question is answered in the affirmative because the university students within each individual academic major studied demonstrated similar score patterns of perceptual learning style. For example, eighty percent of architecture students were dominant in the visual modality. eighty percent of engineering students showed dominance in the visual modality. One hundred percent of human performance students showed dominant styles in the aural modality, and seventy percent of social work students showed dominance in both the aural and interactive modalities. The presence of these similar patterns raises an interesting question: "Why do these similarities exist?"

CONCLUSION: It can be concluded that college seniors in a given major within this university population do exhibit similar patterns of perceptual learning style dominance as measured by the MMPALT-II, but there are also differences in styles among them.

4. Are those patterns what we expect?

The findings of this study show that many of the patterns predicted by deans and/or department heads in given academic majors did match the actual patterns of dominance in the student population in those majors.

CONCLUSION: It can be concluded that college administrators representing the academic majors studied were sometimes, but not always, able to predict correctly the dominant styles of successful students in their programs.

ADDITIONAL CONCLUSIONS

CONCLUSION: It can be concluded that the styles identified by French do manifest themselves from elementary age children through a range of adult populations.

This is one of many studies of perceptual styles using different populations. Gilley (1975/1976) used the original MMPALT to test third grade students. Cherry (1981/1982) used the MMPALT-II to test a diverse population of adults. Schaiper (1983/1984) tested 53 university students, and James and Galbraith (1984) used the MMPALT-II to study a population of adults ranging from university students to senior adults. All have found manifestation of the seven styles conceptualized by French in their populations. Findings of this study replicate those of the previous studies.

CONCLUSION: It can be concluded that differences as well as similarities in perceptual learning styles exist even in homogeneous populations such as those engaged in similar work or advanced study.

Deans and/or department heads representing each of the majors studied were asked to predict the expected patterns of dominance demonstrated by the students within their respective academic areas. Of the four administrators, two administrators predicted correctly the patterns of dominance demonstrated by their students. One administrator's predictions only partially described the expected patterns of dominance correctly, and the remaining administrator's predictions did not match the two most common patterns of dominance demonstrated by the students in that major.

The findings of this study suggest implications for advising, academic counseling, and instruction.

IMPLICATIONS

Implications for Advising

There are several implications for the advisement of college students in choosing an academic major:

(1) Since we don't know at this time if styles can be strengthened, perhaps students should be tested for perceptual learning styles utilizing the

MMPALT-II or some other instrument prior to choosing a major. If this were done early in their academic programs, it would make them aware of their styles which they could then compare with the style patterns of successful students in their proposed major.

(2) Could the use of the MMPALT-II affect students on academic review? Perhaps it could be used to determine reasons for academic problems which could then be addressed by assisting students in a) locating individual courses or professors who complement his or her perceptual learning style or b) developing learning techniques appropriate to the courses and professors available.

Implications for Academic Counseling

There are also several implications for academic counseling.

(1) By utilizing results of the MMPALT-II, perhaps students could be counseled in choosing materials and strategies which complement their perceptual learning style(s) and which will assist them in being successful in their academic studies. For example, tape recording lectures could work well for aural learners, and marking text material with colored markers may assist those who are high visual learners. It is possible that these and other techniques have the potential to provide an individualized program of study for students in even the most conventional classes.

(2) Students who express difficulty with a particular course or portion of their academic program might be counseled as to the possible causes of frustration. Perceptual learning style profiles could be used as a point of understanding and a focal point for further discussion in areas of academic difficulty.

(3) It appears that cultural differences could affect style. For example, a student whose native language is Spanish may be a natural print learner; however, the language difference may cause him to have difficulty within his dominant style. Perhaps these students could be counseled to utilize other areas of dominance to assist them as they struggle to communicate in a different language.

(4) The results of this study suggest that perceptual learning style is a critical aspect of career counseling. A student's choice of career may not be compatible with his/her perceptual learning style or with his/her expectations about learning and work tasks. For example, the student who has a highly kinesthetic ability and wants to be an engineer so he or she can work outdoors and build bridges can sometimes become frustrated with an academic engineering program that requires endless hours of lecture and indoor reading (a program compatible with the aural and print styles). Students facing this dilemma could be counseled as to the possible implications of this conflict .

(5) Perhaps counseling programs could provide tutorial assistance or instruction within their programs to help students improve, wherever possible, the use of weaker perceptual modalities.

Note: There is no evidence that weaker perceptual modality styles can be improved to the point of becoming dominant styles.

Implications for Instruction

There are also implications for instruction.

(1) MMPALT-II data could assist instructors and administrators in recognizing individual style differences. This awareness might then assist them in recognizing the need for a multi-sensory approach to teaching. For example, classes could be constructed to provide a focus for interactive learners, while kinesthetic learners would benefit from the ability to physically move around the room. By recognizing the individual differences among students, instructors might be led to provide opportunity for greater variety of learning approaches. Professional development for instructors and administrators in the area of perceptual learning styles could assist in recognition and utilization of styles in the classroom.

(2) We are currently in a time where quickly advancing technologies are providing us with instructional materials that are adept in graphics, sound, and video. These could provide a greater opportunity for students to acquire

information in different modalities. Faculty development in technology applications could, in turn, offer students more individualized instructional opportunities.

(3) It is possible that department heads and lead teachers could develop academic programs with a greater focus on the dominant strengths of students in their program. For example, social work programs, whose students are dominant in aural and interactive styles, could integrate additional learning tools to provide more opportunities for students in their programs.

(4) Why do similar patterns of learning modalities exist among successful students in individual academic majors? Is it because students with particular perceptual learning styles succeed in programs matching their styles whereas students with incompatible styles are not able to perform in that program? Or does the instructional system mold the styles of students to conform to their methods of instruction or expected methods of academic performance? The implication of these questions calls for further, focused research.

(5) Why do human performance and sports study students demonstrate such extensive multiple dominance? Why are the patterns of dominance among these students different than the patterns of other student majors tested? Do the instructional demands of that program require students to be proficient in a diverse range of perceptual learning styles or are

certain types of learners with unique qualities attracted to these programs? Is there some connection between the dominance of the kinesthetic modality and a wider range of ability among styles? Again, the implication is a need for further, focused research.

RECOMMENDATIONS FOR FURTHER RESEARCH AND DEVELOPMENT

Within the boundaries of this study, the following recommendations are presented for further research.

1. The MMPALT-II needs to be mass-produced. Many of the protocol materials utilized for this test are difficult to find and almost impossible to duplicate exactly without a mass-produced version of the test . For example, the haptic modality utilizes many objects of different shapes and textures. It is difficult to standardize these objects unless they are produced in quantity and provided for testing purposes. This production would also make testing more convenient. Many of the testing procedures are currently very awkward and cumbersome. For example, the olfactory test which currently relies on extracts used in vials or bottles could be mass-produced using "scratch and sniff" instrumentation.

2. Additional research should be done in areas of reliability and validity. Additional data are needed to solidify the validity and reliability of the instrument in its present form.

3. The individual tests that make up the MMPALT-II should be equated for level of difficulty.

4. Replications of this study, utilizing both identical majors and other majors, would provide additional information about relationships between perceptual learning style and choice of college major. This research is needed because the student population used in this investigation were limited in size and only four majors were investigated.

5. Research should be done to determine the relationships among multiple dominant styles. We need to know if people operate in more than one dominant style simultaneously, or if they use only one modality at a time.

6. Studies have suggested that students who are creative or gifted have the ability to produce many ideas and to process and react to many kinds of stimuli. The relationship between multiple modalities and creativity or giftedness should be researched. The uniqueness of the students in the human performance and sports studies program who were studied supports the need for inquiry in this area.

7. Emerging technologies are uniquely suited to presenting instructional materials in multi-sensory modes through the use of sound, graphics, and video. Meaningful research could be done on the impact of these technologies on students with different perceptual styles.

8. Longitudinal studies would provide information on the developmental changes that occur, if any, in an individual's perceptual learning style. For example, MMPALT-II data could be collected on students when they enter an academic program. Those students could then be tested at the successful conclusion of that program and at a mid-point to determine if the environment has affected their perceptual learning style profile. Studies could focus on those students who drop out or change majors several times during their academic careers. Additional studies could also be conducted using a pre-post design to determine the effect of particular interventions on perceptual modality learning style. Two or more instruments could be administered at different points within an academic program to determine if certain types of learning styles are modifiable. For example, the MMPALT-II, as well as Kolb's Learning Style Inventory, could be administered upon entrance into a student's academic program and then readministered at the completion of the program to determine if certain areas of style are modifiable whereas others are not. The MMPALT-II and Kolb inventory are used here as examples of instruments purportedly measuring different areas of learning style.

9. The study of perceptual learning styles in relationship to other aspects of perceptual learning style is important. Determining relationship between perceptual style, personality, emotional style, and social style would be useful.

10. The relationship of academic achievement to perceptual learning styles should also be investigated. This relationship could be a very important

variable in curriculum development, selection of teaching methods, and construction of exams. Further, research into the relationships among a person's grade-point average (G.P.A.), academic major, and perceptual learning style would be valuable. For instance, are those students who have a low G.P.A. and who struggle through an academic program really less academically able than those with a higher G.P.A., or is it that they are studying in a program that is not compatible with their perceptual learning style(s)?

11. More research should be focused on the relationship of perceptual learning style to instruction. Should we match student and teacher perceptual learning styles to provide a learning environment that is the least frustrating for the student, or should we allow students to experience diversity in style in order for them to expand their abilities? There is little or no research that demonstrates that weak styles can be strengthened over time. We do know, however, that the more exposure a student gets to different styles, the more he/she will be able to discover his/her own abilities or weaknesses in those styles.

12. More research is needed to determine the relationship between perceptual learning styles and factors of race, culture and gender. Many studies have noted a need for further advancement in these areas; however, none have studied the cultural differences that may hinder testing of perceptual learning style. For example, a student whose native language is Spanish could be a dominant interactive learner but could be tested as a low

interactive learner because of difficulty in communicating in a second language.

13. Finally, the role of the conventional classroom should also be studied in relationship to perceptual learning style. For example, most conventional education is centered on print, aural, and visual learning. The most time is spent, particularly in the area of higher education, on activities which require students to listen, read, and watch in order to learn information given to them. Additional research which could enhance the conventional classroom in light of the true perceptual learning styles of students could be of critical importance.

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APPENDICES

APPENDIX A

THE UNIVERSITY OF TENNESSEE
KNOXVILLE

College of Education
Curriculum and Instruction
301 Claxton Education Building
Knoxville, Tennessee 37996-3400
(615) 974-3165

What are learning styles, and why should we measure them?

As people are left handed or right handed, they also have different ways of learning. Some learn best by reading, touching, seeing, or hearing: others learn best by talking with friends, actively doing things, or even by smelling things. The measurement of learning styles is not a matter of finding good or bad, or determining pass or fail; it is a matter of discovering individual differences. By identifying your individual style(s), you can have a greater understanding of yourself and maximize your intake of information.

Here at the University of Tennessee, we have developed an experiential based learning style measurement to identify these styles. It is one of the few systems of its type and is becoming more utilized as we refine and perfect the instrument. The test is commonly referred to at the MMPLAT-II. Because it is based on actual learning experiences, it is beneficial and fun for those who participate as well as those who will assisting you in identifying your dominant learning style(s).

The goal of this project is two fold. First, we are interested in identifying the individual style(s) of ten advanced architecture students. Secondly, we would like to find out how those style(s) effect your goals and career decisions in the future. Just as it is hard to imagine an artist who lacks visual capabilities or a surgeon who cannot work with his hands, we are interested in the capabilities that constitute the profile of a successful architect. By identifying the patterns or profiles of successful architecture students and comparing those to the profiles of other major career fields, we can greatly benefit both the advising and counseling of students seeking this career.

How will this measurement program be conducted?

When you arrive, you will be asked to fill out an information card. After an explanation of the concept of learning styles and an introduction to the measurement procedures, you will move on to the actual testing location. You will be asked to remember pairs of words, pictures, objects smells, or movements. The number of pairs remembered will indicate the participant's strengths in each of seven learning styles: print, aural, interactive, visual, haptic, kinesthetic, and olfactory. The last stage in the process will be an interview where you will receive your "learning profile". Your style(s) will then be explained and you will have an opportunity to discuss ways in which this information can be utilized to promote a maximized learning environment for you in the future.

When, Where, and How Long?

Following the initial sign-up you will receive information listing the room in Claxton Education Building, and time you selected. All testing will take place on Saturday, March 13th. It will take approximately 1and1/2 -to 2 hours to complete both the measurement and the interview.

Thanks for your interest in this project. We are sure it will be a beneficial experience for you!

For additional information or sign-up contact:

Marsha Butler
108 Claxton Education Building or
691-2124

What are learning styles, and why should we measure them?

As people are left handed or right handed, they also have different ways of learning. Some learn best by reading, touching, seeing, or hearing: others learn best by talking with friends, actively doing things, or even by smelling things. The measurement of learning styles is not a matter of finding good or bad, or determining pass or fail; it is a matter of discovering individual differences. By identifying your individual style(s), you can have a greater understanding of yourself and maximize your intake of information.

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The goal of this project is two fold. First, we are interested in identifying the individual style(s) of ten students from each of the following disciplines: Engineering, Architecture, Social Work and Human Performance/Recreation. Secondly, we would like to find out how those style(s) effect your goals and career decisions in the future. Just as it is hard to imagine an artist who lacks visual capabilities or a surgeon who cannot work with his hands, we are interested in the capabilities that constitute the profile of a successful professional in your career choice. By identifying the patterns or profiles of successful students in your field and comparing those to the profiles of other major career fields, we can greatly benefit both the advising and counseling of students seeking this career.

How will this measurement program be conducted?

When you arrive, you will be asked to fill out an information card. After an explanation of the concept of learning styles and an introduction to the measurement procedures, you will move on to the actual testing location. You will be asked to remember pairs of words, pictures, objects smells, or movements. The number of pairs remembered will indicate the participant's strengths in each of seven learning styles: print, aural, interactive, visual, haptic, kinesthetic, and olfactory. The last stage in the process will be an interview where you will receive your "learning profile". Your style(s) will then be explained and you will have an opportunity to discuss ways in which this information can be utilized to promote a maximized learning environment for you in the future.

When, Where, and How Long?

All testing will take place on Saturday, March 13th. It will take approximately 1and1/2 -to 2 hours to complete both the measurement and the interview.

Thanks for your interest in this project.

Marsha Butler

Subject Informed Consent

MMPALT-II Testing

Because this is part of a research project, the learning styles measurement will be conducted under a rigid set of rules:

1. Participation is on a voluntary basis and individuals may withdraw from the project or any part of it at any time.

2. Individual privacy will be fully protected.

3. Published results will not identify individual participation.

4. No participant will be subjected to any physical, psychological, or social risk or injury.

Participation in this study is not required for any course or academic program. Refusal to participate involves no penalty or loss of benefits. I have read the introduction to the learning styles measurement project and I would like to be a participant in the project. I freely choose to voluntarily participate in this study as confirmed by my signature below:

Printed Name : _____

Signature : _____

Social Security Number : _____

Birth Date : _____ Age : _____

College Major : _____

Years in Major Program: _____

Career Goals:

DEAN / DEPARTMENT HEAD INTERVIEW GUIDE

Entrance requirements for incoming _____ students?

Formal requirements?

"Implied" requirements?

Factors that make up or describe the "typical"_____ student?

(We are assuming that in order to reach senior status, there must be some level of success or "weeding out" of those who are not successful in this field.)

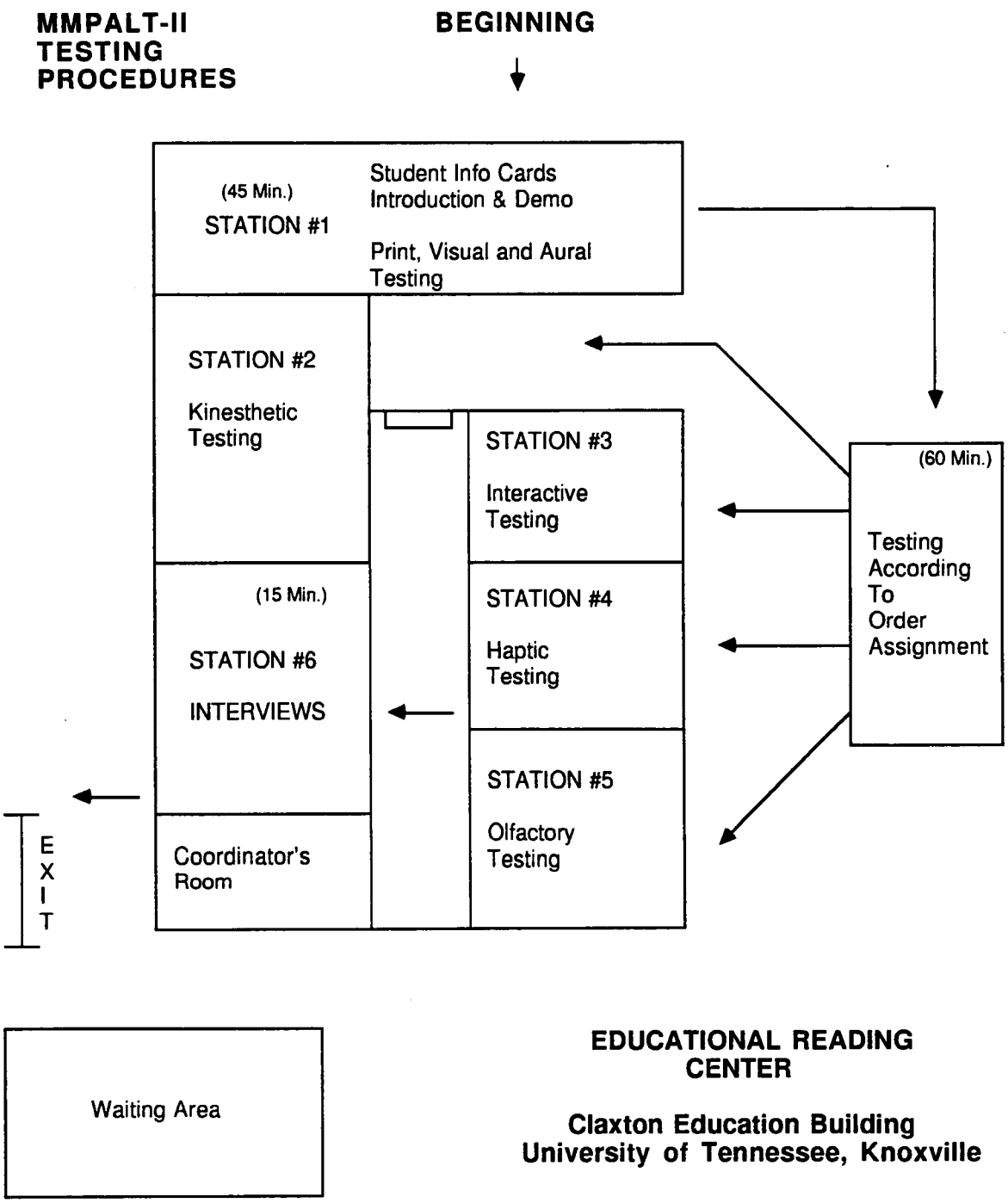
Do you agree, disagree, and what would you consider is the level of success?

What career paths do "typical" _____ students follow?

What makes someone a "successful" _____?

APPENDIX B

LAYOUT OF FACILITY USED FOR MMPALT-II TESTING



EDUCATIONAL READING CENTER

Claxton Education Building
University of Tennessee, Knoxville

INTRODUCTION OF PERCEPTUAL LEARNING STYLES MEASUREMENT PROCEDURES

You are about to be measured to determine your strongest perceptual learning style or styles. This measurement process will serve two purposes. First, you will receive a perceptual learning style profile identifying some perceptual strengths and weaknesses. This can help you in your future learning endeavors. Secondly, the results of this testing will be used to support an educational research project. Therefore, each of you will have an opportunity to contribute towards improving learning and schooling for others.

Since the data from your measurements will be used in a research report, you have been asked to sign a release form. Although you have filled out a form with you name and other personal information on it, all personal identification will be removed from the published measurement results. You have been assigned code numbers, and those numbers will be used on all reports.

You will receive three measurements in this room. The first measurement you will be given will identify your strengths as a print learner. You will be shown ten pairs of words. One word in each pair is a nonsense word, and the other is a common word. (Show slides). In this pair "WUQ" is paired with the common word "Robin". After you have seen all ten pairs, the nonsense words will be presented to you again, but in a different order: For example, when you see the nonsense word "WUQ" again, you are to respond by writing the word "Robin" on your answer sheet.

For the visual measurement, you will be shown ten pairs of pictures to remember. After you have seen all ten pairs, you will be shown one of the pictures from each pair and asked to identify or recall what was paired with that picture. For example (Show slides) : the diagonal line is paired with a picture of a truck: When you see the diagonal line again, you should respond, by writing the word "TRUCK" on the response sheet.

For the aural learning style measurement, you will be blindfolded and asked to listen to a tape recording containing presentations of ten nonsense words paired with ten common words. The tape will sound something like :

"The nonsense word in this pair is ROP : ROP is paired with CORN.
You are to remember that CORN goes with ROP."

You will hear ten pairs . Then, when you hear the word ROP again, you are to respond by writing the word CORN on your answer sheet.

After these three tests are completed, you will be moved to another location for the remaining tests. For the interactive measurement, you will discuss pairs of nonsense and common words with an evaluator. The evaluator will pronounce the word Pairs and ask you to repeat the words. (Demonstrate with "YAG" and "EYE".). You will be given an opportunity to briefly discuss how you will remember the pairs. (DEMONSTRATE). After discussing each of the ten pairs, you will hear the nonsense word spoken ("YAG") and be asked to state the appropriate common word ("EYE").

For the haptic measurement, you will be blindfolded and allowed several seconds to hold, touch and examine each of ten pairs of items.(DEMONSTRATE) After holding all ten pairs, you will be given one member of each pair and allowed ten seconds to name or describe the other item in that pair. (DEMONSTRATE).

The olfactory measurement involves the sense of smell. For this measurement you will be blindfolded and presented with pairs of small vials containing different aromas. The second aroma in each air will be identified by name to assist you in remembering the pairs of smells. (DEMONSTRATE). After receiving all ten pairs of smell vials, you will be presented with the first smell in each pair and asked to name the aroma it was paired with. (DEMONSTRATE).

The kinesthetic measurement involves body movement. From a specified starting point in the room, you will be guided and directed through pairs of body movements while blindfolded. (DEMONSTRATE WITH THE STOOP as the stimulus and ARMS MAKING A SQUARE IN THE AIR as the response member.) After going through all ten pairs, your evaluator will again guide and direct you through the first movement of each pair. You are to respond by demonstrating or describing the appropriately paired second movement. (DEMONSTRATE WITH THE STOOP. ASSISTANT RESPONDS WITH MAKING A SQUARE IN THE AIR).

Throughout each measurement be as relaxed as possible and try your best. After the last measurement, you will receive your scores and your learning profile and be able to discuss your results before leaving. Are there any questions?

PROCEDURES FOR MEASURING THE VISUAL LEARNING STYLE

Equipment: 35mm slide projector, slides, screen, response sheets and pencils.

Steps:

1. Place subjects approximately six feet from screen.

2. Distribute response sheets (face down) and pencils.

3. Display each stimulus member and response member pair at seven second intervals.

4. Have subjects pick up pencils and prepare to respond.

5. Announce number of response and display each stimulus member for ten seconds; e.g.,

NUMBER ONE
(WAIT TEN SECONDS)

NUMBER TWO
(WAIT TEN SECONDS), etc

6. Collect answer sheets.

Pairings and sequence of stimulus/response pairs:

Stimulus Member: (Symbols)	**Response Member:** (Picture)
Square	Tree
Circle	Hat
Triangle	Chair
Rectangle	Boot
Plus Sign	Window
Star (Open)	Boat
Oval	Flower
Asterisk	Eye Glasses
Diamond	Scissors
Infinity Sign	Umbrella

Sequence for stimulus only display:

1. Asterisk
2. Circle
3. Plus Sign
4. Rectangle
5. Infinity Sign
6. Oval
7. Diamond
8. Square
9. Star
10. Triangle

PROCEDURES FOR MEASURING THE PRINT LEARNING STYLE

Equipment: 35mm slide projector, slides, screen, response sheets and pencils.

Steps:

1. Place subjects approximately six feet from screen.

2. Distribute response sheets (face down) and pencils.

3. Display each stimulus member and response member pair at seven second intervals.

4. Have subjects pick up pencils and prepare to respond.

5. Announce number of response and display each stimulus member for ten seconds; e.g.,

NUMBER ONE
(WAIT TEN SECONDS)

NUMBER TWO
(WAIT TEN SECONDS), etc

6. Collect answer sheets.

Pairings and sequence of stimulus/response pairs:

Stimulus Member: (Symbols)	**Response Member:** (Picture)
BIW	Cat
CEQ	Party
PUQ	Name
DUP	Bed
XIB	Box
CYC	Horse
KOY	Rain
HEZ	Sister
LEZ	Paper
NYH	Coat

Sequence for stimulus only display:

1. DUP
2. CYC
3. KOY
4. BIW
5. XIB
6. NYH
7. CEQ
8. LEZ
9. PUQ
10. HEX

PROCEDURES FOR MEASURING THE AURAL LEARNING STYLE

Equipment: Tape Player, tapes, blindfolds, response sheets, and pencils.

Steps:

1. Place subjects approximately six feet from player.
2. Have subjects locate response sheets and pencils.
3. Have subjects put on blindfolds.
4. Play tape recording containing stimulus/response pairs.
5. Have subjects remove blindfolds and prepare to respond.
6. Play tape recording containing stimulus words and response questions.
7. Collect response sheets.

Script and Instructions for Tape:

FOR THIS EVALUATION, YOU WILL BE LISTENING TO PAIRS OF WORDS. THE FIRST WORD IN EACH PAIR IS A NONSENSE WORD AND THE SECOND IS A COMMON WORD. YOU SHOULD TRY TO REMEMBER THE COMMON WORD IN EACH PAIR AND RECOGNIZE WHICH NONSENSE WORD IT GOES WITH. AFTER YOU HAVE BEEN GIVEN ALL TEN PAIRS OF WORDS, YOU WILL THEN HEAR EACH NONSENSE WORD AGAIN BUT IN A DIFFERENT ORDER. YOU ARE TO THEN WRITE THE COMMON WORD THAT IS APPROPRIATE FOR THE NONSENSE WORD. LET'S BEGIN.

(USE THE FOLLOWING STYLE TO PRESENT EACH PAIR)

THE NONSENSE WORD IN THIS PAIR IS (STIMULUS): (STIMULUS) IS PAIRED WITH (RESPONSE). YOU ARE TO REMEMBER THAT (STIMULUS) GOES WITH (RESPONSE).

(PAUSE THREE TO FIVE SECONDS BETWEEN EACH PAIR)

Pairings and sequence of stimulus/response pairs:

Stimulus Member:	**Response Member:**
VOM	Apple
UND	Baby
TUD	Kitten
SUL	Shoe
ROZ	Duck
POH	Leg
OMP	Bread
MOG	Table
KIV	Rabbit
JUS	Bird

(USE THE FOLLOWING FOR THE RESPONSE MEASUREMENT TAPE)

NOW THAT YOU HAVE RECEIVED ALL TEN PAIRS, WE'LL CHECK YOU RECALL. YOU WILL BE GIVEN A NUMBER AND A NONSENSE WORD. YOU WILL HAVE TEN SECONDS TO WRITE THE APPROPRIATE COMMON WORD BY THE APPROPRIATE NUMBER.

(USE THE FOLLOWING STYLE FOR ALL STIMULUS WORDS)

NUMBER (ONE, TWO, ETC.) IS (STIMULUS).

WHAT DID (STIMULUS) GO WITH?

(PAUSE TEN SECONDS AFTER PRESENTING EACH WORD)

Sequence for stimulus only presentation:

1. POH
2. OMP
3. JUS
4. VOM
5. TUD
6. MOG
7. UND
8. SUL
9. KIV
10. ROZ

PROCEDURES FOR MEASURING THE HAPTIC LEARNING STYLE

Equipment : Small desk or table, box of twenty stimulus/response items, blindfold, and response sheets.

Steps :

1. Seat Subject across table from primary evaluator.
2. Have subject put on blindfold
3. Place stimulus member of each pair in subject's hand, place corresponding response member in subject's other hand, and wait seven seconds before taking both items from the subject.

4. Place each stimulus member in subject's hand, and ask subject to identify the paired response item.

PLEASE DESCRIBE OR IDENTIFY THE ITEM THAT THIS ITEM WAS PAIRED WITH.

5. Second evaluator keeps score without reporting results to the subject.

Pairings and sequence of stimulus / response pairs:

Stimulus Member :	**Response Member:**
Piece of Carpet	Light Bulb
Rock	Pencil
Table Leg	Tennis Ball
Hose Coupling	Paint Brush
Wooden Rectangle	Table Fork
Bushing	Key Ring
Metal Tube	Scissors
Odd Shaped Wood Piece	yo-yo
Plastic Golf Ball	Padlock
Door Knob	Drinking Glass

Sequence for Stimulus only presentation :

1. Piece of Carpet
2. Plastic Golf Ball
3. Odd Shaped Wood Piece
4. Bushing
5. Table Leg
6. Wooden Rectangle
7. Rock
8. Door Knob
9. Metal Tube
10. Hose Coupling

PROCEDURES FOR MEASURING THE INTERACTIVE LEARNING STYLE

Equipment : This document and response sheets.

Steps:

1. Seat subject where he or she is at the same level and face to face with the primary evaluator. Secondary evaluator should sit to the rear and side of the subject to score the responses. Scoring must be accomplished without distracting or prompting the subject.

2. Primary evaluator presents stimulus/response pairs using the following script.

THE NONSENSE WORD IN THIS PAIR IS (STIMULUS), AND THE COMMON WORD IS (RESPONSE) PLEASE REPEAT BOTH WORDS.

(REPEAT AS NECESSARY UNTIL SUBJECT CAN SAY BOTH WORDS)

HOW WILL YOU REMEMBER THIS PAIR OF WORDS?

(ALLOW TEN SECONDS FOR SUBJECT TO RESPOND TO QUESTION)

(DO NOT COMMENT ON SUBJECT'S REPLY)

Pairing and sequence of stimulus/response pairs:

Stimulus Member:	Response Member:
ZED	Wind
FAI	Tooth
CES	Ball
HEZ	Christmas
SCI	Fire
PEX	Floor
CHI	Egg
JEC	Dog
TOZ	Milk
ZON	Toy

3. Primary evaluator presents stimulus words and asks the subject to state the response words. Use the following script.

THE NONSENSE WORD IS (STIMULUS).
WHAT WAS (STIMULUS) PAIRED WITH?
(ALLOW TEN SECONDS FOR THE RESPONSE)

Sequence for stimulus only presentation:

1. HEZ
2. ZED
3. SCI
4. CHI
5. FAI
6. JEC
7. TOZ
8. CES
9. PEX
10. ZON

PROCEDURES FOR MEASURING THE KINESTHETIC LEARNING STYLE

Equipment: This document, blindfold and response sheets.

Steps:

1. As subject arrives, announce:

THIS EVALUATION INVOLVES BODY MOVEMENT: THERE WILL BE LIMITED SPOKEN DIRECTIONS DURING THIS PROCEDURE. FROM THIS (IDENTIFY) STARTING POINT, I'LL GIVE AND DIRECT YOU THROUGH TEN PAIRS OF BODY MOVEMENTS. YOU WILL BE BLINDFOLDED: THEREFORE, I'LL STAY CLOSE BY YOU TO KEEP YOU STEADY AND PREVENT ANY ACCIDENTS. AFTER WE HAVE COMPLETED THE TEN PAIRS OF MOVEMENTS, I'LL GUIDE AND DIRECT YOU THROUGH THE FIRST MOVEMENT OF EACH PAIR. YOU ARE TO RESPOND BY PERFORMING THE MOVEMENT THAT THE FIRST MOVEMENT WAS PAIRED WITH. LET'S BEGIN.

2. Have subject put on blindfold.

3. Move subject through the stimulus/response pairs. As necessary, use the following spoken directions:

THE FIRST MOVEMENT IS (STIMULUS)
IT IS PAIRED WITH (RESPONSE)

The evaluator should start each movement by gently placing his or her hands on the subject's shoulders. The various movements will require gently movements of the subject's arms and legs. This must be accomplished without alarming the subject in any way. As necessary, additional verbal directions may be used, but those directions must not detract from the actual movements.

4. Move the subject through the various stimulus movements and allow ten seconds for the subject to respond by performing or describing the paired movement. It maybe necessary to say:

THIS MOVEMENT IS (STIMULUS).
WHAT WAS IT PAIRED WITH?

5. Second evaluator scores the responses without reporting the results to the subject.

Pairings and sequence of stimulus/response pairs:

Stimulus Member:	Response Member:
1.Move diagonally across the room and return	1. Stoop
2.Stand on one leg	2.Raiseboth hands into the air
3.Rotate left arm	3.Bend over forward
4.Hands on hips	4.Alternate raising both legs
5.Left arm over head	5.Walk in circle
6.Clasp hands over head and lower to side	6.Take two steps forward and return
7.Twist body in circle	7.Clasp hands in front of body
8.With right arm, draw "O" in the air	8.Stand spread eagle
9.Cross arms over head	9.Hands behind head
10.Get on hands and knees	10.Stand at attention

Sequence for stimulus only presentation

1. Stand on one leg
2. Get on hands and knees
3. With right arm, draw an "O" in the air
4. Cross arms over head
5. Hands on hips
6. Move diagonally across the room and return
7. Clasp hands over head
8. Cross arms over head
9. Twist body in circle
10. Rotate left arm

PROCEDURES FOR MEASURING THE OLFACTORY LEARNING STYLE

Equipment: Small desk or table, aroma vials, blindfold, and response sheets.

Steps:

1. Seat subject across table from primary evaluator.
2. Make the following statement:

FOR THIS EVALUATION, YOU WILL BE BLINDFOLDED AND GIVEN VIALS CONTAINING DIFFERENT AROMAS. FIRST, YOU WILL BE PRESENTED WITH PAIRS OF AROMAS. THE FIRST VIAL OF EACH PAIR CONTAINS AN ABSTRACT AROMA AND I T WILL NOT BE IDENTIFIED. THE SECOND VIAL OF EACH PAIR CONTAINS AN COMMON AROMA, AND I WILL IDENTIFY IT FOR YOU. YOUR JOB IS TO REMEMBER WHICH PAIR OF AROMAS GO TOGETHER. AFTER EXAMINING ALL TEN PAIRS, YOU WILL BE GIVEN THE VIAL CONTAINING THE FIRST AROMA IN EACH PAIR. YOU ARE TO IDENTIFY THE NAME OF THE AROMA IT WAS PAIRED WITH.

3. Have subject put on blindfold.

4. Present the stimulus / response pairs as follows:

THIS IS THE FIRST AROMA OF THIS PAIR.
(LIFT VIAL 2-4 INCHES BELOW THE NOSTRILS OF THE SUBJECT)

THIS IS THE SECOND AROMA OF THIS PAIR.
(SAME PROCEDURE)

THIS SECOND AROMA IS THE SMELL OF (RESPONSE AROMA)
(ALLOW THE SUBJECT TO EXAMINE EACH PAIR FOR SEVEN SECONDS)

5. Present subject with stimulus member vial of each pair and allow him or her ten seconds to identify the appropriate response aroma. It may be necessary to say :

THIS IS ONE OF THE ABSTRACT AROMAS.
WHAT IS IT PAIRED WITH?

Present all ten stimulus vials in the same manner while second evaluator records results.

Pairing and sequence of stimulus/response pairs:

Stimulus Member: (Vial number and aroma)		**Response Member:** (Vial number and aroma)	
#1	Black Walnut	#11	Peppermint
#2	Vanilla	#12	Onion
#3	Almond	#13	Orange (oil)
#4	Rosemary	#14	Butter
#5	Pineapple	#15	Chocolate
#6	Rum	#16	Coconut
#7	Brandy	#17	Licorice
#8	Banana	#18	Oil of Cloves
#9	Maple	#19	Lemon
#10	Strawberry	#20	Cinnamon

Sequence for stimulus only presentation:

(Response Order, Cap Identification and Aroma)

1.	A	Vanilla
2.	B	Rosemary
3.	C	Maple
4.	D	Banana
5.	E	Black Walnut
6.	F	Almond
7.	G	Pineapple
8.	H	Brandy
9.	I	Rum
10.	J	Strawberry

Vial Number and Aroma:		Source of Chemical:
#1	Black Walnut	McCormick Imitation Black Walnut Extract
#2	Vanilla	McCormick Pure Vanilla Extract
#3	Almond	McCormick Imitation Almond Extract
#4	Rosemary	McCormick Rosemary Leaves
#5	Pineapple	McCormick Imitation Pineapple Extract
#6	Rum	Sauer's Pure Rum Flavor
#7	Brandy	McCormick Imitation Brandy Extract
#8	Banana	Kroger Imitation Banana Flavor
#9	Maple	McCormick Imitation Maple Flavor
#10	Strawberry	Kroger Imitation Strawberry Flavor
#11	Peppermint	Humco Peppermint Oil
#12	Onion	Howard's Onion Juice
#13	Orange	Kroger Pure Orange Extract
#14	Butter	Sauer's Imitation Butter Flavor
#15	Chocolate	Kroger Pure Chocolate Extract
#16	Coconut	McCormick Imitation Coconut Extract
#17	Licorice	McCormick Pure Anise Extract
#18	Oil of Cloves	Lorann Oils Oil of Cloves
#19	Lemon	Humco Lemon Oil
#20	Cinnamon	McCormick Ground Cinnamon

APPENDIX C

RESPONSE SHEET - VISUAL

Subject Number : _____

Symbol Number	Picture
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

VISUAL SCORE _____

RESPONSE SHEET - PRINT

Subject Number : _____

Nonsense Word Number	Common Word
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

PRINT SCORE _____

RESPONSE SHEET - AURAL

Subject Number : _____

Nonsense Word Number	Common Word
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

AURAL SCORE _____

SCORE SHEET - HAPTIC

Subject Number : _____

Stimulus Member	Response	Correct	Incorrect
Piece of Carpet	Light Bulb		
Plastic Golf Ball	Padlock		
Odd Shaped Wood Piece	Yo-Yo		
Bushing	Key Ring		
Table Leg	Tennis Ball		
Wooden Rectangle	Table Fork		
Rock	Pencil		
Door Knob	Drinking Glass		
Metal Tube	Scissors		
Hose Coupling	Paint Brush		

HAPTIC SCORE _____

SCORE SHEET - INTERACTIVE

Subject Number : _____

Nonsense Word	Common Word	Subject Word	Correct	Incorrect
hez	Christmas			
zed	Wind			
sci	Fire			
chi	Egg			
fai	Tooth			
jec	Dog			
toz	Milk			
ces	Ball			
pex	Floor			
zon	Toy			

INTERACTIVE SCORE _____

SCORE SHEET - OLFACTORY

Subject Number : _____

Stimulus Number	Response Aroma	Correct	Incorrect
2	Onion		
4	Butter		
9	Lemon		
8	Oil of Cloves		
1	Peppermint		
3	Orange (oil)		
5	Chocolate		
7	Licorice		
6	Coconut		
10	Cinnamon		

OLFACTORY SCORE _____

SCORE SHEET - KINESTHETIC

Subject Number : _____

Stimulus Member	Response	Correct	Incorrect
Stand on One Leg	Hands in air		
Get on hands and knees	Stand at attention		
With right arm, draw an "O" in the air	Stand spread eagle		
Cross arms over head	Hands behind head		
Hands on Hips	Raise both legs and alternate		
Move diagonally across room & return	Stoop		
Clasp hands over head, lower to side	Take two steps and return		
Left arm over head	Walk in a circle		
Twist body in circle	Clasp hands in front		
Rotate left arm	Bend over forward		

KINESTHETIC SCORE _____

STUDENT COPY

LEARNING STYLE PROFILE

Subject Number : _____

MODALITY	MMPLAT-II SCORE
Print	
Aural	
Interactive	
Visual	
Haptic	
Kinesthetic	
Olfactory	
General Comments	

VITA

Marsha Gayle Butler-Tindell was born in Ashland, Kentucky to Paul and Alethea Ann Butler. She graduated from Boyd County High School in 1984. After graduating with a Bachelors of Music Education from Morehead State University in 1987, she served a two year appointment with the Home Mission Board of the Southern Baptist Convention as the Director of Island Resort Ministries on Hilton Head Island, South Carolina. She then moved to Knoxville, Tennessee to pursue graduate studies at the University of Tennessee. In 1991 she obtained a Masters of Science Degree in Educational Psychology while serving as the Director of Baptist Student Ministries at Maryville College and teaching in the Department of Social and Behavioral Sciences at Pellissippi State Technical Community College. In 1993, she joined the faculty as an assistant professor of Psychology at Charleston Southern University in Charleston, South Carolina. In 1994, she returned to Knoxville and was married to Chad B. Tindell in June of that year. Chad is an attorney with the law firm of Stone and Hinds, P.C. in Knoxville. She received the Doctor of Philosophy Degree in Education in December of 1994.