

THE MEASUREMENT OF THE PERCEPTUAL LEARNING STYLES
OF FEDERAL AVIATION ADMINISTRATION SUPERVISORS

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PREFACE

This study was conducted concurrently with six other students: Jack Akins, Joe Nix, Linda Rice, Bill Brown, Walter Lucas, and Evelyn Stewart. The study was coordinated and under the direction of Dr. Wayne B. James, Associate Professor, School of Occupational and Adult Education, Oklahoma State University. The group also worked closely with Dr. Russell L. French, Professor at the University of Tennessee and Dr. Clarence E. Cherry, Jr., an instructor with the Tennessee Air National Guard.

Parts of these studies may be similar due to the close association of this group of students while conducting research and collecting data.

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CHAPTER I

INTRODUCTION

Four out of five Americans are involved in the learning programs of the nation (Cherry, 1981). Adult learners are participating in a wide variety of adult learning experiences. Adult learning experiences have been designed to be responsive to adult learning needs and diverse educational, social, economic and occupational grade levels. Penland (1978) reported that adult learners have individualistic learning patterns and that they prefer to control the pace and character of their own learning. Adult learning facilitators and administrators, who have an intense drive for success in their adult program efforts, need tools and skills that help identify individual differences in adult learners (French, 1981).

Numerous models have been developed to identify individual differences, but there has been a lack of agreement among the approaches (French, 1981). Models that have psychological foundations focus on internal or neural processes (Martens, 1975). Models that have classroom process foundations focus on the learning environment and the students' interactions to stimuli (Oen, 1973). Both approaches to the study of individual differences have resulted in concern for learning style as one of the basic differences among learners. As a result of French's study, it has been found that there are differences in learning styles and those differences affect the way people learn. In

particular, French (1982) reported that individuals differ enormously in the ways in which they learn.

Most studies, concerned with individual differences in learning styles have dealt with children (Cherry, 1981). Knowles (1978) furthers the notion that measurement of adult learning styles has been neglected.

Additionally, Scarbrough (1977) reported that investigation into learning style preferences has been hampered by the lack of appropriate study instruments. London (1976), Sailor (1978), and Sheriff (1978) reported that the more subjective instruments seem to lack validity. The more objective instruments are narrow in scope, time consuming, and complex; and have been applied to a limited population of age groups and backgrounds.

Based on French's (1975) concepts of learning styles, Gilley (1975) developed and tested an objective instrument for measuring individual differences in perceptual learning style. Gilley's "Multi-Modal Paired Associates Learning Test (MMPALT)" was used to measure six of French's perceptual modality elements. Gilley validated the MMPALT and concluded that his subjects (third grade students), "do receive and process information with differing degrees of efficiency across six sensory modalities" (p. 80). Gilley's recommendation for additional research served as the basis for Cherry's (1981) study of the measurement of adult learning styles and subsequent development of MMPALT II.

Statement of the Problem

Federal Aviation Administration (FAA) supervisors are required by the Civil Service Reform Act (CSRA) to attend the Supervisor Initial Training Course. Successful completion of the supervisor's course is required in order to continue in a supervisory position. For further

career development, a total of 17 different courses are offered at the FAA Management Training School (MTS) located in Lawton, Oklahoma. To function as an effective supervisor, it is necessary for each individual to learn required knowledge and skills. All 17 courses have been developed and presented without any study of the learning styles of the supervisory student participants. (See Appendix A for a listing of the courses).

Purpose

The purpose of this study was to gather data on the learning styles of FAA supervisory students attending courses at the Management Training School.

The Multi-Paired Associates Learning Test (MMPALT II) and the Perceptual Modality Preference Survey (PMPS) were the instruments used to gather the data. The data gathered in this study could be used by the FAA supervisors to gain an understanding of their personal learning styles. The MTS Superintendent, Training Managers, and Course Developers could find the information useful in planning, developing, and evaluating course offerings for the adult learners.

Research Questions

The research questions this study intended to answer included:

1. What are the preferred learning styles of the FAA supervisors as measured by MMPALT II?
2. Is there a correlation between the employee's MMPALT II scores and the employee's perceived learning styles as measured by the Perceptual Modality Preference Survey (PMPS)?

3. What are the characteristics or general patterns of the perceptual learning styles of the FAA supervisors?
4. Are there any significant differences in learning styles based on demographic characteristics categories?

Significance of the Study

Traditional management education programs tend to group students and conduct classes in more or less the same manner for all learners, but learning is an individual activity and requires some level of individualized instruction. The individualization of instruction is dependent on a knowledge of individual differences in each person. Several researchers identified in this study, have concluded that studying learning styles increases individualization and educational efficiency and effectiveness. This study identified general patterns of FAA supervisory employees and examined similarities and differences among various groupings of that population. This new information can be added to the existing knowledge about the individual differences of the adult learner and, since no one has studied learning styles in the FAA work environment, this research should be valuable to future efforts.

Assumptions

Assumptions basic to this study include the following:

1. Awareness of student learning styles will influence the teaching-learning process.
2. The MMPALT II is an effective instrument for objectively measuring individual differences in the perceptual modality elements of adult learning styles.

3. Responses to the Perceptual Modality Preference Survey (PMPS) reflect each subject's subjective perception of his or her own learning style.

4. This study focused on measurements of the individual learning styles of self-directed adults; therefore, the use of volunteer subjects does not distort or damage the findings.

Scope and Limitations

The following statements describe the scope and limitations of the study:

1. From September 13, 1983 to October 14, 1983, 153 FAA supervisors attended training at the Management Training School in Lawton, Oklahoma.

2. The study sample was limited to 43 adults who volunteered to have their perceptual learning styles measured.

3. The MMPALT II uses a paired associates testing procedure. That procedure, which measures one's ability to remember or discriminate among information presented within a particular framework, may not measure all factors which make up one's perceptual learning style.

Definitions

The following definitions are used in this study:

Adult: A person who is responsible for his own actions.

Aural (A): Perceptual learning style that gathers information primarily through listening.

FAA SUPERVISOR: A person who plans, organizes, directs, and controls activities of subordinates in the FAA work environment.

General Schedule (GS): A wage classification category for technical, administrative and professional employees.

Haptic (H): Perceptual learning style that gathers information primarily through touching or holding.

Interactive (I): Perceptual learning style that gathers information primarily through discussion and talking with others.

Kinesthetic (K): Perceptual learning style that gathers information primarily through performance or engaging in body movements.

Learner: A person engaged in the acquisition of new skills, knowledge, or abilities.

Learning Style: "Individual differences in relating to or interacting with the environment for the purpose of learning" (Cherry, 1981, p. 16).

Management Training School (MTS): The MTS was established in 1971 to provide initial and recurrent supervisory and managerial training to FAA employees.

Olfactory (O): Perceptual learning style that gathers information primarily through the sense of smell.

Perceptual Modality of Learning Style:

The approach which an individual learner uses in gathering information and knowledge from the world about him or her through the five senses. . . . the seven perceptual style elements identified by French and researched by Gilley and were the basis for investigation (Cherry, 1981, p. 16).

Perceptual Modality Preference Survey (PMPS): A 42-item questionnaire designed to survey each subject's intuitive perception of his or her perceptual learning style, and report those styles in rank order.

Revised Multi-Modal Paired Associate Learning Test (MMPALT II): A seven part paired associates learning test designed to rank order the

perceptual modality strengths and weaknesses of each subject through objective measurement.

Trigram: A three letter nonsense word.

Visual (V): Perceptual learning style that gathers information through seeing pictures, images, objects, and activities.

Organization of the Study

Chapter I has identified the problem, purpose, research questions, significance of the study, assumptions made by the research, limitations and scope, and defined special terms used in the study.

Chapter II presents a review of related literature on individual differences and learning, modalities and elements of learning styles, measurement of learning styles, and research findings.

Chapter III details the procedures, design, instrumentation, participants, data collection, and statistical treatment of the study. Chapter IV presents the findings and analysis of the data. It describes the participants and factors included in the study. Chapter V provides the summary, conclusions, and recommendations resulting from the study for practice and further research.

CHAPTER II

REVIEW OF LITERATURE

The literature review is presented in six sections related to the basic concepts of this study. The content of the sections are presented as follows: (1) background, (2) learning differences of individuals, (3) learning style elements, (4) individual learning style measurements, (5) results of investigation, and (6) summary.

Background

French (1982) reported that individuals seek to improve themselves or their society by increasing their knowledge, skills or their sensitivity. Organizations, groups, or individuals who try to assist this process must consider many individual differences. The individual differences include visual and auditory activity, mental capacity or cognitive ability and body adaptation. French (1982) also reported that much had been written about the cognitive process and learning ability. An important study that contributed knowledge concerning adult learning abilities was conducted by Thorndike (1935) during the 1920's.

The majority of the material describing the cognitive process that relates to personal learning style was produced by psychologists and focuses on human internal reaction to stimuli and external behavior reactions. Cherry (1981) and French (1981) reported that individual learners are purposeful actors when learning, not reactors, but research

with this focus is very limited.

There is a need for instruction directed at individual differences because individual differences exist in acquiring knowledge. Educators in most fields recognize the need and its relation to learning styles. Bjorkquist (1971, p. 8), a vocational educator, stated: "Teachers are increasingly becoming managers of the learning process rather than dispensers of knowledge and are being challenged to individualize their instruction to account for variability."

Griffin (1974, p. 76), a community college educator, reported: "If a community college is truly committed to the idea of individualized learning, it must make a concerted effort to discern the learning style preference for each student." McKenney (1972) used a model to explain the human processing of information and related the model to individual differences. McKenney reported that individuals develop conscious strategies and unconscious habits for absorbing information. McKenney stated:

Human information processing is composed of two general modes of behavior: first, communicating with the environment to obtain data and to return data to other people. Second, organizing data received to bring relevant experience to bear to make useful predictions. Man's information processing is essentially cognitive process of communicating with the world and manipulating information that comes to him (Martens, 1975, p. 6).

Eliuk-Nakonechny (1976, p. 106) another language educator stated: "Individualized learning is one of the current educational trends. This approach is an answer to the differences found among students in terms of their abilities and disabilities, learning styles and interests."

Learning Differences of Individuals

Prior to 1942 learning style and teaching style were viewed as meaning the same thing. The favorite style of a traditional teacher was assumed to be the best style for all students in any class. Theorists, in the early 1940's, began looking at individual differences with more interest.

Lowenfield (1939) observed a group of partially blind students. As a result of his research, he rejected the theory that all learners had the same perception. He discovered that some learners would attempt to use their limited sight while others would not. This led Lowenfield to theorize that some individuals are visually oriented and others are haptically oriented.

Gagne (1965) believed that learning was a stimulus and response relationship. He reported an unvarying relationship between stimulus and response. Gagne viewed all animals, including humans, as close equals in learning style. In discussing learning situation elements, Gagne reported:

First there is a learner, who is a human being. . . . the most important parts of the learner are his senses, his central nervous system, and his muscles. Events in his environment affect the learner's senses, and start chains of nervous impulses that are organized by his central nervous system, specifically, his brain. This nervous activity occurs in certain sequences and patterns that alter the nature of the organizing process itself, and this effect is exhibited as learning. Finally, the nervous activity as the movement of muscles in executing responses of various sorts (p. 6).

Gagne's views about learning led him to make generalizations about teaching. Gagne (1965, p. 175) wrote: "the individual learns simple things first, then more and more complex things; while all this is happening, he is growing older."

Gagne (1967) appeared to change in views around 1965. He edited Learning and Individual Differences in 1967, and implied that learning was an individual matter. Gagne seriously questioned earlier research related to learning styles by 1970. In 1970 Gagne reported:

As a field of endeavor, research on how human beings learn and remember is in a state of great ferment today. Many changes have taken place, and are still taking place, in the conception of what learning is and how it occurs. Perhaps the most general description that can be made of these changes is that investigators are shifting from what may be called a connectionist view of learning to an information processing view of learning. From an older view which held that learning is a matter of establishing connections between stimuli and responses, we are processed in quite a number of different ways by the human central nervous system, and that understanding learning is a matter of figuring out how these various processes operate (p. 468).

The early views of Gagne that learning style applied to all animals was challenged by Forgas (1966). In his view, Forgas did separate the human learner from lower animals. He identified extraction of information from the environment, or perception, as the most important differences between learners in his summary of learning and individual differences. Forgas (1966) wrote:

I have decided to place the process of perception within the context of man's general need to adapt to his environment if he is to cope effectively with the demands of life.

Perception, learning, and thinking have traditionally been referred to as the cognitive processes since they all deal, to some extent, with the problem of knowledge. Perception can generally be defined as the process by which an organism receives or extracts certain information about the environment. Learning is defined as the process by which this information is acquired through experience and becomes part of the organism's storage of facts (pp. 1-2).

Both Gagne (1967) and Lowenfield (1939) considered the senses as important factors of individual learning and differences. They further theorized on the relation of sensation and perception.

Early psychologists in the nineteenth century used to make distinctions between what they called 'sensation' on the one hand and 'perception' on the other. 'Sensation' was thought of as some locally and specifically determined procedure in the receptive system of the organism, where 'perception' referred to what was centrally picked up from the sensory materials. The opinion of the irrelevance of this distinction is nowadays shared by most psychologists. Here the term 'perception' will be preferred despite its ambiguity. Such a term probably makes it easier to consider the alternatives of 'objective' or 'subjective' or better of 'external' and 'internal' determinants of our expressed life space (Van Fieandt, 1977, p. 8).

The focus on each participant in this study as a purposeful actor in acquiring knowledge is supported by this internal-external division of perception.

Learning Style Elements

Learning style research has resulted in a conflict of terminology. The term cognitive style continues to be used and is frequently used interchangeably with the term learning style. Cherry (1981) reported:

During the winter quarter of 1980, a group of potential learning style researchers at the University of Tennessee, Knoxville, met weekly to discuss the general thrust and results of past research in the area of personal learning style. It was decided that the most logical and appropriate overall term for this field of study was 'learning style.' Additionally, secondary levels of the pattern were labeled 'modalities'. The original four modalities identified were: perceptual, cognitive, emotional, and social (p. 26).

Figure 1 is a model that describes the modalities and elements of learning style and their relations. Identification of these modalities is suitable for comparison of past learning style terminology and areas of human learning activity. This includes (1) information extracted by the senses, (2) information processed mentally, (3) social interaction that affects individual learning processes, and (4) information influenced by feelings, attitudes and personality factors that build and

LEARNING STYLE

<u>Perceptual Modality</u>	<u>Cognitive Modality</u>	<u>Social Modality</u>	<u>Emotional Modality</u>	<u>Other</u>
(Elements)	(Elements)	(Elements)	(Elements)	??
Print Aural Interactive Visual Haptic Kinesthetic Olfactory	Sequential Logical Intuitive Spontaneous	Independent Collaborative Cooperative	Sanguine Choleric Phlegmatic Melancholy	

Source: French, Russell L., Handout, (1982).

Figure 1. Modalities and Elements of Learning Style

apply individual knowledge. Also, there may be other modalities to add to learning styles that are not contained in Figure 1.

Forgus' (1966) model of learning and thinking partially supports the concepts presented in Figure 1.

. . . the three cognitive processes are closely inter-related and difficult to separate in practical situations . . . at the beginning of the process, learning and thinking either are nonexistent or operate at a low level . . . where information extraction requires more active effort on the part of the organism, learning and thinking play an increasingly important role . . . thus we consider learning and thinking as events or processes which aid in the extraction of information (p. 3-4).

Learning and thinking, as pointed out by Forgus, involve emotion and social activity, therefore, this modal can be very closely related to the four modalities of the University of Tennessee group.

Within the pattern of terms, the University of Tennessee group labeled the tertiary level of elements. The terms previously used to identify individual learning style differences were arranged as elements under the four modalities to produce a logical pattern of communication. Example, the visual element of the perceptual modality of learning style; the field dependent-field independent element of the cognitive modality of learning style; the impulsive-reflective element of the emotional modality of learning style; or the collaborative as independent element of the social modality of learning style (Cherry, 1981, p. 18).

Numerous researchers have investigated various style elements. Oen (1973) prepared a cross-referenced matrix of 62 style elements of 18 different authors. More than two-thirds (13) of the authors failed to define elements in common with other members of the group. Seven out of 62 elements were used by more than one of the authors. The elements reported by Oen were: visual; oral/aural; physical/tactile; perceptual/conceptual; auditory; olfactory; and kinesthetic. These styles are similar to the styles with which this study was concerned;

however, few of Oen's specific guidelines were applied to this study.

The focus of this study was on the perceptual modality elements conceptualized by French (1975) and investigated by Gilley (1978) and Cherry (1981). The elements were: print, aural, interactive, visual, haptic, kinesthetic, and olfactory.

In 1975, French theorized that each learner has an individual orientation or preference in one or more of the sensory-intake styles. He encouraged teachers to observe learner activities in the various modes, identify each learner's orientation, and develop instructional strategies to meet the student's learning style. French also suggested that extensive research was needed to produce effective measurement instruments (Cherry, 1981, p. 29).

Gilley (1978) tested and validated six of French's elements by developing and using the MMPALT. The six elements were: print, aural, interactive, visual, haptic, and kinesthetic. He found that third grade students possessed individual differences in perceptual learning styles. The two most dominant styles of the students were haptic and visual. Gilley reported that the six elements could be measured validly and reliably with third grade students using the MMPALT.

Other authors have reported on the visual, haptic, kinesthetic and aural learning styles. Lowenfeld (1945) tested over 1100 subjects and reported 47 percent were visual, 23 percent haptic and 30 percent unidentifiable. Riesmann (1962) identified seven characteristics of deprived children in The Culturally Deprived Child. Reismann reported that one characteristic of deprived children was that they were "physical rather than aural" (p. 73). Barbe and Milone (1981) reported visual, auditory and kinesthetic learning styles in Educational Leadership:

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 24 percent of the population are auditory, and the remaining 15 percent are kinesthetic.

Primary grade children are more auditory than visual, and are least well developed kinesthetically. Between kindergarten and sixth grade, however, a modality shift occurs. Vision becomes the dominant modality, and kinesthesia overtakes audition.

Sometimes between the late elementary grades and adulthood another shift occurs. Vision remains the dominant modality but audition becomes more important than kinesthesia (p. 378).

Keefe (1970, p. 127) disagreed with the conclusion of Barbe and Milone concerning the "perceptual preference seems to evolve for most students from psychomotor (tactile/kinesthetic) to visual and aural as the learner matures." Research related to print, olfactory and interactive styles has been sparse. Hill (1976) in a self-report measurement system included olfactory and savory styles. Dunn and Dunn (1978), in another self-report measurement system included print and visual considerations.

Elements used in this study have previously been applied inappropriately and have resulted in measurement inconsistencies. Examples were (1) the printed word was used to measure visual style, and (2) some researchers mixed speaking and listening skills to measure the aural learning style. Gilley and Cherry's studies were the only studies that objectively measured the interactive style. Cherry's study was the only study that objectively measured the olfactory style. The visual style has been the most researched style, but most studies have focused on cognitive processes. The terms haptic, kinesthetic, and tactile have been used interchangeably. The inconsistent

use of terms has caused confusion when trying to correlate most results with new research (Cherry, 1981). Although there have been some inconsistencies and confusion in the past, it was very apparent that the seven style elements measured in this study do exist in individual learners and there is need for extensive study of these styles with individual learners.

Individual Learning Style Measurements

The majority of validated subjective and objective measurements of individual learning style differences have derived from the field of psychology (French, 1982). Measurements made have tended to focus on cognitive modality mental processing, however, some of that information has provided limited guidance for this study.

Lowenfeld, (1948, cited in Ragan, 1979) developed several cognitive style tests that focused on haptic and visual elements. His testing was based on distinctions between visual and haptic:

Whereas the visual has the ability to see a whole, break it up and see its component details, and then resynthesize the details back into a whole the haptic is unable to do this.

Whereas the visual tends to react to stimulus as a spectator and to 'see' experiences the haptic tends to react emotionally, to 'feel' stimuli, and place self into the situation.

Whereas the visual has the tendency and ability to visualize and integrate tactile and partial experiences, the haptic has neither this tendency nor ability.

Whereas the visual has the ability to maintain visual imagery mentally, the haptic is unable to do this (p. 21).

The materials Lowenfeld used to measure style elements, as reported by Ragan (1979), were kept simple enough to minimize mental imagery

and emotional reaction. Cherry (1981) reported that this was an important requirement in the design of his study.

An instrument was used by Hill and Associates (1976) to measure individual differences. Sailor (1978) was critical of the validity of Hill's measurements for determining learning style preferences. Sailor concluded that Hill appeared to include some variables which seemed to be of little value in measuring cognitive style and that a number of Hill's variables should be eliminated. Sheriff (1978) reported that Hill's instrument was not a measure of discrete variables. London's (1976) criticism suggests that Hill's instruments needed structural and psychometric modification. Cogan (1976) reported Hill's instrument as a self-report instrument instead of a psychometric instrument.

Auditory, visual, and tactile elements of cognitive style were measured by the Embedded/Figures Test. Ragan (1979) reported that these tests were influenced by the subject's intellectual ability. Rohwer and Ammon (1971) emphasized that testing with paired-associate requires verbatim responses and that Jenson classified these as the lowest level of ability. Revisions to the MMPALT made by Cherry in 1981 resulted from this need to minimize the intellectual and cognitive ability impact on test results. This was the reasoning behind Cherry's choice of 10 item clusters and a simplified scoring procedure.

Ragan (1979) reported that Golden, in 1975, developed a group application of the Stroop Color-Word Test that required written responses. The results were found to be very reliable. Cherry used

this information and recommendations of Gilley to establish response procedures used in print, aural, and visual elements of the MMPALT II.

Dunn and Dunn (1978) developed the "Learning Styles Questionnaire". The instrument was designed to be used by teachers to determine individual student learning styles for setting classroom activities. The instrument relied on teacher observation, but it was viewed as a self-report instrument. Cherry's (1981) intent was to develop a self-report instrument that would correlate with the MMPALT II. This resulted in the Perceptual Modality Preference Survey (PMPS).

Results of Investigations

Primary validation sources for the instruments used in this study were the studies of Gilley (1978) and Cherry (1981). Gilley's study contained a population of 24 third grade students -- 12 high achievers and 12 low achievers, as determined by a standard achievement test. Both high and low achievers demonstrated primary strengths in the haptic style. Rank-order findings of the learning style strengths for Gilley's study were:

High Achievers	Low Achievers
1. Haptic	1. Haptic
2. Visual	2. Visual
3. Aural	3. Kinesthetic
4. Print	4. Aural
5. Kinesthetic	5. Interactive
6. Interactive	6. Print

Gilley, 1975, p. 80.

Figure 2. Gilley's Rank Order Findings

Cherry's study contained a population of 96 adults who ranged in age from 19 to 68 years and represented an education range from eighth grade to advanced degrees. Primary strengths were demonstrated in the visual style and secondary strengths were demonstrated in the haptic style. Rank order findings of the learning style strengths for Cherry's study were:

1. Visual
2. Haptic
3. Aural
4. Interactive
5. Print
6. Kinesthetic
7. Olfactory

Cherry, 1981, p. 83.

Figure 3. Cherry's Rank-Order Findings

Results of measured learning styles reported by Cherry are important information for adult participants. The information is also important to research associated with children because of the impact style has on teaching strategy. Primary grade school children were strongest in auditory style as reported by Barbe and Milone (1981). However, they also found that the visual style was the strongest for sixth grade students and adults. Lowenfield (1945) reported that the primary style for adults was visual. The study by Riesmann (1962) of deprived children revealed that the children were strongest in physical styles and should be taught in kinesthetic/haptic styles.

The limited research that has been accomplished has resulted in varied results and supports the need for further research in this area.

Griggs and Price (cited in Keefe, 1979) concluded that non-gifted students perceived the auditory learning style as their best style of learning. The instruments used in their research were the Stanford Achievement Test and the Dunn, Dunn and Price Learning Styles Inventory.

Keefe (1979) summarized his study of self-reporting research by inferring that younger students are primarily kinesthetic learners. In contrast, adults were primarily visual and aural learners.

Summary

Individualized instruction needs are based on the assumption that individuals possess a variety of learning differences and that self knowledge and instructor awareness of individuals learning styles will enhance the teaching learning process. Perception or sensory intake are some of the primary differences. The individual's primary way of extracting information from the environment is the perceptual modality. Seven elements in the perceptual modality were included in this review. The literature revealed that past studies of individual differences have focused mainly on internal cognitive processes or self-reporting instruments. Review of studies using empirical measurement approaches and self-reporting devices gave direction to this investigation and provided sources for comparison of findings. Literature concerning the specific concepts of individual learning style differences was used in this study. The fact that research was limited supported the need for further study.

CHAPTER III

METHODOLOGY AND PROCEDURES

This chapter describes the methods and procedures of this study. The study developed out of a need for information concerning the perceptual learning styles of individual FAA supervisors. It was the objective of the study to determine the learning styles preferred by the FAA supervisors that were tested at the FAA Management Training School.

The methods and procedures used to survey the identified participants are presented in the following pages. The following topics are included: (1) description of participants, (2) instrumentation, (3) design, (4) collection of data, and (5) statistical analysis.

Description of Participants

A written interoffice communication was sent to the FAA Management Training Superintendent in September, 1982. This communication requested authorization for FAA supervisory students to become participants in this research study. Approval was granted within five days to the MTS Superintendent (See Appendix B).

All potential participants received a verbal invitation to participate in the research study. No pressure was applied to persuade participants to volunteer. The response of the participants to volunteer was most positive and rewarding to this researcher.

To insure privacy each participant was given a two-digit

identification number. Each participant had a folder for collecting answer sheets and a worksheet for recording MMPALT II and PMPS results. Demographic data were collected and recorded on each participants' folder.

Instrumentation

Each participant completed two measurements of his or her perceptual modality learning style. The two instruments used in this study were the Multi-Modal Paired Associates Learning Test (MMPALT II), and the Perceptual Modality Preference Survey (PMPS). Permission to reproduce the MMPALT II was obtained from Dr. Russell French. Letter of permission is attached at Appendix C.

Multi-Modal Paired Associates Learning Test (MMPALT II)

This instrument identifies the relative strengths of the seven elements of perceptual style in the person being tested: print, aural, interactive, visual, haptic, kinesthetic and olfactory. A copy of the procedures for the MMPALT II are attached in Appendix D. The test consists of 10 pairs of stimulus response members for each element. The participant is presented with all 10 pairs of stimulus and response members in a particular element. Then the participant is presented with only the stimulus member of each associated pair in a different order from that used in the initial presentation and asked to recall the correct response member. The seven scores (one for each element tested) for each participant are arranged by high to low to produce a rank ordering of the elements of the participant's perceptual learning style.

Perceptual Modality Preference Survey (PMPS)

The purpose of this survey was to secure each participants intuitive assessment of his or her own strengths and weaknesses in each of the seven perceptual learning styles. The forced choice questionnaire contains 42 response items. Each perceptual style element is contrasted with each of the other style elements twice and in reverse order. A participant responds to each statement by choosing one of four alternatives: always, usually, seldom, or never. To counteract any conflicting responses and evaluate both style elements in conflicting responses and evaluate both style elements in each statement, responses are scored with positive (accepting the statement) and negative (rejecting the statement) values.

The scores for the various style elements are then arranged from high to low to produce a strongest (preferred) to weakest rank ordering of the participants subjective assessment of his or her own learning style. The PMPS scoring is based on the Likert method of summated ratings as reported by Best (1959). A copy of the PMPS and the hand-scoring worksheet are found in Appendix E.

MMPALT II Administration

To measure the participant's MMPALT II learning styles, each participant was processed through five stations. At Station 1, the participants received an introduction to the concept of learning styles and an explanation of the testing procedures. Print, aural and visual subtests were completed at this station. The remaining subtests: interactive, haptic, kinesthetic and olfactory were completed at Stations 2, 3, 4, and 5 respectively. After all testing was completed, the participants were given feedback on their MMPALT II performance.

Response sheet examples are found in Appendix F.

To control first-test, second-test interaction bias, half of the participants completed the PMPS as their first testing activity, and half completed the PMPS as their last activity. PMPS and MMPALT II scores were returned to individual participants at the conclusion of all testing.

Design of Study

The purpose of this study was to gather data on the learning styles of FAA supervisory employees using the MMPALT II developed by Cherry (1982). The questions for this study were:

1. What are the preferred learning styles of the FAA supervisor as measured by MMPALT II?
2. Is there a correlation between the employee's MMPALT II scores and the employee's perceived learning styles as measured by the Perceptual Modality Preference Survey (PMPS)?
3. What are the characteristics or general patterns of the learning styles of the FAA supervisors?
4. Are there any significant differences on learning styles based on demographic characteristics categories?

The first testing session was conducted on September 13, 1983. Two participants were tested. All measurements were conducted in Smith Hall, Cameron University, Lawton, Oklahoma.

Subsequent testing of other participants was completed as the participant's schedules permitted. Table I is a summary of measurement dates, places and the number of participants.

TABLE I
SUMMARY OF DATES, PLACES, AND
PARTICIPANTS TESTED

Date	Place	Participants
September 13	Smith Hall	2
September 14	Smith Hall	2
September 15	Smith Hall	10
September 21	Smith Hall	22
October 5	Smith Hall	2
October 14	Smith Hall	<u>5</u>
Total		43

Control of the measurement process was assured on all dates and location by processing and measuring in accordance with standardized written procedures. All measurements for this study were conducted by this researcher or by one other trained evaluator.

The one trained evaluator was a volunteer. He was keenly interested in the project because of his prior background. He was the former Superintendent of the Management Training School.

The evaluator was trained by this researcher. The evaluator only administered the interactive, haptic, kinesthetic and olfactory tests. All of the print, aural, and visual tests for all participants were administered by this researcher.

Collection of Data

Testing of the participants was conducted at Cameron University, Smith Hall, Room 205, 206 and 207. Room 205 was used to administer the print, aural and visual tests and the PMPS (Station 1). Room 206 was used to administer the interactive and haptic tests (Station 2 and 3). Room 207 was used to administer the kinesthetic and olfactory tests (Station 4 and 5).

At Station 1, the participants were welcomed by the researcher. Next, the participants were presented an overview of the measurement process which included a general explanation of learning styles and a description of the seven learning style MMPALT II elements. Other opening activities at Station 1 included giving the participants reasons for measuring learning styles, explanation of procedures to be used, followed by a brief question and answer session.

Participants were encouraged on the need to do as well as possible on each of the measurements, but it was emphasized that the activities completed were measurements, not pass or fail testing. The objectives of the overview session, conducted at Station 1, was to prepare each participant for the measurements without increasing anxieties or lowering motivation and enthusiasm.

Upon completion of the overview, participants were given the print, aural, and visual subtests by the researcher. The Station 1 overview and subtest administration required approximately 45 minutes. Station 1 procedures included three MMPALT II subtest measurements: print, aural, and visual.

Print

Following a review of the procedures, the participants were seated at tables facing a carousel projector screen. Participant's chairs were about 10 feet from the screen. Each participant was provided a response sheet and a pencil. Participants wrote their name on the response sheet and then turned the sheet face down. Chairs were spaced at the tables at intervals to prevent eye contact with other participant's response sheets. The evaluator encouraged the participants to relax and focus their attention to the content projected on the screen.

Next the evaluator projected 35mm slide pairs of trigrams (non-sense words) and common nouns on the screen. The trigram was projected on the left side of the screen and the common noun on the right half. Each pair was displayed for seven seconds.

After presenting all 10 pairs, the evaluator instructed

participants to write their responses by the appropriate number on the response sheet. As the evaluator projected each stimulus trigram on the left half of the screen, he said the number of the slide, e.g. "number one, number two, etc." The participants were allowed to see each trigram and record their responses. Upon completion of the print subtest, the evaluator collected the response sheets and prepared for the aural measurement.

Aural

The participants were given a different response sheet for this subtest. Participants entered their name on the response sheet and were instructed to listen to a tape recording. The tape recording contained an introduction and gave the participants an example of how the test would be conducted. Taped recordings of each trigram and the paired common nouns were presented at seven second intervals.

After all 10 pairs were presented, the evaluator played the response test tapes. The tape recording contained all other instructions to the participants and allowed 10 seconds for each written response. The evaluator stopped the tape player and collected the response sheets when the test was completed.

Visual

The participants were provided another response sheet and pencils. After placing their names on the response sheets, the participants were prepared to complete the visual subtest. The evaluator presented pairs containing an abstract symbol and a common object symbol. The evaluator presented the pairs using a projector and 35mm slides and allowed seven

seconds between each pair of abstract symbols and common objects. After the 10 pairs were presented, the evaluator showed the abstract symbols from another set of slides and allowed the participants 10 seconds for each response. When the test was completed, the evaluator turned off the projector and collected the response sheets.

Completion of the visual subtest ended the test activities at Station 1.

Interactive

For this measurement, the evaluator welcomed each participant and made an effort to make each individual feel relaxed and comfortable. Each participant was seated facing the evaluator and blind folded. This subtest began with the evaluator explaining the measurement procedures to the participant. Then, the evaluator used a prepared script to present 10 pairs of trigrams and common nouns to the participant. The participant was afforded an opportunity to discuss each pair as it was presented. After all 10 pairs were presented, the evaluator used the randomized list of trigrams and procedures script to conduct the response test. As each trigram was spoken, the participant was allowed 10 seconds to provide the correct paired response. The evaluator scored the responses on a prepared answer sheet. The answer sheet responses were not provided the participant as far as the number of correct or incorrect responses, at this time. With the completion of this measurement, the activity at Station 2 was completed (Smith Hall Room 206).

Haptic

The haptic subtest was conducted in Smith Hall, Room 206, Station 3. The participant had the procedures for this test explained after being seated at a small table across from the evaluator. For the haptic test, the participant was blind-folded and presented 10 pairs of items. Each pair contained a nonsense item and a common item. The evaluator placed the nonsense item of each pair in the left hand of the participant, and the common item in the right hand. As the item pairs were presented to the participant, the evaluator made sure the participant could identify the common item.

The participant had seven seconds to remember what nonsense item was paired with the common item. After presenting all 10 pairs, the test began. Test procedure called for placing the nonsense item in the left hand of the participant and asking the participant the name of the common item with which the nonsense item was paired. The participant was allowed 10 seconds to reply. The evaluator kept the score on a response sheet without reporting results (correct or incorrect) to the participant. When this test was completed, the participant was instructed to move to Station 4 (Smith Hall, Room 207).

Kinesthetic

After the welcome of the participant and an assurance that the procedures were safe and understood, the participant was placed in a standing position and blind-folded. The kinesthetic test involved body movements. The evaluator guided and directed the participant through 10 pairs of body movements (Stimulus/Response) with limited spoken

directives. After the 10 pairs of body movements were completed, the evaluator guided the participant through the stimulus body movement and the participant responded by performing or describing the response body movement with which the stimulus body movement was paired. Participant responses were scored by the evaluator on the response sheet without reporting results to the participant. When the kinesthetic test was completed, the participant was instructed to move to Station 5 (Smith Hall, Room 207).

Olfactory

For the olfactory test, the participant was seated across the table from the evaluator and blind-folded. The participant was given bottles containing different aromas. The aromas were presented to the participant in pairs. The first bottle of each pair contained an abstract aroma which was not identified. The second bottle of the pair contained a common aroma, which was identified for each participant. The task for the participant was to remember which pairs of aromas went together. Each participant was allowed seven seconds to examine each pair of aromas. After presenting all 10 pairs, the evaluator presented the abstract aroma to the participant and allowed him or her 10 seconds to identify the appropriate response aroma. The evaluator scored the participant responses on the response sheet without reporting the results to the participant.

Coordinating

Coordinating responsibilities for the measurements were accomplished

by this researcher. Since each measurement required 10 to 15 minutes, it was necessary for the coordinator to schedule participants appropriately and to manage the collection and scoring of the participant response sheets.

An additional coordinating effort was required in the PMPS administration. Twenty-one of the participants completed the PMPS before and 22 participants completed the PMPS after the MMPALT II testing.

When all measurements were completed and scored, this researcher scheduled a feedback session with each participant prior to their departure from MTS. Each subject received a report of his or her MMPALT II and PMPS results. These reports included the raw scores and rank order of the MMPALT II and PMPS elements. Each feedback session was concluded by thanking each participant for participating in the study.

Statistical Analysis

When all measurements were completed, the raw data consisting of each participant's paper and pencil scored PMPS and the seven score sheets from the MMPALT II were checked for possible recording errors when they were recorded on each participant's summary score sheet. Summary score sheet data and rank order data, along with demographic data was coded and recorded to use in this study.

Processing of the data was under the direction of a professional OSU statistician. A program was written to calculate: (1) the analysis of variance of FAA supervisors based on pay grade level, (2) t-test value

measure significant difference between sexes, pay grades, age, and education, (3) a Pearson Product Moment to determine the correlation coefficient on the PMPS and MMPALT II scores and the PMPS and MMPALT II ranks; and, (4) the total and mean scores of each of the seven learning style subtests surveyed by the PMPS and measured by the MMPALT II.

The final analytical step was to analyze the computer output to determine responses to the research questions contained in Chapter I. That information comprises Chapter IV of this study. The source for determining the linear relationship in the correlation analysis was Best's (1959) text.

<u>Coefficient</u>	<u>Relationship</u>
00 to $\pm .20$	negligible
$\pm .20$ to $\pm .40$	low or slight
$\pm .40$ to $\pm .60$	moderate
$\pm .60$ to $\pm .80$	substantial or marked
$\pm .80$ to ± 1.00	high to very high

Source: Best, (1959, p. 240).

Figure 4. Correlation Coefficients

CHAPTER IV

ANALYSIS AND PRESENTATION OF FINDINGS

Introduction

The basic organizational pattern for this chapter was the four research questions used in this study. The general criteria for data analysis were provided by these research questions. In section one, a description of the participants taking part in the study is given. The section two analysis describes the preferred learning styles of the FAA supervisory employees as determined by the MMPALT II and PMPS. Section three addresses the correlation of self-assessed and measured learning styles. Section four analyzes group differences (ANOVA) of the FAA supervisory employee learning styles. Sex, age, and education differences were measured for the MMPALT II and PMPS (t-tests/ANOVA) in section five. This chapter concludes with some observations relating to the five sections of this chapter.

Description of Participants

Forty-three FAA supervisory employees participated in this study. Of the 43 employees, nine were GS-15 pay grade level; nine were GS-14 pay grade; 10 were GS-13 pay grade; and 15 employees were GS-12 pay grade and below. Thirty-five of the employees were men and eight were women. Forty were married and three were single. Twelve had a

Master's degree, 13 had a Bachelor's degree and 15 supervisors had no degree. See Table II for a breakdown of educational data of FAA supervisory employees.

Additional demographic data are contained in Table III. The average income for female supervisors was \$31,725 per year. The average income for male supervisors was \$41,660. Fifteen of the participants were smokers, while 28 participants were non-smokers. Six participants were left-handed. Only 28 percent of the supervisors had Master's degrees, 28 percent had Bachelor's degrees and approximately 44 percent had no degree.

Demographic data describing the age distribution of the FAA supervisors are contained in Table IV. The youngest supervisor was 29 and female. The oldest supervisor was 65 and male.

Preferred Learning Styles as Measured by MMPALT II and PMPS

Results of the MMPALT II test scores also showed that the visual learning style subtest had the highest scores. See Table V for a summary of the results. Thirty-four of the 43 participants scored eight or above on the visual subtest and 24 participants had a maximum score of 10. The mean score for the visual subtest was 8.60, the highest of all means.

Again, based on MMPALT II subtest scores instead of rank order results, the haptic and aural learning styles of the participants were the identified backup styles. The means for the haptic and aural learning style subtest were 5.46 and 5.53 respectively. Although the mean score for the aural learning style was slightly higher, the haptic

TABLE II
EDUCATIONAL DATA OF FAA SUPERVISORY EMPLOYEES

	Pay Grade N	Sex		Educational Level Achieved					
		Women N	Men N	M.S. Degree		B.S. Degree		No Degree	
				Women N	Men N	Women N	Men N	Women N	Men N
GS - 15	9	1	8	1	3	0	2	0	3
GS - 14	9	2	7	2	4	0	2	0	1
GS - 13	10	0	10	0	0	0	5	0	5
GS - 12 and Below	<u>15</u>	<u>5</u>	<u>10</u>	<u>2</u>	<u>0</u>	<u>0</u>	<u>4</u>	<u>3</u>	<u>6</u>
Total	43	8	35	5	7	0	13	3	15

TABLE III
DEMOGRAPHIC CHARACTERISTICS OF FAA SUPERVISORS

Characteristics	N	%
Sex:		
Female	8	18.6
Male	35	81.4
Educational Status:		
Degree	25	58.1
No Degree	18	41.9
Average Income Level:		
Female (\$31,725)	8	18.6
Male (\$41,660)	35	81.4
Marital Status:		
Married	40	93.0
Single	3	7.0
Smoker Status:		
Yes	15	34.9
No	28	65.1
Left Hand or Right Hand Status:		
Left	6	14.0
Right	37	86.0

TABLE IV
AGE DISTRIBUTION OF FAA SUPERVISORS

Age	Frequency	Cumulative Frequency	Percent	Cumulative Percent
29	1	1	2.3	2.3
30	2	3	4.7	6.9
34	1	4	2.3	9.3
35	2	6	4.7	13.9
36	2	8	4.7	18.6
37	2	10	4.7	23.3
38	2	12	4.7	27.9
39	1	13	2.3	30.2
40	1	14	2.3	32.5
41	1	15	2.3	34.8
42	1	16	2.3	37.2
43	3	19	6.9	44.2
44	2	21	4.6	48.8
45	1	22	2.3	51.2
46	1	23	2.3	53.5
47	2	25	4.7	58.1
48	4	29	9.3	67.4
49	2	31	4.7	72.1
50	1	32	2.3	74.4
51	1	33	2.3	76.7
53	3	36	6.9	83.7
54	1	37	2.3	86.0
55	1	38	2.3	88.4
56	2	40	4.7	93.0
59	1	41	2.3	95.3
60	1	42	2.3	97.8
65	1	43	2.3	100.0

TABLE V
SUMMATION OF MMPALT II SUBTEST SCORES FOR
FAA SUPERVISORY EMPLOYEES

Subtest		0	1	2	Scores Made On Subtests					8	9	10	Range	Mean
					3	4	5	6	7					
Print	N*	3	3	1	9	5	4	4	2	5	5	2	0-10	4.88
Aural	N	0	1	3	8	1	9	7	5	2	4	3	1-10	5.53
Interactive	N	3	3	6	4	4	5	5	4	4	4	1	0-10	4.74
Visual	N	0	0	0	0	1	5	3	0	7	3	24	4-10	8.60
Haptic	N	1	3	5	5	3	3	7	4	3	4	5	0-10	5.46
Kinesthetic	N	0	6	11	11	8	5	1	1	0	0	0	1- 7	3.05
Olfactory	N	11	14	10	5	2	1	0	0	0	0	0	0- 5	1.47

*N=Number of participants making score

backup style was identified as the first backup style.

The summation of MMPALT II subtest scores also showed that the olfactory learning style results was the lowest score by the participants. The range of scores was from zero to five and the subtest mean was 1.47.

Analysis of the results for the MMPALT II measurement of the FAA supervisor's performance showed a definite variability of preferred styles. Table VI is a summation of learning style strengths of the participants. The most preferred learning style of the FAA supervisor was the visual learning style. Twenty-six of the 43 participants had results on the visual learning style subtest that were ranked number one. All participants' visual learning style subtest results were ranked either 1, 1.5 or 2.

Twenty-three of the 43 participants showed a strong score for the haptic learning style, based on rank orders of one through three. The aural learning style was the style with the next highest score based on rank order of one through three. Twenty of the 43 participants based on rank order one through three resulted in the aural learning style determination as the second backup style. In comparing the haptic versus the aural rank scores on learning style of the participants, the mean scores were 5.46 and 5.53 respectively.

A summary of the PMPS scores is contained in Table VII. The possible PMPS scores range from -36 to +36. The majority of the PMPS scores were in categories having a range between -16 to +27 in six of the seven learning styles. The majority of the PMPS olfactory scores (37 of 43) were in interval categories having scores of -6 to -35. The mean of the olfactory PMPS score was -20.09.

The PMPS learning style having the highest mean score (5.63) was

TABLE VI
SUMMATION OF LEARNING STYLE STRENGTHS DEMONSTRATED BY MMPALT II
RANK ORDER OF FAA SUPERVISORY EMPLOYEES

Rank Order	Print N	Aural N	Interactive N	Visual N	Haptic N	Kinesthetic N	Olfactory N
1	1	0	0	26	0	0	0
1.5	2	2	2	12	6	0	0
2	2	11	5	5	10	0	0
2.5	4	4	3	0	1	1	0
3	8	3	4	0	6	2	0
3.5	6	5	3	0	0	4	0
4	7	3	7	0	6	3	1
4.5	2	4	3	0	2	3	0
5	4	6	6	0	4	7	1
5.5	4	2	3	0	5	8	0
6	1	2	4	0	1	9	4
6.5	0	1	2	0	1	5	11
7	2	0	1	0	1	1	26
Total	43	43	43	43	43	43	43

TABLE VII
SUMMARY OF PMPS SCORES FOR FAA SUPERVISORY EMPLOYEES

Learning Style	Participant Distribution by Score Categories (Intervals)							Range	Mean
	(-36 -28) N	(-27 -17) N	(-16 -6) N	(-5 +5) N	(+6 +16) N	(+17 +27) N	(+28 -36) N		
Print	1	2	6	14	12	8	0	-28 +25	4.02
Aural	0	1	12	9	17	4	0	-21 +23	1.77
Interactive	0	0	4	19	16	4	0	-14 +25	5.63
Visual	0	1	5	24	11	2	0	-17 +18	2.67
Haptic	0	2	12	12	16	1	0	-17 +27	-.88
Kinesthetic	1	4	7	11	7	11	2	-31 +31	3.42
Olfactory	10	21	6	3	2	1	0	-36 +14	20.09

the interactive style. While the interactive style had the strongest PMPS score, the print, kinesthetic, aural and visual styles were perceived to be strong styles by the participants. The haptic and olfactory learning styles were perceived to have a low preference by the participants. Haptic and olfactory means scores were $-.77$ and -20.09 , respectively.

Frequency of Rank Order Data (PMPS)

Rank order data for the PMPS were grouped by rank order and style for all participants in Table VIII. It appears that a majority of this sample felt the print and interactive styles were strongest and the olfactory style weakest but this was the extent of commonality with 43 variances within this range.

Correlation of Self-Assessed (PMPS) and Measured Learning Styles (MMPALT II)

The PMPS and MMPALT II scores and rank orders were used to calculate a correlation between the MMPALT II style scores and the PMPS style scores. A Pearson r was used to calculate the correlation coefficients.

The negligible or low correlations between MMPALT II ranks by style and PMPS ranks by style are presented in Table IX. The relationship between MMPALT II scores and PMPS scores is shown in Table X indicating negligible or low correlation.

Group Differences

Analysis of variance tests were used to analyze the differences

TABLE VIII
SUMMARY OF PMPS RANK ORDERS FOR
FAA SUPERVISORY EMPLOYEES

Rank Order	Print N	Aural N	Interactive N	<u>Style</u>		Kinesthetic N	Olfactory N
				Visual N	Haptic N		
1	10	3	6	3	4	15	2
1.5	0	0	1	0	0	1	0
2	2	10	4	7	10	4	0
2.5	2	1	3	1	1	0	0
3	8	6	10	4	3	1	3
3.5	2	3	3	3	1	0	0
4	6	4	7	10	6	0	0
4.5	1	0	0	3	0	2	0
5	2	8	5	8	8	6	1
5.5	1	0	0	1	0	0	0
6	6	7	4	3	9	10	2
6.5	0	0	0	0	1	1	0
7	3	1	0	0	0	3	36

TABLE IX
CORRELATION OF MMPALT II STYLE RANKS WITH
PMPS RANK OF THE SAME STYLE

PMPS Ranks	MMPALT II RANKS						
	P*	A	I	Style V	H	K	O
P*	.007 (negligible)						
A		-.114 (negligible)					
I			-.322 (low)				
V				.092 (negligible)			
H					.206 (low)		
K						.110 (negligible)	
O							.109 (negligible)

*P - Print

A - Aural

I - Interactive

V - Visual

H - Haptic

K - Kinesthetic

O - Olfactory

TABLE X
CORRELATION OF MMPALT II STYLE SCORES WITH
PMPS SCORES OF THE SAME STYLE

PMPS Scores	MMPALT II SCORES						
	P*	A	I	Style V	H	K	O
P*	-.194 (negligible)						
A		-.072 (negligible)					
I			-.005 (negligible)				
V				.202 (low)			
H					.295 (low)		
K						.047 (negligible)	
O							-.158 (negligible)

*P - Print
A - Aural
I - Interactive
V - Visual
H - Haptic
K - Kinesthetic
O - Olfactory

between sub-groups and the study participants. The 43 participants consisted of four distinct groups: GS-15 (9), GS-14 (9), GS-13 (10), and GS-12/below (15). Results of ANOVA tests of PMPS style scores for GS grades 15, 14, 13 and 12 are displayed in Table XI. Results of the ANOVA tests on MMPALT II scores for GS grades 15, 14, 13 and 12 are displayed in Table XII. There were no significant differences at the .05 level in these tests.

Sex, Age, and Education Differences

T-tests were used to determine significant differences between the learning style scores by sex, measured by the MMPALT II and the PMPS. Hartley's f max was calculated by the computer as a check on equality of variances. If variances were not equal, the computer adjusted for these differences by adjusting the degree of freedom and calculated value. Results of the t-test for sex comparison on the PMPS style scores are displayed in Table XIII. There were no significant differences beyond the .05 level for any of the t-tests for the PMPS style scores.

Results of the t-test by sex comparison on the MMPALT II are displayed in Table XIV. No significant differences at the .05 level were obtained from these tests.

Age groups consisted of three groups: age group 29-39 had 13 participants, age group 40-49 had 18 participants, age group 50 and above had 12 participants. Results of ANOVA tests on PMPS style scores are displayed in Table XV. Results of ANOVA tests on MMPALT II scores for the age groups are displayed in Table XVI. No significant differences at the .05 level were observed for either the PMPS or the MMPALT scores.

TABLE XI
RESULTS OF ANOVA TESTS ON PMPS STYLE SCORES
FOR GS 15, 14, 13, and 12

Style	Sources of Variance	df	SS	MS	F
Print	Between groups	3	47.96	15.99	0.27
	Within groups	39	<u>2311.20</u>	59.26	
	Total	42	2359.16		
Aural	Between groups	3	142.81	47.50	1.78
	Within groups	39	<u>1041.51</u>	26.71	
	Total	42	1184.32		
Interactive	Between groups	3	206.96	68.99	1.70
	Within groups	39	<u>1578.94</u>	40.49	
	Total	42	1785.90		
Visual	Between groups	3	114.80	38.27	1.20
	Within groups	39	<u>1243.11</u>	31.87	
	Total		1357.91		
Haptic	Between groups	3	46.11	15.37	0.46
	Within groups	39	<u>1314.68</u>	33.71	
	Total	42	1360.79		
Kinesthetic	Between groups	3	24.57	8.19	0.11
	Within groups	39	<u>3028.54</u>	77.65	
	Total	42	3053.11		
Olfactory	Between groups	3	291.83	97.28	1.33
	Within groups	29	<u>2849.24</u>	73.05	
	Total	42	3141.07		

TABLE XII
RESULTS OF ANOVA TESTS ON MMPALT II STYLE SCORES
FOR GS 15, 14, 13 and 12

Style	Source of Variance	df	SS	MS	F
Print	Between groups	3	16.36	5.45	0.65
	Within groups	39	<u>328.06</u>	8.41	
	Total	42	344.42		
Aural	Between groups	3	7.01	2.34	0.38
	Within groups	39	<u>241.69</u>	6.20	
	Total	42	248.70		
Interactive	Between groups	3	28.36	9.45	1.18
	Within groups	29	<u>311.82</u>	8.00	
	Total	42	340.18		
Visual	Between groups	3	19.25	6.42	1.83
	Within groups	39	<u>137.03</u>	3.51	
	Total	42	156.28		
Haptic	Between groups	3	28.39	9.46	1.08
	Within groups	39	<u>342.31</u>	8.78	
	Total		370.70		
Kinesthetic	Between groups	3	5.18	1.73	0.81
	Within groups	39	<u>82.72</u>	2.12	
	Total	42	87.90		
Olfactory	Between groups	3	0.79	0.26	0.16
	Within groups	39	<u>63.91</u>	1.64	
		42	64.60		

TABLE XIII
RESULTS OF t -TESTS ON PMPS STYLE SCORES BY SEX

Style	Sex	N	M	SD	t
Print	Female	8	10.88	7.79	0.995
	Male	35	10.86	7.54	
Aural	Female	8	8.63	5.13	0.879
	Male	35	8.94	5.42	
Interactive	Female	8	7.00	7.27	0.655
	Male	35	8.28	6.43	
Visual	Female	8	5.38	4.44	0.289
	Male	35	7.43	5.92	
Haptic	Female	8	12.25	3.41	0.022
	Male	35	8.34	5.89	
Kinesthetic	Female	8	10.25	8.22	0.208
	Male	35	14.60	8.49	
Olfactory	Female	8	23.25	3.15	0.228
	Male	35	20.86	9.45	

TABLE XIV
RESULTS OF t-TEST ON MMPALT II
STYLE SCORES BY SEX

Style	Sex	N	M	SD	t
Print	Female	8	4.88	2.70	0.992
	Male	35	4.89	2.94	
Aural	Female	8	8.63	5.13	0.879
	Male	35	8.94	5.42	
Interactive	Female	8	7.00	7.27	0.655
	Male	35	8.29	6.43	
Visual	Female	8	5.38	4.44	0.289
	Male	35	7.43	5.92	
Haptic	Female	8	12.25	3.41	0.022
	Male	35	8.34	5.89	
Kinesthetic	Female	8	10.25	8.22	0.208
	Male	35	14.60	8.49	
Olfactory	Female	8	23.25	3.15	0.227
	Male	35	20.86	9.45	

TABLE XV
RESULTS OF ANOVA TESTS ON PMPS STYLE
SCORES BY AGE GROUP

Style	Source of Variance	df	SS	MS	F
Print	Between groups	2	5.17	2.58	0.04
	Within groups	40	<u>2354.00</u>	58.84	
	Total	42	2359.17		
Aural	Between groups	2	31.98	15.99	0.55
	Within groups	40	<u>1152.44</u>	28.81	
	Total	42	1184.42		
Interactive	Between groups	2	116.80	53.40	1.40
	Within groups	40	<u>1669.10</u>	41.72	
	Total	42	1785.90		
Visual	Between groups	2	83.58	41.84	1.31
	Within groups	40	<u>1274.22</u>	31.85	
	Total	42	1357.90		
Haptic	Between groups	2	212.01	106.00	3.69
	Within groups	40	<u>1148.78</u>	28.72	
	Total	42	1360.79		
Kinesthetic	Between groups	2	276.52	138.26	1.99
	Within groups	40	<u>2776.59</u>	69.41	
	Total	42	3053.11		
Olfactory	Between groups	2	230.48	115.24	1.58
	Within groups	40	<u>2910.59</u>	72.76	
	Total	42	3141.07		

TABLE XVI
RESULTS OF ANOVA TESTS ON MMPALT II STYLE
SCORES BY AGE GROUP

Style	Source of Variance	df	SS	MS	F
Print	Between groups	2	28.83	14.41	1.83
	Within groups	40	<u>315.59</u>	7.89	
	Total	42	344.42		
Aural	Between groups	2	23.25	11.62	2.06
	Within groups	40	<u>225.45</u>	5.64	
	Total	42	248.70		
Interactive	Between groups	2	92.38	46.19	7.46
	Within groups	40	<u>247.80</u>	5.19	
	Total	42	339.18		
Visual	Between groups	2	32.09	16.05	5.17
	Within groups	40	<u>124.19</u>	3.10	
	Total	42	156.28		
Haptic	Between groups	2	88.53	44.26	6.27
	Within groups	40	<u>282.17</u>	7.05	
	Total	42	370.70		
Kinesthetic	Between groups	2	11.46	5.73	3.00
	Within groups	40	<u>76.44</u>	1.91	
	Total	42	87.90		
Olfactory	Between groups	2	15.60	7.80	6.36
	Within groups	40	<u>49.04</u>	1.22	
	Total	42	64.69		

Education groups consisted of three groups: group one (high school diploma) had 18 members, group two (Bachelor's degree) had 13 members group three (Master's degree) had 12 members. Results of ANOVA tests on the PMPS style scores for education groups are displayed in Table XVII. Results of ANOVA tests on the MMPALT II style scores for education groups are displayed in Table XVIII. No significant differences at the .05 level were obtained from these tests. A summary of individual participant scores and ranks for MPALT II and PMPS are presented in Table XIX (see Appendix G).

Observations

The 43 individuals who participated in this study were all FAA supervisory employees. Although educational achievements varied widely and the range in age was 29 to 65 there were no significant differences between age and education groups.

Marital status did not appear to have any observed effect on learning styles nor did income level. Two participants that were left-handed mentioned that they were left-handed, but did not ask for the stimulus items to be placed in their left hand during testing. Left-handedness or right-handedness did not appear to have any observed effect on learning styles.

The overall physical and health conditions of the participants were excellent. There were no hearing, sight, or sense of smell disabilities. The participants that were smokers appeared to have no performance difficulties in the olfactory test because of their smoking.

The participants were keenly interested in being a part of this research. They listened to instructions and each appeared to give

TABLE XVII
RESULTS OF ANOVA TESTS ON PMPS STYLE
SCORES BY EDUCATION GROUPS

Style	Source of Variance	df	SS	MS	F
Print	Between groups	2	31.74	15.87	0.27
	Within groups	40	<u>2327.42</u>	58.18	
	Total	42	2359.16		
Aural	Between groups	2	161.04	80.52	3.15
	Within groups	40	<u>1023.38</u>	25.58	
	Total	42	1184.42		
Interactive	Between groups	2	68.24	32.92	0.77
	Within groups	40	<u>1720.06</u>	43.00	
	Total	42	1785.90		
Visual	Between groups	2	35.09	17.55	0.53
	Within groups	40	<u>1322.81</u>	33.07	
	Total	42	1357.90		
Haptic	Between groups	2	11.53	5.76	0.17
	Within groups	40	<u>1349.27</u>	33.73	
	Total	42	1360.80		
Kinesthetic	Between groups	2	13.90	6.95	0.09
	Within groups	40	<u>3039.21</u>	75.98	
	Total	42	3053.11		
Olfactory	Between groups	2	58.67	29.33	0.38
	Within groups	40	<u>3082.40</u>	77.06	
	Total	42	3141.07		

TABLE XVIII
RESULTS OF ANOVA TESTS ON MMPALT II
STYLE SCORES BY EDUCATION GROUPS

Style	Source of Variance	df	SS	MS	F
Print	Between groups	2	35.60	17.80	2.31
	Within groups	40	<u>308.81</u>	7.72	
	Total	42	344.41		
Aural	Between groups	2	6.29	3.15	0.52
	Within groups	40	<u>242.40</u>	6.06	
	Total	42	248.69		
Interactive	Between groups	2	51.23	25.62	3.55
	Within groups	40	<u>288.95</u>	7.22	
	Total	42	340.18		
Visual	Between groups	2	35.72	17.86	5.93
	Within groups	40	<u>120.56</u>	3.01	
	Total	42	156.28		
Haptic	Between groups	2	16.23	8.11	0.92
	Within groups	40	<u>354.47</u>	8.86	
	Total	42	370.70		
Kinesthetic	Between groups	2	3.26	1.63	0.77
	Within groups	40	<u>84.64</u>	2.12	
	Total	42	87.90		
Olfactory	Between groups	2	2.68	1.34	0.87
	Within groups	40	<u>62.02</u>	1.55	
	Total	42	64.70		

their best efforts in each of the MMPALT II subtests and on the PMPS.
They eagerly awaited their test scores with enthusiasm.

Chapter V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter contains three sections. Section one contains a summary of the study. Conclusions to the study questions are contained in the second section and recommendations for further research and future practice are presented in section three.

Summary

The purposes of this study was to measure the perceptual learning styles of FAA supervisory students attending courses at the FAA Management Training School. The population of this study consisted of 43 volunteers residing in 21 different states. Measurements were conducted between September 13, 1983 and October 14, 1983.

The MMPALT was developed by Gilley (1975) and French (1975) and revised by Cherry (1981). The MMPALT II, used in this study, contained seven elements of perceptual modality measurement. These elements were print, aural, interactive, visual, haptic, kinesthetic, and olfactory styles. Cherry (1981) also developed the PMPS, a self-report survey for use with the MMPALT II.

Demographic characteristics of the participants were analyzed for significant differences by sex, age, and education. The participant's GS pay grade was used as the comparison mode. Rank order findings were established for both the PMPS and MMPALT II on each participant.

Relative total scores were determined for this study population by style on both instruments. Correlation coefficients were determined for each participant in relation to each style for self-assessment and actual measurement of learning styles. Statistical treatments for this study were developed by the Oklahoma State University Computer Center.

Conclusions

The conclusions of this study were related to the four study questions identified in the purpose of the study in Chapter I. Gilley (1975) assumed that individuals receive and process information differently. Gilley verified his assumptions with his graphed findings which showed that no two children had the same rank-ordered alignment of styles. Gilley concluded that the six learning styles under examination in his study did exist as sensory-input learning style. Cherry (1981) concluded for the same reason that the same styles and a seventh style, olfactory, existed in the adult population of his study. An analysis of the scores obtained on the MMPALT II by the participants of this study also revealed that no two participants had identical scores or rank order patterns (Appendix E). Results similar to the Gilley and Cherry studies led this researcher to conclude that the seven learning styles also existed in this study sample.

The visual learning style was the strongest learning style of most individuals participating in this study. The mean scores for the visual style was 8.60 out of a possible 10. Information as displayed in Table V revealed that 34 participants scored seven or better. The second highest style was haptic with a mean score of 5.46, however only 16 of the participants scored seven or better in this style.

only style that showed similar agreement, as was evidenced for the visual style, was the olfactory style. This, however, was a negative agreement. The number of participants scoring three or less was 40 for the olfactory style. [A mean score of 1.47 for the olfactory style made it the seventh ranked style. The aural style was third, print was fourth, interactive was fifth, and kinesthetic was sixth.] Research question number one was: "What are the preferred learning styles of the FAA supervisors as measured by MMPALT II?" [Results indicated the strongest style for the sample was the visual learning style with the haptic and aural styles as second and third, respectively.]

Research question number two was: "Is there a correlation between the employee's MMPALT II scores and the employee's perceived learning styles as measured by the PMPS?" [Negligible or low correlation existed between MMPALT II ranks and PMPS ranks. Also, negligible or low correlation existed between MMPALT II scores and PMPS scores by style. Therefore, it can be concluded that no correlation existed between the MMPALT II and PMPS instruments.]

Research question number three was "What are the characteristics or general patterns of the perceptual learning styles of the FAA supervisors?" [The majority of the participants in this study perceived their interactive style as their strongest and the olfactory style as the weakest, based on the PMPS results, but this was the extent of commonality with 43 variances within this study. The results of the MMPALT II did show that the participants did exhibit some commonalities in the identification of the visual style as the strongest and the olfactory style as being the weakest. Therefore, it is concluded that this population does not report characteristics or patterns in common]

with each other in the PMPS. However, the MMPALT II result does show commonalities in the strong visual and weak olfactory scores.

Research question number four was: "Are there any significant differences in learning styles based on demographic characteristics categories?" Results of the ANOVA tests on MMPALT II style scores and PMPS style scores indicated that no significant differences occurred at the .05 level based on GS pay grades of the participants. A t-test for variances by sex, and an analysis of variance for the three age groups and three education groups indicated no significant differences for all seven styles on both the MMPALT II and the PMPS. It is concluded that status, position, sex, age, and education level of the participants had no relationship to their learning styles.

Recommendations

Recommendations for practice at the FAA Management Training School (MTS) are:

1. All training courses presented at MTS contain large amounts of print material. [Each course should be reviewed with an objective to reduce the amount of print material. Reductions of material would result in savings and enhance learning opportunities for individual participants.]

2. All visuals, films, video tapes, handouts, correspondence courses, et cetera, should be reviewed with an objective to insure that the training aids best meet the predominant learning style (visual) of all FAA participants.

3. Perceptual learning styles should become a part of the curriculum for supervisory and manager students at MTS and the Executive School.

4. MTS staff members should be developed to apply learning style techniques in their facilitator tasks.

5. Regions, center, and headquarters training personnel should be administered the MMPALT II instrument to increase their ability to create, design, or procure adult training programs in the future.

Recommendations for further research include:

1. MMPALT II measurements for specific occupational groups should be considered, i.e., Air Traffic, Flight Standards, Air Way Facilities, etc.

2. MMPALT II measurements for participants engaged in technical training should be considered.

3. MMPALT II measurements should be conducted for potential participants in computer-based or computer-assisted learning activities.

Recommendations for future test use or modifications include:

1. Style rotation of order of presentation to participants so that one style is not presented first each time should be studied further. The purpose of the study should be to determine if it makes any differences in the order of style presentation.

2. There was negligible to low correlation of the PMPS and MMPALT II. While the PMPS did not result in any linear relationship most participants felt that awareness of learning styles was of great value to employees in supervisory and management positions. Therefore, selective use of the PMPS should be considered.

3. The olfactory learning style results indicate limited application for adult learning, life-long learning and self-directed learning programs. Selective use in the MMPALT II of the olfactory subtest should be strongly considered.

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APPENDIXES

APPENDIX A

FAA MANAGEMENT TRAINING SCHOOL

COURSE OFFERINGS

COURSE #		COURSE TITLE	WKS	HRS
01200	(SCI)	The Supervisor's Course, Phase I	2½	99
01226	(SCII)	The Supervisor's Course, Phase II	2	59
01204	(IB)	Interpersonal Behavior in Problem Solving	2	59
01205	(LMR)	Labor Management Relations	1	35
01300	(MA)	The Manager's Course	2	75
01303	(RM)	Resource Management	2	59
01304	(OS)	Occupational Safety for Management Inspectors	1	30
01305	(ES)	Executive Seminar	1	24
01501	(DH)	Developing Human Relations Skills	2	67
01505	(EO)	Equal Employment Opportunity Counselor Effectiveness Training	1	35
01511	(PE)	Program Evaluation	1	35
01524	(SW)	Staff Work Course	2	59
01525	(DI)	Discrimination Complaints Investigator Course	1	35
01526	(AVS)	Aviation Standards	1	35
01523	(FTC)	Facilitator Training Course	2½	99
01617	(A-76)	OMB Circular A-76 Cost Comparison Workshops	1	23
01528	(GFC)	Work Group Facilitator Course	1	40

APPENDIX B

LETTER OF PERMISSION TO CONDUCT
RESEARCH STUDY

THE UNIVERSITY OF OKLAHOMA INTEROFFICE COMMUNICATION

To Cle Cox, FAA/MTS Superintendent Date September 3, 1982
From Billie W. Russell Subject Measurement of Individual Learning Styles


As part of my graduate studies at Oklahoma State University, I will be conducting measurements of individual learning styles. This project can be valuable to the FAA Management Training School and myself. I will need to measure the learning styles of approximately 50 FAA supervisors. The information which you receive from this project can help in your future FAA course development efforts.

Participation of the FAA supervisors will be voluntary. I would not expect you to approve my project without specific information and certain guarantees. Therefore, I have attached an introduction to learning styles measurement and this project. Please read the introduction before making a decision.

Thank you for your time and consideration.

Billie W. Russell
BILLIE W. RUSSELL
Senior Course Moderator

APPROVED:

 9-7-82
Cle Cox
Superintendent, FAA/MTS

LEARNING STYLES MEASUREMENT

INTRODUCTION

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 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. When a student's style is measured, he or she can use the measurement results to plan and conduct his/her individual study programs.

How will this measurement program be conducted?

After an exploration of the concept of learning styles and an introduction to the measurement procedures, each participant will receive seven practical measurements and complete a written survey. For the practical measurement, the participants 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 written survey asks the participant's opinion on various methods for learning. A summary of those opinions indicates the participant's preferred method for learning.

When, where, and how long?

The location to be used will be Room 200, Smith Hall. Individual measurements will be conducted between 8AM and 5PM on six consecutive Saturdays; commencing in January 1983.

It will take approximately two hours for each participant to complete the process. Individuals will be scheduled to start the activities at 8AM, 10AM, 12 noon, or 2PM on the date of their choice. Each starting group will be limited to ten participants on a first sign-up, first scheduled basis.

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 at anytime.
2. Individual privacy will be fully protected.
3. Published results will not identify individual participants.
4. No participant will be subjected to any physical, psychological, or social risk or injury.

For additional information or sign-up contact:

Billie W. Russell
7065 Westchester Circle
Lawton, Oklahoma
536-6687

APPENDIX C

LETTER OF PERMISSION TO
REPRODUCE MMPALT II



Robert L. McElrath
COMMISSIONER

TENNESSEE
STATE DEPARTMENT OF EDUCATION
100 CORDELL HULL BUILDING
NASHVILLE 37219

November 23, 1983

Dr. Wayne James
Occupational and Adult Education
406 Classroom Building
Oklahoma State University
Stillwater, Oklahoma 74074

Dear Wayne:

I am writing to confirm that you have permission of the authors of The MMPACT-II Learning Style Test, to administer the tests, and use the results in a series of doctoral dissertations to be conducted at Oklahoma State University. We are pleased that you are furthering our research. We shall look forward to obtaining the results of your research.

Cordially,

A handwritten signature in dark ink, reading "Russ French", is written over the typed name.

Russell L. French

For the Authors: Russell L. French and Edwin Cherry

RLF:clh

APPENDIX D

ORGANIZATIONAL AND OPERATIONAL PROCEDURES

FOR THE MMPALT II

**OVERVIEW FOR THE RESEARCHER TO
CONDUCT THE MMPALT AND PMPS**

1. Review checklist and assure all equipment is in place and operational.
2. Greet subject and give Introduction (see outline)
3. Have subject complete Subject's Record form.
4. Odd-numbered subjects will complete the PMPS before competing the MMPALT (see procedures).
5. Administer the MMPALT (follow procedures for 7 parts).
6. Even-numbered subjects will complete the PMPS after completing MMPALT.
7. Hand score the PMPS.
8. Score the MMPALT and complete Subject's Record form.
9. Complete Check Sheet H and deliver to subject. (Be sure to answer any questions the subject has.)

**CHECKLIST FOR THE RESEARCHER TO MAKE PREPARATIONS
FOR ADMINSTERING THE MMPALT-II**

1. General: - One or two trained evaluators
 - Quiet and comfortable room
 - Chairs for evaluator/s and subject
 - Desk or table
 - Subject's Record form
 - Pencils
2. Introduction: - Outline
 - 35mm carosel projector
 - Projector screen
 - Demonstration materials, wooden block, baseball, 2 bottles
 and blindfold
3. PMPS: - Instruction sheet and questions
 - Answer sheet
4. Print Test (P): - Instruction/outline
 - Slides (print test)
 - Response sheet "A"
 - Answer key "A"
5. Aural test (A): - Instruction/outline
 - Audiotape cassette recorder
 - Response sheet "B"
 - Answer key "B"
6. Visual test (V) - Instruction/outline
 - Slides (visual test)
 - Response sheet "C"
 - Answer key "C"

- 7. Interactive test (I) - Instructions/outline
 - Response sheet "D"
- 8. Haptic test (H) - Instruction/outline
 - Box of 20 stimulus/response items
 - Blindfold
 - Response sheet "E"
- 9. Kinesthetic test (K) - Instruction/outline
 - Blindfold
 - Response sheet "F"
- 10. Olfactory test (O) - Instructions/outline
 - Blindfold
 - Aroma bottles (20)
 - Response sheet "G"
- 11. Conclusion - Check sheet "H"
 - PMPS Worksheet

OUTLINE FOR THE RESEARCHER TO INTRODUCE LEARNING STYLE
MEASUREMENT EXERCISES TO INDIVIDUAL SUBJECTS

1. Introduction:

NOTE - The purpose of this introduction is to stimulate each subject's interest and enthusiasm toward learning more about their individual uniqueness as a learner. Adjust the presentation to each subject's apparent needs but do not use excessive detail.

YOU ARE ABOUT TO COMPLETE SEVERAL LEARNING EXERCISES TO DETERMINE YOUR STRONGEST LEARNING STYLE OR STYLES. AFTER THE EXERCISES ARE COMPLETED, YOU WILL BE ADVISED AS TO YOUR STRENGTHS AND WEAKNESSES AS A LEARNER. KNOWLEDGE OF THIS INFORMATION CAN HELP YOU IN FUTURE LEARNING SITUATIONS.

1. Background (Develop the following points):

- EACH OF US ARE DIFFERENT FROM OTHERS
- ONE OF THE PRIMARY DIFFERENCES IS THE MANNER IN WHICH WE LEARN
- THIS MIGHT BE NOTED BY THE MANNER IN WHICH WE RECEIVE, PROCESS RETRIEVE, OR USE NEW KNOWLEDGE OR INFORMATION.
- ONE CONCEPT OF HOW WE RECEIVE KNOWLEDGE AND INFORMATION INCLUDES SEVEN LEARNING STYLES (Briefly explain each):
 - . PRINT
 - . AURAL
 - . INTERACTIVE
 - . VISUAL

- . HAPTIC
- . KINESTHETIC
- . OLFACTORY

- EACH OF US SHOULD KNOW MORE ABOUT OUR INDIVIDUAL LEARNING STYLES.
- WE CAN LEARN BETTER BY USING OUR STRONGEST STYLE.

(Allow and encourage subject questions and discussion, then proceed to the exercise procedures.)

3. Measurement exercise procedures:

- IN EACH OF THE SEVEN EXERCISES, YOU WILL BE PRESENTED 10 PAIRS OF THINGS FIRST: WORDS, PICTURES, AROMAS, OBJECTS, ETC. THE FIRST ITEM PRESENTED TO YOU IN EACH PAIR IS CALLED THE STIMULUS, THE SECOND IS CALLED THE RESPONSE. (Show demonstration pairs and point out the stimulus item and the response item.) AFTER ALL 10 PAIRS HAVE BEEN PRESENTED TO YOU, I WILL PRESENT THE STIMULUS ITEM OF EACH PAIR IN A DIFFERENT ORDER FROM THE FIRST PRESENTATION. YOUR TASK WILL BE TO IDENTIFY THE RESPONSE ITEM FOR EACH PAIR FROM MEMORY. (Demonstrate a sample procedure.)
- REMEMBER THERE IS NO PASSING OR FAILING OF THESE EXERCISES. WE ARE SIMPLY TRYING TO FIND YOUR STRENGTHS AND WEAKNESSES SO YOU CAN BECOME BETTER ABLE TO BUILD ON THE STRENGTHS AND IMPROVE WEAK AREAS.
- SPECIFIC PROCEDURES WILL BE GIVEN TO YOU FOR EACH EXERCISE.
- DO YOU HAVE ANY QUESTIONS?

**PROCEDURES FOR THE MULTIMODAL PAIRED
ASSOCIATES LEARNING TEST (MMPALt-II)**

1. Print Test (P)
 - Be sure subjects can see the screen clearly.
 - Distribute response sheet A (face down) and pencil.
 - Give direction and show sample pair.
 - Display stimulus/response pairs at 7 second intervals.
 - Instruct subject to turn response sheet over and pick up pencil.
 - Announce number of response and display each stimulus slide for 10 seconds (For example: "Number one (wait 10 seconds), Number two (wait 10 seconds) etc...")
 - Collect response sheets.

FOR THIS EVALUATION, YOU WILL BE VIEWING PAIRS OF WORDS. THE FIRST WORD IN EACH PAIR IS A NONSENSE WORD (TRIAGRAM) 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 SEE EACH NONSENSE WORD AGAIN. THEY WILL BE PRESENTED IN RANDOM ORDER, NOT IN THE SAME ORDER AS FIRST PRESENTED. YOU ARE TO WRITE THE COMMON WORD THAT IS APPROPRIATE FOR THE NONSENSE WORD ON THE RESPONSE SHEET.

Pairings and sequence of stimulus/response pairs should be as follows:

Sample: hez/sister

- | | |
|--------------|--------------|
| 1) biw/cat | 6) cyc/horse |
| 2) ceq/party | 7) koy/rain |
| 3) puq/name | 8) wup/robin |
| 4) dup/bed | 9) lez/paper |
| 5) xib/box | 10) nyh/coat |

NOW THAT YOU HAVE VIEWED ALL TEN PAIRS, I WILL CHECK YOUR RECALL. YOU WILL VIEW THE NONSENSE WORDS. YOU WILL HAVE TEN SECONDS TO WRITE THE APPROPRIATE COMMON WORD BY THE APPROPRIATE NUMBER.

Sequence for stimulus only displays:

- | | |
|--------|---------|
| 1) dup | 6) nyh |
| 2) cyc | 7) ceq |
| 3) koy | 8) lez |
| 4) biw | 9) puq |
| 5) xib | 10) wug |

2. Aural Test (A)
 - Be sure subjects can hear audiotape well.
 - Distribute response sheet B (face down) and pencil.
 - Give directions for the test and demonstrate stimulus/response pair.

- Play audiotape containing stimulus/response pairs.
- Instruct subject to turn response sheet over and prepare to respond.
- Collect response sheet.

Script and instruction 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.)

Pairing and sequence of stimulus/response pairs should be:

- | | |
|---------------|---------------|
| 1) vom/apple | 6) poh/leg |
| 2) und/baby | 7) omp/bread |
| 3) tud/kitten | 8) mog/table |
| 4) sul/shoe | 9) kiv/rabbit |
| 5) roz/duck | 10) jus/bird |

(Use the following for the response measurement tape.)

NOW THAT YOU HAVE RECEIVED ALL TEN PAIRS, WE'LL CHECK YOUR 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 | 6) mog |
| 2) omp | 7) und |
| 3) jus | 8) sul |
| 4) vom | 9) kiv |
| 5) tud | 10) roz |

3. Visual Test (V) - Be sure subjects can see the screen well.
- distribute response sheet C (face down) and pencil.

- give directions and show sample pair.
- display stimulus/response pair at 7 second intervals.
- Instruct subjects to turn response sheets over and prepare to respond,
- Announce number of response and display each stimulus member for 10 seconds. For example: "Number one (ten seconds), etc..."
- Collect answer sheet and pencil.

FOR THIS EVALUATION YOU WILL BE VIEWING PAIRS OF DRAWINGS. THE FIRST DRAWING IN EACH PAIR IS A SYMBOL AND THE SECOND IS A COMMON OBJECT. YOU SHOULD TRY TO REMEMBER THE COMMON OBJECT PICTURED IN EACH PAIR AND THE SYMBOL IS GOES WITH. AFTER YOU HAVE BEEN GIVEN ALL TEN PAIRS OF PICTURES, YOU WILL SEE EACH SYMBOL AGAIN. THEY WILL NOT BE PRESENTED IN THE SAME ORDER BUT WILL E PRESENTED IN RANDOM ORDER. YOU ARE TO WRITE THE NAME OF THE COMMON OBJECT THAT IS APPROPRIATED FOR THE SYMBOL ON THE RESPONSE SHEET.

Pairing and sequence of stimulus/response pairs should be as follows:

- | | |
|---------------------|------------------------------|
| 1) square/tree | 6) star/boat |
| 2) circle/hat | 7) oval/flower |
| 3) triangle/chair | 8) asterisk/umbrella |
| 4) rectangle/boot | 9) diamond/scissors |
| 5) plus sign/window | 10) infinity sign/eyeglasses |

NOW THAT YOU HAVE VIEWED ALL TEN PAIRS, I WILL CHECK YOUR RECALL. YOU WILL VIEW THE SYMBLOS. YOU WILL HAVE TEN SECONDS TO WRITE THE APPROPRIATE NAME OF THE COMMON OBJECT BY THE APPROPRIATE NUMBER.

Sequence for stimulus only display:

- | | |
|------------------|--------------|
| 1) asterisk | 6) oval |
| 2) circle | 7) diamond |
| 3) plus sign | 8) square |
| 4) rectangle | 9) star |
| 5) infinity sign | 10) triangle |

4. Interactive Test (I)
- Seat subject where he/she is at the same level and face to face with the primary evaluator. If a secondary evaluator is used, he/she should sit to one side and prepare to score the responses. Scoring must be accomplished without distracting or prompting the subject.
 - Try to put the subject at ease, but do not wast too much time pleasantries.
 - Assure subject that procedures are identical to those already encountered in the previous tests and give him/her directions for the test:

IN A MOMENT YOU WILL BE BLINDFOLDED, THEN YOU WILL BE GIVEN TEN PAIRS OF WORDS. EACH PAIR CONTAINS A NONSENSE WORD AND A COMMON WORD. AFTER PRESENTING EACH PAIR, I SHALL GIVE YOU AN OPPORTUNITY TO TALK ABOUT HOW YOU INTEND TO REMEMBER THIS PAIRING. AFTER ALL TEN PAIRS OF WORDS HAVE BEEN PRESENTED AND YOU HAVE COMMENTED ON EACH, I SHALL PRESENT YOU ONLY THE STIMULUS OR NONSENSE WORDS AND ASK YOU ONLY STIMULUS OR NONSENSE WORDS AND ASK YOU TO SUPPLY THE COMMON WORD WHICH WAS PAIRED WITH EACH. DO YOU UNDERSTAND THE PROCEDURE?

- Present 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 this as necessary until the subject can say both words.)

HOW WILL YOU REMEMBER THIS PAIR OF WORDS? (You may need to prompt the subject to be sure that he/she will verbalize these words.)

- Allow ten 10 seconds for the subject to respond to question. (Do not comment on Subject's reply.)

Pairing and sequence of stimulus/response pairs should be:

- | | |
|------------------|--------------|
| 1) zed/wind | 6) pex/floor |
| 2) fai/tooth | 7) chi/egg |
| 3) ces/ball | 8) jec/dog |
| 4) hex/christmas | 9) toz/milk |
| 5) sci/fire | 10) zon/toy |

- Present stimulus words and ask the subject to state response words. Use the following script:

THE NONSENSE WORD IS (Stimulus). WHAT WAS (Stimulus) PAIRED WITH? (Allow 10 seconds for the response.)

Sequence for stimulus only presentation:

- | | |
|--------|---------|
| 1) hex | 6) jec |
| 2) zed | 7) toz |
| 3) sci | 8) ces |
| 4) chi | 9) pex |
| 5) fai | 10) zon |

- Primary or secondary evaluator (researcher) completes scoring without reporting results to subject on check sheet D.
- Be sure subject's correct name or number is on the check sheet.
- Instruct the subject to standby for the next test.

5. Haptic Test (H) - Arrange items on table and cover before starting the test.
- Seat subject across table from researcher. If a secondary evaluator is used, he/she should sit to one side and prepare to

score the responses. Scoring must be accomplished without distracting or prompting the subject.

- Try to put the subject at ease, but do not waste too much time on pleasantries.
- Assure the subject that procedures are the same as for all the other tests and give him/her the following instruction:

FOR THIS TEST YOU WILL BE BLINDFOLDED. I SHALL PRESENT YOU WITH TEN PAIRS OF ITEMS. EACH PAIR CONTAINS A NONSENSE ITEM AND A COMMON ITEM. NONE OF THE ITEMS WILL HURT YOU NOR FEEL TERRIBLE TO YOU. I SHALL ALWAYS PLACE THE NONSENSE ITEM OF EACH PAIR IN YOUR LEFT HAND, AND THE COMMON ITEM IN YOUR RIGHT HAND. FEEL THE TWO ITEMS IN EACH PAIR CAREFULLY SO THAT YOU WILL BE ABLE TO REMEMBER WHAT THINGS ARE ASSOCIATED WITH EACH OTHER. I WILL MAKE SURE THAT YOU CAN IDENTIFY THE COMMON ITEM. AFTER ALL TEN PAIRS HAVE BEEN PRESENTED, I SHALL PRESENT YOU WITH THE STIMULUS OR NONSENSE ITEM AND ASK YOU TO IDENTIFY THE COMMON ITEM WHICH WAS PAIRED WITH EACH. DO YOU UNDERSTAND THE PROCEDURE?

- Make sure subject is blindfolded, then uncover the items on the table.
- Place stimulus member of each pair in subject's left hand; then place corresponding response item in subject's right hand. allow the subject 7 seconds to handle both objects, then take them away from him/her and repeat the procedure with the next pair of items until all ten pairs are presented. Be sure the subject can identify the common item in each pair. He/she will have to name this item again, later.
- Instruct the subject that THE TEST IS TO BEGIN.
- Place each stimulus in the subjects left hand and ask him/her to identify the paired response item place in the right hand.

PLEASE NAME OR DESCRIBE THE OBJECT WITH WHICH THIS ITEM WAS PAIRED. Allow ten (10) seconds for the subject to reply. (Do not comment on the subject's reply.)

- Score is kept without reporting results to the subject on response sheet E.

Pairings and sequence of stimuli/response pairs should be:

- 1) carpet/lightbulb
- 2) rock/pencil
- 3) table leg/tennis ball
- 4) hose coupling/paint brush
- 5) wood rectangle/table fork
- 6) bushing/key ring
- 7) metal tube/scissors
- 8) odd shape wood/yo yo
- 9) plastic golf ball/padlock
- 10) door knob/drinking glass

Sequence for stimulus only presentation:

- | | |
|--------------------|-------------------|
| 1) carpet | 6) wood rectangle |
| 2) golf ball | 7) rock |
| 3) odd shaped wood | 8) door knob |
| 4) bushing | 9) metal tube |
| 5) table leg | 10) hose coupling |

- Be sure that subject's correct name or number is on the response sheet.
- Instruct subject to standby for next test.

6. Kinesthetic Test (K)

- Keep subject seated while explaining test. If a secondary evaluator is used, he/she should sit to one side and prepare to score the responses. Scoring must be accomplished without distracting or prompting subject.
- Try to put the subject at ease, but do not waste too much time on pleasantries.
- Assure the subject that the procedures are the same as for all other test and give him or her direction as follows:

THIS TEST INVOLVES BODY MOVEMENT: THERE WILL BE LIMITED SPOKEN DIRECTIONS DURING THIS PROCEDURE. FROM THIS (IDENTIFY) STARTING POINT, I'LL GUIDE AND DIRECT YOU THROUGH TEN PAIRS OF BODY MOVEMENTS. YOU WILL BE BLINDFOLDED: THEREFORE I'LL STAY CLOSE BY YOU 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 OR DESCRIBING THE MOVEMENT WITH WHICH THE FIRST MOVEMENT WAS PAIRED. DO YOU UNDERSTAND THE PROCEDURE?

- Blindfold the subject.
- Move the subject through the 10 stimulus/response pairs. As necessary, use the following spoken directions:

THE FIRST MOVEMENT IS (Stimulus). IT IS PAIRED WITH (Response)

- Start each movement by gently placing your hands on the subjects shoulders. The various movements will require gentle movement of the subject's arms and legs. This must be accomplished without alarming the subject in any way. As necessary, you may use additional verbal directions, but those directions must not detract from the actual movements.
- Move the subject through the various stimulus movements and allow 10 seconds for the subject respond by performing or describing the paired movements. It may be necessary to say:

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

- Score responses without reporting results to subjects on response sheet F.
- Be sure that subject's correct name or number is on the response sheet.
- Instruct subject to standby for next test.

Pairings and sequence pairs should be as follows:

<u>STIMULUS</u>	<u>RESPONSE</u>
1) Move diagonally across room and back	1) Stoop
2) Stand on one leg	2) Raise both hands in air
3) Rotate left arm	3) Bend forward at waist
4) Hands on hips	4) Alternate raising both legs
5) Wrap left arm over head	5) Walk in circle
6) Clasp hands over head, then lower to sides	6) Take two step forward and return
7) Twist body in circle	7) Clasp hands in front of body
8) With right arm, draw a circle in the air	8) Stand with legs spread far apart
9) Cross arms over head	9) Clasp hands behind neck
10) Get on hands and knees	10) Stand at attention (rigid body position)

Sequence for stimulus only presentation:

- 1) Stand on one leg
- 2) Get on hands and knees
- 3) With right arm, draw a circle in the air
- 4) Cross arms over head
- 5) Hands on hips
- 6) Move diagonally across room and return
- 7) Clasp hands above head, then lower them to side
- 8) Left arm above head

9) Twist body in circle

10) Rotate left arm

7. Olfactory Test (O)
- Arrange aroma bottles by numbers and cover before starting the test.
 - Seat subject across table from primary evaluator (researcher). If a secondary evaluator is used, he/she should sit to one side and prepare to score responses. Scoring must be accomplished with distracting or prompting the subject.
 - Try to put the subject at ease, but do not waste too much time on pleasantries.
 - Assure subject that procedures are the same as for all other tests and give him/her direction as follows:

FOR THIS TEST YOU WILL BE BLINDFOLDED AND GIVEN BOTTLES CONTAINING DIFFERENT AROMAS. FIRST, YOU WILL BE PRESENTED WITH PAIRS OF AROMAS. THE FIRST BOTTLE OF EACH PAIR CONTAINS AN ABSTRACT AROMA WHICH WILL BE IDENTIFIED. THE SECOND BOTTLE CONTAINS A COMMON AROMA, AND I WILL NOT IDENTIFY IT FOR. YOUR TASK IS TO REMEMBER WHICH PAIRS OF AROMAS GO TOGETHER. AFTER EXAMINING ALL TEN PAIRS, YOU WILL BE GIVEN THE BOTTLE CONTAINING THE FIRST AROMA IN EACH PAIR. YOU ARE TO IDENTIFY THE NAME OF THE AROMA WITH WHICH IT WAS PAIRED. DO YOU UNDERSTAND THE PROCEDURE?

- Blindfold the subject.
- Present the stimulus/response pairs as follows:

THIS IS THE FIRST AROMA OF THIS PAIR. (Give bottle to subject; help him/her lift it to nose.) THIS IS THE SECOND AROMA OF THIS PAIR (Same procedure).

- Allow the subject 7 seconds to examine each pair of aromas.
- Then present subject with the stimulus member bottle of each pair and allow him/her 10 seconds to identify the appropriate response aroma. It may be necessary to say:

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

- Score responses without reporting the results to the subject on check sheet G.
- Be sure subject's correct name or number is on the response sheet.

- Instruct subject to remove blindfold and standby for a report on the results of the entire test issued on check sheet H.

Pairings and sequence of stimulus/response pairs should be:

- | | |
|-----------------|----------------------|
| 1) Cherry | 11) Peppermint |
| 2) Vanilla | 12) Strawberry |
| 3) Almond | 13) Orange |
| 4) Raspberry | 14) Butter |
| 5) Pineapple | 15) Chocolate |
| 6) Brandy | 16) Coconut |
| 7) Rum | 17) Anise (Licorice) |
| 8) Banana | 18) Cloves |
| 9) Maple | 19) Lemon |
| 10) Wintergreen | 20) Cinnamon |

Sequence for stimulus only presentations:

- | | |
|-------------------|-----------------------|
| 1) Vanilla (#2) | 6) Almond(#3) |
| 2) Raspberry (#4) | 7) Pineapple (#5) |
| 3) Maple (#9) | 8) Rum (#7) |
| 4) Banana (#8) | 9) Brandy (#6) |
| 5) Cherry (#1) | 10) Wintergreen (#10) |

APPENDIX E

COPY OF PMPS AND SCORING KEY

PERCEPTUAL MODALITY PREFERENCE SURVEY (PMPs)

This survey is designed to help you identify your style of learning. It specifically deals with how you best receive new information or knowledge. The results of this survey will help you plan your future learning experiences.

You will be responding to forty-two statements concerning how you learn best. This is not a test; there are no right or wrong answers. When making your responses, you should consider your past learning experiences and your own intuitions about your learning style.

The response choices are ALWAYS, USUALLY, SELDOM, and NEVER. The ALWAYS response indicates that the statement is strong representation of your learning style preference. If the statement is a good way for you to learn, but not your most preferred, you should mark USUALLY. If the statement indicates a way you can learn, but you prefer other methods, mark your response as SELDOM. The NEVER response indicates that you reject the statement as a way for you to learn. If you feel completely neutral to a statement, do not mark a response.

The construction of the survey requires that you respond to all statements in the order presented. Therefore, do not omit responses or skip statements unless they are meant to be a neutral response. Do not go back over the statements.

1	2	3	4	5
ALWAYS	USUALLY	SELDOM	NEVER	DO NOT MARK

1. I can learn better by reading than by listening.
2. I can learn better by listening than by talking with others.
3. I can learn better by talking with others than by looking at things like movies and slides
4. I can learn better by looking at things like movies and slides than by touching or holding objects
5. I can learn better by touching or holding objects than by physically participating in activities such as sports or games.
6. I can learn better by physically participating in activities such as sports and games than by smelling things.
7. I can learn better by smelling things than by reading.
8. I can learn better by reading than talking with others.
9. I can learn better by talking with others than by touching or holding objects.
10. I can learn better by touching or holding objects than by smelling things.
11. I can learn better by smelling things than by listening.
12. I can learn better by listening than by looking at things like movies and slides.
13. I can learn better by looking at things like movies and slides than by physically participating in activities such as sports and games.
14. I can learn better by physically participating in activities such as sports and games than by reading.
15. I can learn better by reading than by looking at things like movies and slides.
16. I can learn better by looking at things like movies and slides than by smelling things.

1	2	3	4	5
ALWAYS	USUALLY	SELDOM	NEVER	DO NOT MARK

- | | | | | |
|--------|---------|--------|-------|-------------|
| 1 | 2 | 3 | 4 | 5 |
| ALWAYS | USUALLY | SELDOM | NEVER | DO NOT MARK |
17. I can learn better by smelling things than by talking with others.
 18. I can learn better by talking with others than by physically participating in activities such as sports and games.
 19. I can learn better by physically participating in activities such as sports and games than by listening.
 20. I can learn better by listening than by touching or holding objects.
 21. I can learn better by touching holding objects than by reading.
 22. I can learn better by reading than by smelling things.
 23. I can learn better by smelling things than by physically participating in activities such as sports and games.
 24. I can learn better by physically participating in activities such as sports and games than by touching or holding objects.
 25. I can learn better by touching or holding objects than by looking at things like movies and slides.
 26. I can learn better by looking at things like movies and slides than by talking with others.
 27. I can learn better by talking with others than by listening.
 28. I can learn better by listening than by reading.
 29. I can learn better by reading than by physically participating in activities such as sports and games.
 30. I can learn better by physically participating in activities such as sports and games than by looking at things like movies and slides.
 31. I can learn better by looking at things like movies and slides than by listening.

1	2	3	4	5
ALWAYS	USUALLY	SELDOM	NEVER	DO NOT MARK

1	2	3	4	5
ALWAYS	USUALLY	SELDOM	NEVER	DO NOT MARK

32. I can learn better by listening than by smelling things.
33. I can learn better by smelling things than by touching or holding objects.
34. I can learn better by touching or holding objects than by talking with others.
35. I can learn by talking with others than by reading.
36. I can learn better by reading than by touching or holding objects.
37. I can learn better by touching or holding objects than by listening.
38. I can learn beter by listening than by physically participating in activities such as sports and games.
39. I can learn better by physically participating in activities such as sports and games than by talking with others.
40. I can learn better by talking with others than by smelling things.
41. I can learn better smelling things than by looking at things like movies and slides.
42. I can learn better by looking at things like movies and slides than by reading.

1	2	3	4	5
ALWAYS	USUALLY	SELDOM	NEVER	DO NOT MARK

PERCEPTUAL MODALITY PREFERENCE SURVEY

SCORING SYSTEM

Each survey statement contains two contrasting perceptual modality elements. Each element is included in 12 different statements; 6 times in the primary or first position and 6 times in the secondary or last position. Each element can therefore, be scored 12 times. Then listed in the primary position, the element will be scored: Always = +4, Usually = +2, Seldom = -2, and Never = -4. When listed in the secondary position, the element will be scored: Always = -2, Usually = -1, Seldom = +1, and Never = +2. The maximum possible score range for any element is +36 to -36.

Print Element Statements:

Primary Position: 1, 8, 15, 23, 29, and 36.
 Secondary Position: 7, 14, 21, 28, 35, and 42.

Aural Element Statements:

Primary Position: 2, 12, 20, 28, 32, and 38.
 Secondary Position: 1, 11, 19, 27, 31, and 37.

Interactive Element Statements:

Primary Position: 3, 9, 18, 27, 35, and 40.
 Secondary Position: 2, 8, 17, 26, 34, and 39.

Visual Element Statements:

Primary Position: 4, 13, 16, 26, 31, and 42.
 Secondary Position: 3, 12, 15, 25, 30 and 41.

Haptic Element Statements:

Primary Position: 5, 10, 21, 25, 34, and 37.
 Secondary Position: 4, 9, 20, 24, 33, and 36.

Kinesthetic Element Statements:

Primary Position: 6, 14, 19, 24, 30, and 39.
 Secondary Position: 5, 13, 18, 23, 29, and 38.

Olfactory Element Statements:

Primary Position: 7, 11, 17, 23, 33, and 41.
 Secondary Position: 6, 10, 16, 22, 32, and 40.

	1		2		3		4		5
	ALWAYS		USUALLY		SELDOM		NEVER		DO NOT MARK
1.	(1)	(2)	(3)	(4)			22.	(1)	(2) (3) (4)
2.	(1)	(2)	(3)	(4)			23.	(1)	(2) (3) (4)
3.	(1)	(2)	(3)	(4)			24.	(1)	(2) (3) (4)
4.	(1)	(2)	(3)	(4)			25.	(1)	(2) (3) (4)
5.	(1)	(2)	(3)	(4)			26.	(1)	(2) (3) (4)
6.	(1)	(2)	(3)	(4)			27.	(1)	(2) (3) (4)
7.	(1)	(2)	(3)	(4)			28.	(1)	(2) (3) (4)
8.	(1)	(2)	(3)	(4)			29.	(1)	(2) (3) (4)
9.	(1)	(2)	(3)	(4)			30.	(1)	(2) (3) (4)
10.	(1)	(2)	(3)	(4)			31.	(1)	(2) (3) (4)
11.	(1)	(2)	(3)	(4)			32.	(1)	(2) (3) (4)
12.	(1)	(2)	(3)	(4)			33.	(1)	(2) (3) (4)
13.	(1)	(2)	(3)	(4)			34.	(1)	(2) (3) (4)
14.	(1)	(2)	(3)	(4)			35.	(1)	(2) (3) (4)
15.	(1)	(2)	(3)	(4)			36.	(1)	(2) (3) (4)
16.	(1)	(2)	(3)	(4)			37.	(1)	(2) (3) (4)
17.	(1)	(2)	(3)	(4)			38.	(1)	(2) (3) (4)
18.	(1)	(2)	(3)	(4)			39.	(1)	(2) (3) (4)
19.	(1)	(2)	(3)	(4)			40.	(1)	(2) (3) (4)
20.	(1)	(2)	(3)	(4)			41.	(1)	(2) (3) (4)
21.	(1)	(2)	(3)	(4)			42.	(1)	(2) (3) (4)

1	2	3	4	5
ALWAYS	USUALLY	SELDOM	NEVER	DO NOT MARK

WORKSHEET FOR HAND-SCORING
PERCEPTUAL MODALITY PERFORMANCE SURVEY

Print:			Aural:			Interactive:		
A	1	28	I	2	27	V	3	26
I	8	35	V	12	31	H	9	34
V	15	42	H	20	37	K	18	39
H	36	21	K	38	19	O	40	17
K	29	14	O	32	11	P	35	8
O	22	7	P	28	1	A	27	2
Visual:			Haptic:			Kinesthetic:		
H	4	25	K	5	24	O	6	23
K	13	30	O	10	33	P	14	29
O	16	41	P	21	36	A	19	38
P	42	15	A	37	20	I	39	18
A	31	12	I	34	9	V	30	13
I	26	3	V	25	4	H	24	5

Survey Results:			MMPALT Results:		
Olfactory:	Style:	Score: Rank	Score:	Rank:	
P 7 22	Print				
A 11 32	Aural				
I 17 40	Interactive				
V 41 16	Visual				
H 33 10	Haptic				
K 23 6	Kinesthetic				
Olfactory					

Primary Position: Always +4, Usually +2, Seldom -2, Never -4

Secondary Position: Always -2, Usually -1, Seldom +1, Never +2

APPENDIX F

RESPONSE AND CHECK SHEETS FOR THE
MMPALT II

RESPONSE SHEET A
PRINT
LEARNING STYLE

SUBJECT NUMBER: _____

NONSENSE WORD
NUMBER:

COMMON WORD:

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

RESPONSE SHEET B

AURAL

LEARNING STYLE

SUBJECT NUMBER: _____

NONSENSE WORD
NUMBER:

COMMON WORD:

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

RESPONSE SHEET C
VISUAL
LEARNING STYLE

SUBJECT NUMBER: _____

SYMBOL
NUMBER:

PICTURE

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

CHECK SHEET D
INTERACTIVE
LEARNING STYLE

SUBJECT NUMBER: _____

NONSENSE WORD:	COMMON WORD:	SUBJECT CORRECT	RESPONSE INCORRECT
-------------------	-----------------	--------------------	-----------------------

hez

zed

sci

chi

fai

jec

toz

ces

pex

zon

TOTAL CORRECT: _____

RESPONSE SHEET E
HAPTIC
LEARNING STYLE

SUBJECT NUMBER: _____

STIMULUS MEMBER:	RESPONSE MEMBER:	SUBJECT CORRECT	RESPONSE INCORRECT
PIECE OF CARPET	LIGHT BULB		
PLASTIC GOLF BALL	PADLOCK		
ODD SHAPED PIECE OF WOOD	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		
TOTAL CORRECT: _____			

RESPONSE SHEET F
KINESTHETIC
LEARNING STYLE

SUBJECT NUMBER: _____

STIMULUS MEMBER:	RESPONSE MEMBER:	SUBJECT CORRECT	RESPONSE 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 BE- HIND HEAD		
HANDS ON HIPS	RAISE BOTH LEGS (ALT.)		
MOVE DIAGONALLY ACROSS ROOM AND RETURN	STOOP		
CLASP HANDS OVER HEAD, LOWER TO SIDE	TAKE TWO STEPS FWD AND RETURN		
LEFT ARM OVER HEAD	WALK IN A CIRCLE		
TWIST BODY IN CIRCLE	CLASP HANDS IN FRONT		
ROTATE LEFT ARM	BEND OVER FORWARD		
TOTAL CORRECT: _____			

CHECK SHEET G
OLFACTORY
LEARNING STYLE

SUBJECT NUMBER: _____

STIMULUS NUMBER:	RESPONSE AROMA:	SUBJECT CORRECT	RESPONSE INCORRECT
2	STRAWBERRY		
4	BUTTER		
9	LEMON		
8	OIL OF CLOVES		
1	PEPPERMINT		
3	ORANGE		
5	CHOCOLATE		
7	LICORICE		
6	COCONUT		
10	CINNAMON		
TOTAL CORRECT:		_____	

CHECK SHEET H

PARTICIPANTS REPORT

SUBJECT NUMBER: _____

Your individual survey and the learning style tests have been scored and your results are as follows:

<u>LEARNING STYLE</u>	<u>MMPALT SCORE</u>	<u>MMPALT RANK ORDER</u>	<u>PMPS RANK ORDER</u>
PRINT	_____	_____	_____
AURAL	_____	_____	_____
INTERACTIVE	_____	_____	_____
VISUAL	_____	_____	_____
HAPTIC	_____	_____	_____
KINESTHETIC	_____	_____	_____
OLFACTORY	_____	_____	_____

If these results are a true reflection of your strengths as a learner, the style ranked as #1 is your best method for studying and learning. You might consider using that style as much as possible, and, at the same time, attempt to improve your skills in weaker styles. Example: if aural is your #1 style, you learn best by listening. If print is your #7 style, this would be your weakest style and you should attempt to improve your reading skills.

THANK YOU VERY MUCH FOR BEING A PART OF THIS STUDY.

APPENDIX G

SUMMARY OF INDIVIDUAL SCORES AND RANKS
BY STYLE FOR THE MMPALT II AND PMPS

TABLE XIX
SUMMARY OF INDIVIDUAL PARTICIPANT SCORES AND RANKS FOR MMPALT II AND PMPS

Parti- cipant Number	Instru- ment	SUBTEST													
		Print		Aural		Interactive		Visual		Haptic		Kinesthetic		Olfactory	
		Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
1	MMPALT	10	2	10	2	5	5	10	2	9	4	4	6	1	7
	PMPS	6	3	-4	5	24	1	1	4	-9	6	8	2	-36	7
2	MMPALT	9	1.5	6	4.5	6	4.5	9	1.5	7	3	2	6	1	7
	PMPS	5	3	15	2	22	1	0	4.5	-17	6	0	4.5	-27	7
3	MMPALT	5	4	3	5.5	8	2	10	1	6	3	3	5.5	2	7
	PMPS	1	4	-8	6	8	2.5	8	2.5	-6	5	18	1	-18	7
4	MMPALT	8	4	7	5	10	1.5	10	1.5	9	3	6	6	3	7
	PMPS	5	3	-6	5	3	4	10	2	-17	6	21	1	-20	7
5	MMPALT	1	5	2	3.5	0	6.5	4	1.0	3	2	2	3.5	0	6.5
	PMPS	7	3.5	7	3.5	12	1.5	-10	6	-8	5	12	1.5	-22	7
6	MMPALT	8	2.5	8	2.5	5	5	10	1	7	4	1	6	0	7
	PMPS	4	4	10	2	16	1	8	3	-12	6	-6	5	-18	7
7	MMPALT	9	3	10	1.5	3	5.5	10	1.5	7	4	3	5.5	2	7
	PMPS	7	3	-7	6	1	5	4	4	8	2	22	1	-30	7
8	MMPALT	3	2.5	2	4.5	2	4.5	8	1	1	7	3	2.5	2	6
	PMPS	-15	6	11	2	8	3	4	4.5	13	1	4	4.5	-30	7

TABLE XIX (Continued)

Participant Number	Instrument	SUBTEST													
		Print		Aural		Interactive		Visual		Haptic		Kinesthetic		Olfactory	
		Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
9	MMPALT PMPS	9 -1	3.5 4	9 -7	3.5 5	6 5	5 3	10 13	1.5 2	10 27	1.5 1	5 -22	6.5 7	5 -21	6.5 6
10	MMPALT PMPS	3 15	3 2	1 23	6 1	1 9	6 3	8 -2	1 5	6 2	2 4	2 -15	4 6	1 -25	6 7
11	MMPALT PMPS	8 20	3 1	9 -6	2 5	7 10	4 2	10 4	1 4	3 -12	5 6	1 8	6 3	0 -19	7 7
12	MMPALT PMPS	0 21	7 1	3 7	3 3.5	2 -3	5 5	5 7	1 3.5	3 9	3 2	3 -9	3 6	1 -36	6 7
13	MMPALT PMPS	6 6	3 4	6 8	3 3	1 18	6 1	10 -12	1 5	6 12	3 2	2 -17	5 6	0 -23	7 7
14	MMPALT PMPS	4 -28	3.5 7	2 -7	6 5	2 1	6 4	10 11	1 3	6 14	2 2	4 21	3.5 1	2 -19	6 6
15	MMPALT PMPS	1 13	4 2.5	5 -14	1.5 5	0 13	6.5 2.5	5 -17	1.5 6	1 -13	4 4	1 31	4 1	0 -19	6.5 7
16	MMPALT PMPA	4 4	3.5 3	5 10	2 2	4 16	3.5 1	-1 8	5 1	2 1	6 4	3 -2	5 6	1 -14	7 7
17	MMPALT PMPS	6 25	2 1	6 9	2 2	4 8	4 3	6 -6	2 4	2 -8	5.5 5	2 -21	5.5 6	1 -25	7 7

TABLE XIX (Continued)

Parti- cipant Number	Instru- ment	SUBTEST													
		Print		Aural		Interactive		Visual		Haptic		Kinesthetic		Olfactory	
		Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
18	MMPALT PMPS	5	3	7	2	2	5.5	8	1	2	5.5	3	4	0	7
		-8	6	2	3	12	2	14	1	0	4	-2	5	-16	7
19	MMPALT PMPS	6	4	5	5	8	2.5	10	1	8	2.5	3	6	1	7
		-12	6	0	4	10	3	12	2	-4	5	16	1	-18	7
20	MMPALT PMPS	3	3	7	2	2	5.0	10	1	2	5	2	5	1	7
		-4	5.5	-21	7	-2	4	-4	5.5	13	2	23	1	6	3
21	MMPALT PMPS	2	5.5	5	3.5	7	2	10	1	2	5.5	5	3.5	1	7
		8	2.5	8	2.5	-4	5	6	4	-14	6.5	-14	6.5	14	1
22	MMPALT PMPS	7	3	6	4	1	6	9	1.5	9	1.5	4	5	0	7
		-10	6	-6	5	8	3	-3	4	12	2	21	1	-19	7
23	MMPALT PMPS	9	3.5	8	5	9	3.5	10	1.5	10	1.5	5	6	1	7
		7	4	11	3	13	2	0	5	16	1	-12	6	-30	7
24	MMPALT PMPS	3	4	3	4	3	4	6	1	5	2	2	6	1	7
		-3	5	19	1	8	2	3	4	7	3	-12	6	-31	7
25	MMPALT PMPS	1	4.5	3	2.5	3	2.5	5	1	0	6.5	1	4.5	0	6.5
		16	2	17	1	2	3.5	2	3.5	0	5	-2	6	-31	7

TABLE XIX (Continued)

Participant Number	Instrument	SUBTEST													
		Print		Aural		Interactive		Visual		Haptic		Kinesthetic		Olfactory	
		Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
26	MMPALT	8	2.5	6	5	7	4	10	1	8	2.5	2	6.5	2	6.5
	PMPS	21	1	-2	4	-7	6	5	2	-3	5	-22	7	-1	3
27	MMPALT	3	5.5	5	3.5	3	5.5	8	1.5	8	1.5	5	3.5	2	7
	PMPS	1	4	-16	6	2	3	-2	5	10	1	4	2	-22	7
28	MMPALT	3	3	4	2	2	4	10	1	1	5.5	1	5.5	0	7
	PMPS	2	3.5	-10	6	2	3.5	8	2	0	5	22	1	-33	7
29	MMPALT	4	4.5	5	2	4	4.5	10	1	4	4.5	4	4.5	3	7
	PMPS	-22	7	8	3.5	-14	6	17	2	8	3.5	30	1	-5	5
30	MMPALT	4	5	7	4	8	3	10	1	9	2	1	7	2	6
	PMPS	1	4.5	-9	6	13	2.5	1	4.5	13	2.5	19	1	-36	7
31	MMPALT	0	7	3	5	5	2	5	2	5	2	3	5	3	5
	PMPS	-18	7	0	4	-10	6	-4	5	7	2	17	1	6	3
32	MMPALT	0	7	3	5.5	6	2	6	2	6	2	3	5.5	4	4
	PMPS	17	1	9	2	5	3	-4	5	-2	4	-15	6	-35	7
33	MMPALT	8	4	9	2.5	9	2.5	10	1	5	5	4	6.5	4	6.5
	PMPS	4	3	-12	6	4	3	-2	5	4	3	10	1	-16	7
34	MMPALT	4	5.5	9	3	6	4	10	1.5	10	1.5	4	5.5	1	7
	PMPS	6	3	10	2	0	4	14	1	-12	6	-4	5	-16	7

TABLE XIX (Continued)

Participant Number	Instrument	SUBTEST													
		Print		Aural		Interactive		Visual		Haptic		Kinesthetic		Olfactory	
		Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
35	MMPALT PMPS	3	5.5	6	2	5	3	8	1	4	4	3	5.5	0	7
		7	3	14	2	-1	4	18	1	-15	6	-2	5	-24	7
36	MMPALT PMPS	3	5	3	5	5	3	8	1	7	2	3	5	0	7
		13	1	4	2	2	3.5	-6	6	2	3.5	-4	5	-16	7
37	MMPALT PMPS	4	2.5	4	2.5	0	7	5	1	3	4	2	5	1	6
		17	1	-2	4	10	3	-11	6	-10	5	13	2	-24	7
38	MMPALT PMPS	5	4	3	6.5	4	5	10	1.5	10	1.5	7	3	3	6.5
		-10	6	-4	5	-2	4	2	3	10	2	20	1	-19	7
39	MMPALT PMPS	7	5	10	2	9	4	10	2	10	2	4	6	3	7
		-4	5	13	2	2.5	1	4	4	6	3	-11	6	-31	7
40	MMPALT PMPS	5	3.5	5	3.5	9	1.5	9	1.5	4	5.5	4	5.5	2	7
		-12	6	4	3	0	5	2	4	6	2	18	1	-18	7
41	MMPALT PMPS	3	6	5	4.5	8	2	10	1	6	3	5	4.5	1	7
		21	1	7	3	-1	5	2	4	-12	6	12	2	-24	7
42	MMPALT PMPS	10	1.5	6	4.5	7	3	10	1.5	6	4.5	2	6.5	2	6.5
		19	1	3	3	-8	6	13	2	-2	4	-31	7	-5	5
43	MMPALT PMPS	6	3.5	7	2	6	3.5	10	1	3	5	2	6.5	2	6.5
		21	1	-12	6	4	4	6	3	14	2	0	5	-28	7

VITA 2

Billie Wix Russell

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