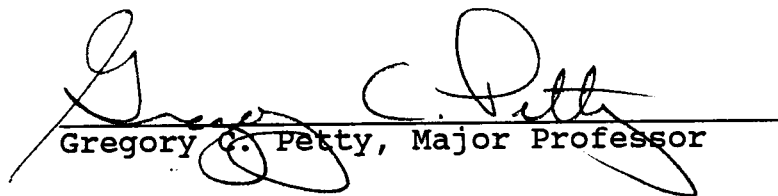
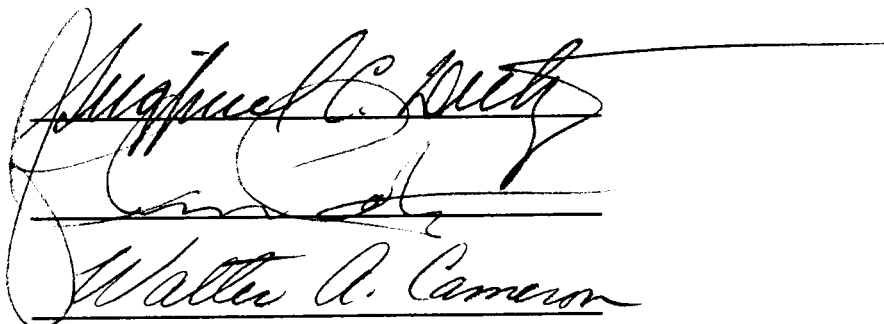
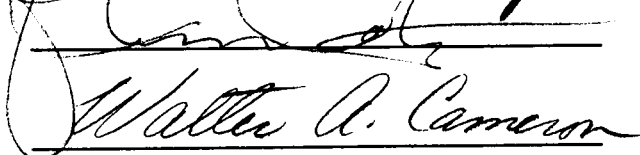


To the Graduate Council:

I am submitting herewith a dissertation written by Fredrick Irwin Holtzman entitled "An Examination of the Relationship Between Hemispheric Dominance and Learning Styles as Described by Keirseyan Temperament Types." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Education, with a major in Vocational-Technical Education.


Gregory C. Petty, Major Professor

We have read this dissertation
and recommend its acceptance:


Michael C. Smith

Walter A. Cameron

Accepted for the Council:


Vice Provost
and Dean of The Graduate School

AN EXAMINATION OF THE RELATIONSHIP BETWEEN
HEMISPHERIC DOMINANCE AND LEARNING STYLES
AS DESCRIBED BY KEIRSEYIAN TEMPERAMENT TYPES

A Dissertation
Presented for the
Doctor of Education
Degree

The University of Tennessee, Knoxville

Fredrick Irwin Holtzman

December 1988

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ABSTRACT

The purpose of this study was to examine the possible relationship of learning styles, as defined by Keirseyan temperaments, and brain dominance. The study focused on three questions: (1) Does a relationship exist between learning styles, as determined through Keirseyan temperament types, and brain dominance; (2) Tentatively positing a left-right continuum for brain dominance (left, integrated, right), can a parallel temperament continuum of the four temperaments be suggested (left, near left, near right, right), which would map onto the brain dominance continuum; and (3) Can such association and mapping be observed in adult learners at the technical institute level of education?

Two standardized testing instruments were employed: the MBTI and the HIPS. Two primary measures were obtained: brain dominance using the HIPS, and MBTI preferences using the MBTI. From the MBTI preferences, Jungian types and Keirseyan temperaments were derived. Learning style was determined, based upon Keirseyan temperament. Two independent variables, brain dominance and temperament

(learning style), were derived from these instruments for statistical analysis.

The study led to the following conclusions:

1. There was a definite relationship between brain dominance and learning style as delineated by Keirseyan temperament. This was based upon a significant chi square of 28.677 with a probability of 0.05 and 9 degrees of freedom and a contingency coefficient of 0.386.

2. There was partial support for the notion of a temperament/learning style continuum which paralleled and mapped onto the brain dominance continuum. This was evidenced by the large frequency distribution of the SJ temperament with left brain dominance, and by the large frequency distribution of the NF temperament and SP temperament with right brain dominance. This was also supported by the results of one way analysis of variance. The SJ temperament tended on the average to score far higher than the NF temperament in the left percentile of brain dominance. Conversely, the NF temperament tended on the average to score far higher than the SJ temperament on the right percentile of brain dominance. The evidence is far from conclusive.

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CHAPTER I

INTRODUCTION

General Background

Continuing education and life-long learning have become a reality for an ever increasing proportion of adult Americans. A large percentage of adults involved in life-long learning and personal development enter or re-enter educational programs. Such persons come from varied economic, social, educational, and occupational backgrounds. Further, such a combination of unique experiences and history would contribute to the individuation of these adult learners. It seems obvious, if not prosaic, to suggest that such individuals would comprehend and assimilate information differently from one another. They learn differently, and with varying degrees of proficiency (McCall, 1983).

The uniqueness of the individual learner is often emphasized by educators. It is fashionable, if somewhat banal, to speak of each individual as unique, different from everyone else. Yet such a doctrine of uniqueness

provides little if any practical help in understanding the people who are to be educated (Myers and McCaully, 1985).

The Challenge of Maximizing Learning Experiences

A persistent and critical challenge of instruction is to provide learning experiences which maximize the learning potential of each individual. Matching educational efforts with the unique characteristics of the student would enhance the learning experience. To the degree that there is mismatch between the student and the teaching effort, the learning process would be impeded (Golay, 1982:2). Adults tend to learn what they perceive as necessary, important, or meaningful (Elias and Merriam, 1984). It was assumed for the purposes of this research that an understanding by the educator of individual learning differences may well augment proficient learning.

Learning Styles and Individual Differences

Individual differences may be better comprehended through the categorization of learning styles. James and Galbraith (1985:21) proposed "Since learning styles impact on the amount of information processed and retained, knowledge and utilization of one's most effective learning style will enhance learning." Golay suggested

. . . that these differences have been classified in such a way that it provides hope for some scientific order in the study of personality. Our present concern is how we will observe, classify and understand human differences. And, more specifically, how can the educational practitioner utilize his under-

standing so as to maximize the learning of each student (1982:11).

Learning style taxa. Various efforts have been made to comprehend individual differences in information processing, and to provide taxa for understanding them. Lawrence (1983) stated that "deep mental habits come in patterns, in combinations." Two current hypothetical constructs which provide understanding of how people process information are cognitive style and learning style. These terms may be defined as follows in the following ways. Cognitive Styles are the characteristic ways of using the mind (Cross, 1976). They are also viewed as the typical means of problem solving, thinking, perceiving, and remembering (Messick, 1976). Learning Styles are the characteristic means used by individuals to perceive and process information (Kolb, 1976).

Four parallel learning schema. In her synthetic efforts, McCarthy ascertained when comparing divergent learning style research that nearly parallel learning schema surfaced (Figure 1). McCarthy concluded:

In fields ranging from psychology to management training, researchers have made nearly the same discoveries. Though they worked separately with different techniques, in different areas, they came up with almost perfectly parallel learning schemes (1980:26).

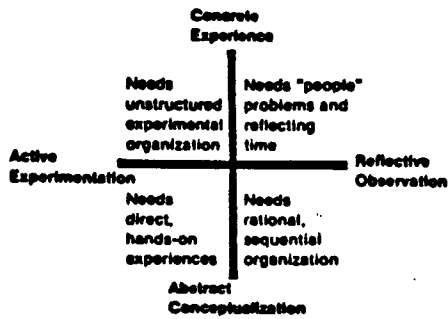
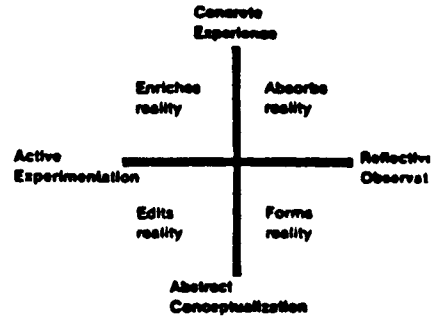
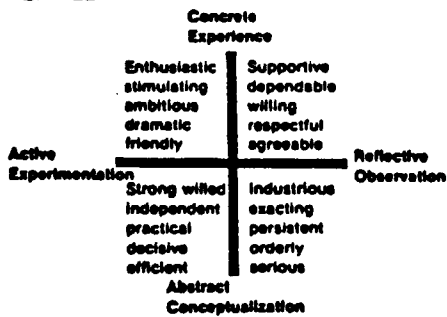
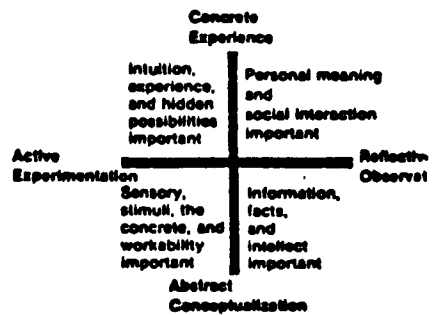
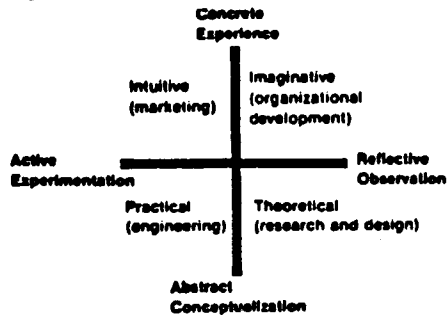
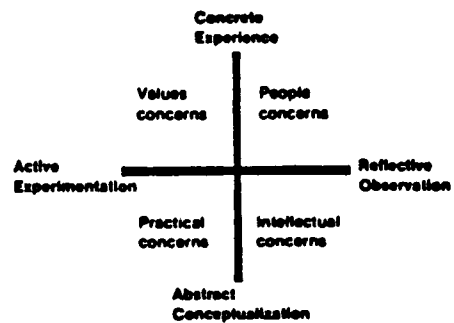
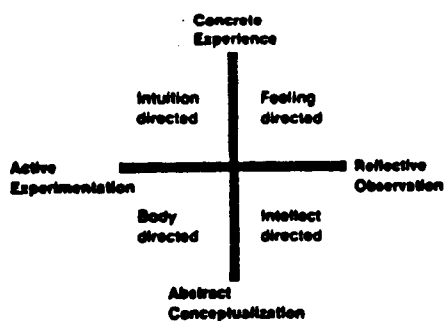
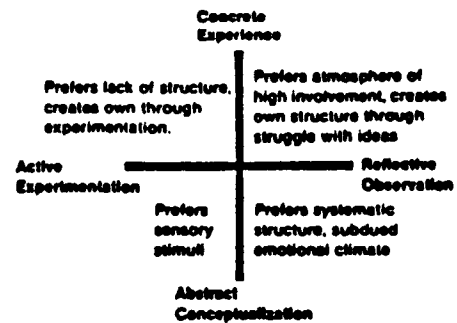
GREGORC**WETZIG****MERRILL****MCCARTHY****KOLB****LOTAS****JUNG****FISCHER(S)**

Figure 1 - McCarthy's Findings

Recent investigations by various researchers parallel this general conceptualization. This model of four significantly different, unique and dominant styles reoccurs in the work of Jung (1971), Kolb (1976), Fisher and Fischer (1979), Gregorc (1979), McCarthy (1979) and Golay (1982).

Jungian typology. The theory of psychological types was described extensively by C.G. Jung (1971). In 1921 he first defined his four categories of how people process and perceive information: Feelers, Thinkers, Sensors, and Intuitors (Jung, 1971). The underlying premise is that what appears to be arbitrary and chance human diversity is actually quite predictable and patterned. In Jungian theory, personality, or psychological type, is formed by the ordered combination of four preferences concerning the use of perception and judgment (Myers, 1980:9). The four bipolar preferences encompass Extraversion-Introversion (EI), Sensing-Intuition (SN), Thinking-Feeling (TF), and Judgment-Perception (JP). These preferences result in the way people think, specifically the way they perceive, and the way they make judgments (Myers, 1980:1). Myers explained:

Perceiving is here understood to include the processes of becoming aware of things, people, occurrences, and ideas. Judging includes the processes of coming to conclusions about what has been perceived (1980:1).

Keirseyan temperaments. Keirsey used the model of Jungian typology and behavior descriptions. However, he subordinated the Jungian concept of "functions" or "function type" to the concept of "temperament" (1984:27). Keirsey viewed temperament as "having a much wider range of convenience as an explainer of behavior" (1984:27). Keirsey supported his contention by clinical observation and practice (Keirsey, 1984).

Keirsey identified four basic temperament styles: the Epimethean (SJ), the Apollonian (NF), the Promethean (NT), and the Dionysian (SP) (Keirsey, 1984; Golay, 1982). Each style is understood to inherently possess its own way of being motivated, being satisfied, relating to others, and most importantly for this study, learning.

Learning styles and the four temperaments. Golay asserted, based upon his research and observation, that the four temperament styles describe four basic types of learners, each with a distinct learning pattern (1982). In an effort to clarify the individual differences, Golay renamed the four temperaments according to their pattern of learning as follows: Epimethean--Actual-Routine Learner (ARL), Promethean--Conceptual-Specific Learner (CSL), Apollonian--Conceptual-Global Learner (CGL) and Dionysian--Actual-Spontaneous Learner (ASL), (1982:27).

Hemisphericity and Brain Dominance

Hemisphericity encompasses the concept of cerebral dominance by either the right or left hemispheres of the brain. Right brain dominants would display the characteristics of the right brain while left brain dominants would evidence qualities of the left brain. Each side of the brain is understood to be unique in its processing. Taggart and Torrance commented:

. . . recent brain research points to the existence of two types of minds within each person. The two hemispheres of the brain process information in different ways. For most people, verbal and logical thought processes are located in the left hemisphere, and spatial and intuitive thinking are located in the right hemisphere. Left handers who write without a hook and right handers who write with a hook have reversed specialization (1984:2).

Springer and Deutsch (1985) identified the left hemisphere function as managing the logical representation of reality and communication with the external world. Its functions include thinking, reading, writing, counting and the awareness of time. The right hemisphere function was associated with understanding patterns and complex relationships which might not be precisely defined or might not be logical.

The Problem

Previous investigation of correlation between both Jung's and Kolb's models and hemisphericity has been attempted. To date, however, there have been no studies

performed which have examined the relationship between Keirseyian temperaments, and their consequent learning styles, and brain dominance. Less than sufficient research has been performed regarding the interaction of learning style theory, as advanced in either Jungian or Keirseyian models, and brain dominance processing strengths. Relationships may well exist between the four types of learning styles and hemisphericity.

Purpose of the Study

The purpose of this study was to explicate the relationship of learning styles as defined by Keirseyian temperament types and brain dominance. Three issues were essential: 1) The possible relationship between learning styles, as determined through Keirseyian temperament types, and brain dominance; 2) Tentatively positing a left-right continuum for brain dominance (left, integrated, right), the existence of a parallel temperament continuum of the four temperaments (left, near left, near right, right), which mapped onto the brain dominance continuum; and 3) The observation of such correlation and mapping in adult learners at the technical institute level of education.

Provisional answers to these questions were offered by hypotheses suggested by a theoretical framework. The theoretical framework was derived from an examination of

learning style taxa, Jungian typological constructs, Keirseyian temperament theory and brain dominance conceptions.

A Theoretical Framework

The foregoing discussion of learning style taxa, Jungian typological constructs, Keirseyian temperament theory, and brain dominance conceptions (treated in greater depth in the review of literature) assisted the formation of the theoretical framework and subsequent questions and hypotheses of this study. The theoretical framework for this research was hypothetical and inductive in nature. It was also functional in that it focused on explanations suggested by educational practitioners and empirical data. These explanations and data were the isolated facts from which a meaningful structure or pattern was advanced. While such an explication stopped short of a model or paradigm, it provided a framework for additional exploration and analysis. The theory includes (1) definitions of critical terms, (2) a deduction from more global constructs and considerations to more empirical and particular concerns providing the identification of relevant facts, (3) a set of hypothetical statements concerning the relationships suggested by the phenomena considered.

Four primary forms of behavior were observed by researchers in various disciplines--education, psychology,

management, business, etc. They were variously described as modalities, modes, types, temperaments, or styles. The rubrics of Jungian typology were very useful for categorizing the styles. The four styles may have been alternately viewed as Jungian types or Keirseyian temperaments. Either approach recognized an inherent or consequent learning style associated with each of the four classifications. Myers, following Jung, developed a typological etiology (Myers, 1980). Keirsey (1984) and Golay (1982) suggested a temperament based model.

Of the various taxa suggested, the theory of temperament type delineated by Keirsey is accepted by the author as the model of typology used in this study. It is perceived as a suitable, representative and serviceable conceptualization of typology and learning style.

Brain dominance and hemisphericity suggested another classification for individuals and their learning styles. People may be conceived of as being left brained, right brained, integrated brained or mixed brained. Right brain dominants would exhibit the characteristics of the right brain while left brain dominants would show qualities of the left brain. The integrated and mixed would evidence qualities of both sides of the brain.

The general characteristics of Keirseyian temperament types and learning style suggested a potential continuum.

On the one end would be the linear or sequential learners, on the other the spontaneous, action-oriented learners. Towards the middle would be the global learners, both the conceptual and the subjective. This tentative pattern potentially paralleled the Left-Integrated-Right continuum delineated by hemispheric dominance theory. Such a conception may permit a temperament continuum to map onto a similar brain dominance continuum of left, integrated, right. Such a mapping was tentatively suggested by seeming similarities in the description of the three brain dominance categories and the four Keirseyian temperaments and their consequent learning styles. Employing Keirseyian temperaments, the categories of brain dominance postulated were: SJ (ARL)--far left , NT (CSL)--near left (integrated left), NF (CGL)--near right (integrated right) and SP (ASL)--far right.

Hypotheses and Questions

The major research hypotheses for this study involved the postulated association of brain dominance and learning style as described by the Keirseyian temperament model. The general questions examined were: (1) Does a relationship exist between learning styles, as determined through Keirseyian temperament types, and brain dominance; (2) Tentatively positing a left-right continuum for brain

dominance (left, integrated, right), may a parallel temperament continuum of the four temperaments be suggested (left, near left, near right, right), which would map unto the brain dominance continuum (the theorized continua are depicted in Figure 2); and (3) May such association and mapping be observed in adult learners at the technical institute level of education?

Two specific questions were investigated.

1. Is there a significant relationship between hemisphericity and learning style as described by Keirseyan temperament for adult learners at the technical institute level of education?

2. Is there a significant relationship between the four learning styles and their position upon the left-right brain dominance continuum for adult learners at the technical institute level of education?

The Hypotheses of this study were:

HO₁: There is no significant relationship between brain dominance and learning style as described by Keirseyan temperament, for adult learners at the technical institute level of education.

HA₁: There is a significant relationship between brain dominance and learning style as described by Keirseyan temperament, for adult learners at the technical institute level of education.

	Far Left	Near Left	Near Right	Far Right
Temperaments	SJ	NT	NF	SP
Learning Style	ARL	CSL	CGL	ASL
Hemisphericity	Left	Integrated Mixed		Right

Figure 2 - Suggested Continua

HA₂: There is a significant relationship between the four learning styles and their position upon the left/right continuum of brain dominance, for adult learners at the technical institute level of education.

Significance of the Study

Formal education and more particularly higher education, with its emphasis on linear thinking, memorization and analysis, have been primarily the domain of left brain dominant people. Schools were designed to accommodate students accomplished at dealing with both verbal and mathematical symbols and sequential or linear details and particulars. There would appear to be a bias, a built-in invisible bias in learning method which does not adequately consider or accommodate the right brain learner. A study by Cherry suggested that

Traditional 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 student. Numerous researchers have concluded that studying learning styles increases individualization, educational effectiveness, and educational efficiency (1981:6).

Investigation of the relationship between learning styles and brain dominance, enhances the development of a theoretical framework concerning learning styles as de

scribed by Keirseyian temperaments and their relationship to hemisphericity. Further, such a study also provides a framework for subsequent research. This study should add to the body of knowledge and facilitate the understanding of human learning potential and instructional technique.

Limitations of the Study

1. The population sampled was limited to beginning students enrolled at State Technical Institute at Knoxville for the 1987-1988 academic year.

2. The measurements were not all conducted in the same classroom location. Care was taken to provide similar physical settings.

3. The State Tech sample may not be representative of the general population found in other schools.

Assumptions of the Study

1. The MBTI was a valid instrument for objectively measuring preferences described in the theory of psychological types by C.G. Jung.

2. The Keirseyian temperament model served as a valid basis for describing and distinguishing learning styles.

3. The HIPS was a valid instrument for objectively measuring hemispheric preferences described in the theory of brain dominance.

4. The subjects, in their own interest, accurately selected self-descriptions indicative of their preferences.

Definition of Terms

Learning style. The individual's characteristic means of perceiving and processing information (Kolb, 1976).

Cognitive style. The characteristic ways of using the mind (Cross, 1976:112), typical means of problem solving, thinking, perceiving, and remembering (Messick, 1976). The person's preferences and approach to problem solving (Springer and Deutsch, 1985:238).

Hemisphericity. The idea that an individual relies more on one hemisphere of the brain than the other in processing information or problem solving (Springer and Deutsch, 1985:238). It is based upon the idea that the two hemispheres of the brain are specialized for different modes of thought.

Brain dominance. One half of the brain (left or right) directs behavior (Springer and Deutsch, 1985:13). One of the two hemispheres is dominant in terms of our preferred mode of processing (Herrmann, 1986). The literature concerning hemisphericity uses four terms interchangeably to designate the predominant use of one hemi-

sphere of the brain: laterality, cerebral dominance, hemispheric dominance and brain dominance.

Typology. C. G. Jung's theory of psychological types indicated that human behavior is orderly and consistent, stemming from basic differences in individual perception and judgment. These preferences delineate four primary types of people. Myers and McCaully, 1985:1)

Temperament. Temperament is central to the individual and regulates thought, desire, and behavior. Temperament predisposes one to having certain wants, motives, or values and to certain ways of thinking, understanding, or conceptualizing (Golay, 1982:11,12). These preferences describe four primary temperaments.

Integrated-brained. The use of both hemispheres of the brain in certain cognitive processes.

Right-brained. The use of the right hemisphere predominantly in certain cognitive processes.

Left-brained. The use of the left hemisphere predominantly in certain cognitive processes.

Mixed-brained. A category established by E.P. Torrance that indicated that no one category of hemispheric function was dominant (Taggart and Torrance, 1984).

Adult. A person over 18 years of age.

CHAPTER II

RELATED RESEARCH AND LITERATURE

Introductory Statement

One of the paramount challenges of instruction is to provide the types of learning experiences that allow each individual to learn successfully to the maximum of his or her individual potential. There is general agreement that all adults do not learn in the same ways (McCall, 1983). They seem to learn differently, and with different degrees of efficiency. These issues were reviewed through an examination of learning style, cognitive style, learning theory, typology, hemisphericity, and methods of assessment.

Cognitive Styles vs Learning Styles

Two concepts have been developed to provide an understanding of how people process information: cognitive style and learning style. These terms were defined as follows. Cognitive Styles are the characteristic ways of using the mind, typical means of problem solving, thinking, perceiving, and remembering (Cross, 1976:112, Messick, 1976). Learning Styles are the characteristic means

used by individuals to perceive and process information (Kolb, 1976). The terms are similar but learning style is more precise and deals specifically with the learning process. The concept of learning style appears more recently in the body of literature, being informed by the earlier endeavors in cognitive style research.

Learning Styles

Various efforts have been made to define learning styles. Any such definitions should be considered with some degree of circumspection. Golay cautioned:

Any symbols or words of description, in actuality, are generalizations, standing inadequately as a representation of the specifics of the reality they point to. Therefore, do not overestimate these descriptions: It remains necessary for you, the practitioner, to attend to and apply your own experience to the task of understanding learning behavior, and to the next step as well--seeing that understanding gives birth to effective applications in specific cases. Be careful not to lose sight of the student amid the many words of description.
(1982:27,28)

The following attempts at definition are best viewed as a guide to comprehending learning patterns. Learning styles are understood to be hypothetical constructs that help explain the learning (and teaching) process (Keefe, 1982:44). They are observed to be relatively persistent qualities in the behavior of individual learners (Keefe, 1982:44). Thus Keefe concluded that "learning styles are cognitive, affective, and physiological traits that serve

as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment" (Keefe, 1982:44). Gregorc suggested that "learning style research indicates that people's styles reveal how they identify, judge, substantiate, confirm, and validate truth" (1982:5). Further, Gregorc offered:

Learning style research also teaches us that people think in different ways. This view is highlighted by Hannah Arendt's definition of thinking. She states: "Thinking is an activity of examining whatever happens to pass or to attract attention regardless of results and specific content" (Gregorc, 1982:5) (Arendt, The Life of the Mind, 1978:5).

Butler proposed, following Gregorc, that learning style reflected the mind's natural abilities, capacities, and preferences for channeling data. He wrote that learning style "signaled that natural means by which a person most easily, efficiently, and effectively understood self, the world and the relationship of the two" (1982:61).

Reasons for the analysis of learning styles. Given that people learn differently, knowledge of one's learning style may be assumed to enhance one's ability to learn. There may be an order to learning style differences, as well as a relationship between personality differences and learning style differences. The differences would have to be somewhat orderly and capable of identification, classification and description. There would also have to be a convenient way of ascertaining learning style differences.

Concerning observed differences, Golay suggested:

. . . that these differences have been classified in such a way that it provides hope for some scientific order in the study of personality. Our present concern is how we will observe, classify and understand human differences. And, more specifically, how can the educational practitioner utilize his understanding so as to maximize the learning of each student (Golay, 1982:11).

The utility of knowing adult learning styles. There are numerous advantages to be found in knowing and making use of adult learning styles. Adults are not all the same but are in fact quite different. If they can indeed be categorized and understood by learning styles, then those involved in adult education can take advantage of this information and better facilitate instruction and learning. James and Galbraith (1985:21) suggest that "Since learning styles impact on the amount of information processed and retained, knowledge and utilization of one's most effective learning style will enhance learning." They suggest further that the diversity of adult learning styles "demands creativity on the part of facilitators to develop a variety of ways to meet adults' diverse needs" (1985:21).

Individual differences. To the degree that there are differences, there are difficulties in providing learning opportunities that are generally beneficial. Golay analyzed the problem as follows:

The problem is that when the practitioner has to deal with differences between students in an environment as complex as the classroom, there are many ways for incompatibility to occur between the needs of students, the instructional program and the utilization of classroom space. Mismatch occurs. Certain modes of instruction are effective with some students but not with others. Some students show an interest in certain subjects but not in others. And, the atmosphere which motivates some students doesn't motivate others.

A mismatch is a deficiency of match. It is incompatibility between student and a task, or a task and a space (1982:2).

Matching instruction and learning activities to the individual characteristics of the adult may seem an almost insurmountable objective (Lawrence, 1983). But to ignore individual differences, when the goal is to maximize the educational experience of each adult, would seem somewhat deleterious and counterproductive.

A learning style paradigm--not yet. Although several approaches have been made to establish research on individual differences, no single theory has found widespread acceptance (Danielson and Seiler, 1979). Hart noted regarding brain research and its implications for education:

We have a great fund of fragmentary knowledge. But, as the literature freely notes, it has not coalesced into a useful theory that can provide an effective basis for instruction and the organization of schools. Research effort has been intensive; but still the teacher and learner wait for practical, applicable help (1978:393)

Learning may be influenced by environment and heredity. Gregorc (1979) suggested that "style appears to be

both nature/nurture in its roots." Keefe concurred "styles reflect genetic coding, personality development, and environmental adaptation" (1982:44). Various influences include: learning environment, emotional makeup, sensory strengths and weaknesses, unique physical needs, concrete-abstract reasoning abilities, reflective-active processing preferences and hemispheric brain dominance (Henderson, Hartnett, & Wair, 1982).

Learning Style Transformation

Learning style is perceived as either intrinsic or developmental. Perhaps temperaments and learning styles change, and perhaps such a transformation occurs over a lifetime. As to the issue of change, there are a limited number of logical positions. (1) Temperaments and learning styles are innate (Golay, 1982; Keirsey and Bates, 1984). (2) Temperaments and learning style are learned, that is, totally the result of socialization and environment (Kolb). We begin with both minds and styles of learning which are tabula rasa. (3) Temperaments and learning styles, regardless of etiology, may be developed and enhanced through training and exercise. (4) Temperaments and learning styles lie dormant or sedimented and are realized only when elicited by life situations.

Arguments for innateness. Many would argue that one's basic temperament or type, and consequent learning style, is innate. Keirsey and Bates suggested that:

This consistency in actions can be observed from a very early age--some features earlier than others--long before events have had time or occasion to imprint the person. It is tempting, therefore, to say that form is given, not acquired, and that temperament is the inborn form of the living being (Keirsey and Bates, 1984:28).

Golay stated that "the form of an individual's personality is indelible. It cannot be changed any more than a leopard can change his spots" (1982:13).

Arguments for development. Kolb's theory of experiential learning proposed that one of the four learning styles is dominant for each individual but the others can be developed. The varying styles are polar opposites. It is suggested that the learner adapts and chooses which learning abilities to bring to bear in a specific learning situation. A logical extrapolation would suggest that learning can be enhanced and developed through various experiences which call upon the various facilities: problem solving, conflict resolution, role playing and the like.

There are two aspects of Kolb's model. On the one hand he views the development and enhancement of a learning style in time though experience. The continued use of the various dimensions produces a characteristic learning style within the individual. That is, the active decision

making process employing a dominant dimension results in that dimension becoming the individual's learning style. On the other hand, each individual engages in the use of all four dimensions throughout diverse life situations.

Research in hemisphericity, problem solving and information processing has also supported transformation. Problem solving and processing style are conditioned by one's professional experience (Doktor and Bloom, 1977). Through experience a preferred style of information processing surfaces. Taggart and Torrance suggested "in spite of the fact that we are biologically equipped with two hemispheres, our educational and occupational experiences lead us to favor one side [of the brain] over the other" (1984:3). One's present style may be viewed as a starting point for exploring complementary modes of problem solving and information processing. Taggart and Torrance asserted that "biological models point to this inherent potential for flexibility in human decision makers" (1984:4).

Evidence for changes in adult learning styles. In a fairly recent study, Dorsey and Pierson (1984), in Life-long Learning, considered in an oblique way alterations in adult learning styles. They did a descriptive study of adult learning styles using Kolb's rubrics of learning styles. Kolb's instrument, the Learning Style Inventory

(LSI), is designed to identify four statistically different learning style types: converger, diverger, assimilator, and accommodator. The LSI does so by identifying the respondent's preference for four learning skills or abilities: concrete experiences (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE). Employing combination scores AC-CE and AE-RO, one can determine learning style types.

The information gathered indicated two interesting trends: tendency clustering about age groups and apparently definite predictable transformations through the age spectrum. In simple terms, at certain ages adults tend to use one learning style in preference to another.

Employing the abstract/concrete dimension, it was observed that from ages 18 to 33 the tendency toward abstractness increased; from ages 34 to 49 the tendency toward concreteness increased, and then from ages 60 to 65 abstractness increased again (Dorsey and Pierson, 1984:9). Similarly, using the active/reflective dimension, it was noted that from ages 18 to 49 respondents preferred an active role then moved to a more reflective role, in later life (Dorsey and Pierson:9).

In their conclusions, the authors suggested that "age and prior work experience influence learning style type" (Dorsey and Pierson:10). That is, the basic learning style of an adult is modified by both age and work experi-

ence. Further they suggest that adults may change their learning styles (1) to compensate for rapid environmental changes, (2) as a result of developmental maturation and (3) in response to fear of the future and loss of self-worth (Dorsey and Pierson:10).

Left Brain - Right Brain Processing

Current learning theory also involves the concept of right/left brain processing or dominance. The field of right/left brain research began in earnest three decades ago somewhat serendipitously. To control seizures, a small number of epileptics had the corpus callosum, the neural connecting link between the two hemispheres of the brain, severed. Post-operation tests demonstrated that the halves of the brain function in different ways.

Stevens wrote:

They take in different types of information, and they do their processing by radically different methods.

The left brain is designed to deal with abstract information. It is highly organized and analytical. Its processing is called "reasoning." The left hemisphere is the seat of the "computer" which rules the realm of logic.

The right brain is designed to deal with concrete reality. It is highly intuitive and creative. Its processing is called "feeling." The right hemisphere is the seat of the "spirit" which rules the realm of inspiration (1984:284).

The work of Roger Sperry. Most of the original hemispheric study was done with brain damaged victims of WWII (Williams, 1983). In the 1960's Roger Sperry, working

with epileptics, performed commissurotomies, severing of the corpus callosum (Sperry, 1966). This surgery separated the two hemispheres so that they functioned independently. The left hemisphere is verbal. The right hand communicates with the left hemisphere. The right hemisphere is non-verbal. The left hand communicates with the right hemisphere (Sperry, 1966). A person, with a severed corpus callosum holding an unseen object in the right hand can describe it verbally. Such a person holding an unseen object in the left hand cannot describe it verbally, but can recognize it when shown it (Springer and Deutsch, 1985). This phenomenon raises an important point for education and learning: "the lack of a verbal answer does not indicate a lack of knowledge but merely an inability to express that knowledge in verbal form" (Williams, 1983:18).

The two hemispheres are suggested to have different characteristics and to process information in somewhat different ways. Springer and Deutsch concluded:

The left hemisphere has been found to be predominantly involved with analytic processes, especially the production and understanding of language, and it appears to process input in a sequential manner. The right hemisphere appears to be responsible for certain spatial skills and musical abilities and to process information simultaneously and holistically (1985:4,5).

McCarthy concurred:

The left mode is typically described in the literature as processing in a serial, analytic, rational way, in which differences are detected and

discrete parts noted. Right mode processing is typically global and holistic; patterning and seeing connections and similarities are stressed (1985:63).

The left hemisphere. The left hemisphere is essentially linear and in a step-by-step style analyzes the parts of a whole. It focuses on the particulars rather than the pattern. It separates the parts which constitute the whole. The left hemisphere is characterized as analytical and its processing is said to be linear and sequential. Williams noted that the left hemisphere ". . . moves from one point to the next in a step-by-step manner. It is most efficient for processing verbal information, for encoding and decoding speech" (1983:2,3). Williams observed:

This linear processing is temporal or time-related in that it recognizes that one stimulus comes before another This type of processing relies on the ability to discriminate the relevant features, to reduce a whole to meaningful parts--in short, to analyze (1983:25,26).

The left hemisphere may be compared to a digital computer. "The digital computer is linear and sequential, moving from one step to the next by rules of logic and a language of its own In the computer each step determines which steps may follow it" (Williams, 1983:4).

The right hemisphere. The right hemisphere is relational or spatial and seeks and constructs patterns. The right specializes in combining parts to create a whole, in

a word, synthesis. Williams asserted that the right hemisphere "seeks and constructs patterns and recognizes relationships between separate parts" (1983:3). It does not process linearly, but rather simultaneously, in parallel. "It does not move from one feature to another but instead seeks patterns and gestalts. It integrates component parts and organizes them into a whole. It is interested in relationship" (Williams, 1983:26). "It is most efficient at visual and spatial processing (images)" (Williams, 1983:4). The right hemisphere may be compared to a kaleidoscope. Williams observed:

The kaleidoscope simultaneously combines its parts to create a rich variety of patterns. It moves by leaps as the parts are reshuffled and reassembled in different relationships to each other.... In the kaleidoscope the parts may relate to each other in an almost infinite number of ways" (1983:4).

Whole brain learning. The two hemispheres work together in a complementary fashion in higher cognitive processes, providing the mind its power and flexibility (Williams, 1983). Learning is thus a whole-brain activity of the two-sided mind. Accounts of creative discoveries and breakthroughs demonstrate this reality. Williams suggested creative breakthroughs are often preceded by:

. . . a good deal of primarily logical, linear thinking as an individual defines and redefines a problem. Then there comes a moment of insight when the answer presents itself (1983:5).

Insight, discernment, discovery, wisdom and the like are often the result of knowledge acquisition, rumination, analysis, definition. The burst of enlightenment or solution just "comes" to the individual, the "aha" phenomenon. "Inner imagery and metaphor (seeing a connection between two unlike things) seem to serve as mechanisms by which the result of nonverbal thought is offered to verbal consciousness" (Williams, 1983:6).

In addition, the hemispheres "specialize" in the kind of input they handle most effectively (Springer & Deutsch, 1985:22). Sometimes the two hemispheres work together, functioning as a team. At other times the two hemispheres take turns, providing a smooth, natural division of labor. It would appear ideal if one would alternately switch back and forth between the two modes of thinking as needed (Stevens, 1984:285-286).

Hemisphericity and brain dominance. It is suggested that behavior and preference are influenced by the dominant hemisphere. Springer and Deutsch wrote that "cerebral dominance nicely captures the idea of one half of the brain directing behavior" (1985:13). Bogen (1975) referred to the reliance on one mode of processing more than the other as "hemisphericity." Individuals are understood to be hemispherically dominant. That is, one would be right or left brained in an analogous fashion to being

right or left handed. Right brain dominants would display the characteristics of the right brain while left brain dominants would evidence qualities of the left brain.

Hemispheric specialization. Hemispheric specialization involves the specialized processing styles of the two parts. Music is an interesting example. The naive listener simply enjoys the music, processing it with the right hemisphere. The knowledgeable or sophisticated listener processes it through the left hemisphere, analyzing it (Williams, 1983).

Education is left-brained. The unfortunate situation which exists in education is that both types of thinking are not emphasized. Education has tended to be primarily if not exclusively left-brained. Most information is presented through lectures and written materials. Williams noted that school work is concerned "almost exclusively with words and numbers, in a world of symbols and abstraction" (Williams, 1983:7). This has a deleterious effect on those whose learning styles are more right brain dominant in nature. Williams argued:

Students who are less proficient at verbal processes are required to learn in a manner that is unnecessarily difficult for them and are thus unable to function at their full potential (1983:7).

Thus such students are currently being expected to perform in ways that are at odds with their learning style.

Sperry expressed similar concern regarding the left-brain orientation of education:

A second message that emerges from the findings on hemispheric specialization is that our educational system and modern society generally (with its very heavy emphasis on communication and on early training in the three R's) discriminate against one whole half of the brain In our present school system, the attention given to the minor hemisphere of the brain is minimal compared with the training lavished on the left, or major, hemisphere (1977).

One of the characteristics of developed countries is the emphasis on the left brain mode of processing in education (Stevens, 1984:286). Present teaching styles and method of lecture and question-answer appeal primarily to left brain processing (McCarthy, 1985:62). Further, Wheatley (1977:3) stated that our society and particularly our schools stress and reward left hemisphere activity. The emphasis is placed on putting ideas into words, stating them explicitly, and operating with rules (Wheatley, 1977:38). Samples observed a strong preference for left brain activities:

Those in education must recognize that we have a strong bias toward specific ways of knowing, and toward particular ways of reporting and recording mind work.... In education, the widespread and unfortunate tendency to focus on a narrow range of skills means that most students never become aware of the broader area of their wisdom (1980:22).

Measurement of Hemisphericity

Can hemisphericity be measured effectively? Among those performing research in the area of lateralization,

there is general agreement as to the measurability of hemisphericity. There is disparity as to the means and methods.

Colburn (1978) suggested that the indices purported to measure the magnitude of the lateralization of a task or function are not based on an empirical foundation. Therefore, the results are somewhat misleading. Such studies are understood to provide a false sense of quantification of the underlying hemispheric factors.

Torrance (Taggart and Torrance, 1984) has argued for the measurability of hemisphericity. He first developed the Your Style of Learning and Thinking (SOLAT) test in 1976. More recently he developed the Human Information Processing Survey (HIPS) in 1984. Both tests are intended to measure left, right, integrated (the combined activity of the two halves) and mixed (no clear dominance). They are both self-report instruments developed from various testing instruments which measured eye movement, gestalt, and verbal and figural analogies.

Learning Styles and Temperament Types

The number of characteristics and their variations are perhaps beyond measure. Some characteristics would be more salient for maximum learning potential. Golay suggested that four categories are of prime consideration: overt behavior (doing), cognitive behavior (knowing),

motivational attitudes (wanting) and affective attitudes (wanting and liking) (1982). He wrote:

What the practitioner needs to know is what sort of person the student is. What, for example, are his characteristic ways of thinking? Is he a conceptual thinker or a concrete thinker? A person who is effective at conceptual thinking may not be effective at concrete thinking. A person who is a practical thinker may not be an effective conceptual thinker. A person might be good at designing or inventing but not effective in remembering isolated facts (1982:3).

In a similar vein, Frymier asserted that:

There never was and never will be "one best way" of doing anything in education because people are different.

Some students learn better when ideas and experiences are sequenced inductively. Others learn better when information and experiences are deductively arranged. Some students learn better directly, others learn better vicariously, and still others better when direct experience and vicarious experience are alternated in particular ways. Some students learn more effectively when ideas and experiences are spaced evenly over long periods of time; others learn more effectively when they are completely immersed in ideas and experiences for a shorter period of time. There is no "one best way" (Frymier, 1977:47-48).

Such difference is succinctly encapsulated by Confucius:

I hear and I forget
I see and I remember
I do and I understand
(Henderson, Hartnett, & Wair, 1982)

Learning style taxa. Various efforts have been made to get at individual differences in information processing and to provide taxa for understanding them. Lawrence states that "deep mental habits come in patterns, in combinations. Two current concepts providing understand-

ing of how people process information are cognitive style and learning style (McCall:2).

In her synthetic efforts, McCarthy ascertained when comparing divergent learning style research that nearly parallel learning schema surfaced. McCarthy concluded:

In fields ranging from psychology to management training, researchers have made nearly the same discoveries. Though they worked separately with different techniques, in different areas, they came up with almost perfectly parallel learning schemes (1980:26).

Her comparison was based upon Kolb's research and formulation of learning style findings into a cogent model (1980:26). The results of her efforts are found in figure 1 of chapter 1.

Learning style and psychological types. There appears to be a correlation between "learning style" and "psychological type." Jung, in developing a comprehensive theory to explain human personality, referred to the patterns of how people perceive and make judgments as "psychological types." Lawrence wrote:

In Jung's theory, all conscious mental activity can be classified into four mental processes--two perception processes (sensing and intuition) and two judgment processes (thinking and feeling). What comes into consciousness, moment by moment, comes either through the senses or through intuition. To remain in consciousness, perceptions must be used. They are used--sorted, weighed, analyzed, evaluated--by the judgment processes, thinking and feeling (1983:6).

Lawrence suggested further:

Personality type is more fundamental than learning style. Learning style constructs are much more intelligible and useful against a backdrop of type (1982:98).

Jungian typology. Typology, while widely promulgated by Jung in this century, actually began in ancient times with the Greeks. It has a history beginning with the Gnostics, who discerned three types: thinking, feeling and sensing. Later Hippocrates delineated four types: choleric, phlegmatic, sanguine, and melancholic (Keirse and Bates, 1984). In a sentence, Golay stated that typology propounds the belief that:

. . . people display a style of life which predisposes them to certain ways of thinking, wanting and emoting and which gives rise to constancies in behavior most of the time" (1982:4).

In 1921, Carl Jung first defined his four categories of how people process and perceive information: Feelers, Thinkers, Sensors, and Intuitors (Jung, 1971). Recent investigations by various researchers parallel this general conceptualization. The model of four significantly different, unique and dominant styles reoccurs in the work of Fisher and Fischer (1979), Kolb (1976), Gregorc (1979), McCarthy (1979) and Golay (1982).

An overview of Jung's theory of psychological types was succinctly stated by Myers:

Under this theory, people create their "type" through exercise of their individual preferences regarding perception and judgment. The interests,

values, needs, and habits of mind that naturally result from any set of preferences tend to produce a recognizable set of traits and potentialities (1980:10)

Myers and McCaully suggested:

The essence of the theory is that much seemingly random variation in behavior is actually quite orderly and consistent, being due to basic differences in the way individuals prefer to use their perception and judgment (1985:1).

Myers and McCaully further explained:

Perception involves all the ways of becoming aware of things, people, happenings, or ideas. Judgment involves all the ways of coming to conclusions about what has been perceived. If people differ systematically in what they perceive and in how they reach conclusions, then it is only reasonable for them to differ correspondingly in their reactions, interests, values, motivations, skills, and interests [sic.] (1985:1).

Kolb's experiential learning model. David A. Kolb (1974) identified four styles of learning based on the theory of experiential learning: accommodators, assimilators, divergers, and convergers. His position is that one of these four styles is dominant but the others can be developed. Kolb's model is based on Jungian typology. It is presented as a four-stage cycle:

The learner, if he is to be effective, needs four different kinds of abilities: Concrete Experience abilities (CE), Reflective Observation abilities (RO). Abstract Conceptualization abilities (AC), and Active Experimentation (AE) abilities. That is, he must be able to involve himself fully, openly, and without bias in new experiences from many perspectives (RO); to create concepts that integrate his observations into logical, sound theories (AC); and to use these theories to make decisions and solve problems (AE) (Kolb, 1976:3).

The varying styles are polar opposites. It is suggested that the learner adapts and chooses which learning abilities to bring to bear in a specific learning situation. A logical extrapolation would suggest that learning can be enhanced and developed through experiences or exercises which call upon the various facilities: problem solving, conflict resolution, role playing and the like. To restate, to be effective in developing learning styles these situations must involve decisions regarding which of the polar extremes in learning ability will be used (Kolb, 1976).

Kolb postulated that learning requires the use of these polar opposites. He suggested that,

. . . there are two primary dimensions to the learning process. The first dimension represents the concrete experiencing of events at one end and abstract conceptualization at the other. The other dimension has active experimentation at one extreme and reflective observation at the other. Thus, in the process of learning, one moves in varying degrees from actor to observer, from specific involvement to general analytic detachment (Kolb, 1976:3).

The four learning styles, with their respective predominant learning abilities and characteristics are as follows:

1. Converger: Abstract Conceptualization and Active Experimentation. Through hypothetical deductive reasoning convergers can focus on specific problems. Convergers excel where there appears to be just one right answer or just one solution to a problem. They are often viewed as unemotional, and seem to prefer being occupied with things and ideas rather than people.
2. Diverger: Concrete Experience and Reflective Observation. Divergers tend to view things from

2. Diverger: Concrete Experience and Reflective Observation. Divergers tend to view things from many perspectives and then synergize, organize them into a meaningful gestalts. The exact opposite of Convergers. They tend to be imaginative and artistic. Divergers are viewed as emotional. They are found working in areas such as humanities and liberal arts.

3. Assimilator: Abstract Conceptualization and Reflective Observation. Inductive reasoning, and synthesizing different observations into integrated explanations is the strength of Assimilators. They are excellent at examining data and devising theoretical models. They are, however, disinterested in practical applications of these models.

4. Accommodator: Concrete Experience and Active Experimentation. Rather than using their analytic ability, accommodators to rely on other people for information. Of the four learning styles they take more risks than the other three. Their main strength is carrying out plans, being involved in new experiences, and solving problems through trial and error (Kolb, 1976).

Keirseyan temperament styles. Keirsey has identified and delineated four different personality types in terms of total behavior patterns. He has termed these types Temperament Styles. As to definition of temperament Keirsey asked:

What is meant, first of all, by temperament? This question is not as naive as it sounds, for American psychology has rarely considered the idea and so is in no position to define it or pronounce its uses. Temperament can denote a moderation or unification of otherwise disparate forces, a tempering or concession of opposing influences, an overall coloration or tuning, a kind of thematization of the whole, a uniformity of the diverse (Keirsey and Bates, 1984:27).

Temperament is central to the individual and regulates thought, desire, and behavior. Golay asserted:

Temperament is primary; abilities, preferences, emotions and actions are secondary. One's temperament predisposes him to certain ways of thinking, understanding, or conceptualizing, and to having certain wants, motives, or values (1982:11,12).

A systems theory of personality. Keirseyan typology is a holistic systems theory approach to the concept of personality. The personality is a unity. It is organized and functions as a whole forming an identifiable pattern or relationship (Golay, 1982:4). There is a theory of personality which is:

. . . a systems approach to the study of personality. According to this model, understanding of an individual as a personality is not to be sought in some specific feature but in the form, style, configuration or pattern of the whole person, seen in action in real life situations (Golay, 1982:11).

Divergence from Jung. This model makes use of Jungian typology and behavior descriptions. However, it diverges at two critical points. It subordinates the Jungian concept of "functions" or "function type" to the concept of "temperament" (Keirsey and Bates, 1984:27). Keirsey views temperament as "having a much wider range of convenience as an explainer of behavior" (Keirsey and Bates, 1984:27). Again temperament is primary. Temperament theory also replaces the "principle of integration" with the "principle of differentiation" (Keirsey and Bates, 1984:29). Thus Keirseyan types emerge by individuation, separation, differentiation rather than association, concatenation, or integration.

Self-esteem and temperament. Behavior is understood to be purposive. The purpose of behavior is to achieve or enhance "self-esteem" (Keirsey and Bates, 1984:28). Self esteem is achieved differently based upon temperament. The four primary modalities or means to self-esteem are pleasure, social solidarity, power, and self-actualization.

The Four Basic Temperament Styles

Four kinds of people were defined by Isabel Myers as Intuitive Feeling types (NF), Intuitive Thinking types (NT), Sensible Judging types (SJ), and Sensible Perceiving types (SP) (Keirsey, 1987:9). Keirsey identified these types as four basic temperament styles which he metaphorically mapped unto four Greek gods commissioned by Zeus to teach man to be more like the gods: Apollo (spirit), Prometheus (science), Dionysus (joy), and Epimetheus (duty).

The Apollonian temperament. For the Intuitive Feeling types (NF), life is primarily self-discovery, self-actualization, self-realization and becoming unique. It is a search for meaning and significance. The Apollonian is people-oriented. They are warm and compassionate and genuinely concerned for others. They look for and seek to develop potential in themselves and in others. They are

natural nurturers (Keirsey and Bates, 1984:57-66, Golay, 1982:21-25). Myers described them as enthusiastic, human, religious, subjective, sympathetic, insightful, creative, imaginative (1962). The nucleus being found in five traits: imaginative, sympathetic, linguistic, enthusiastic, and subjective (Keirsey, 1987:11)

The Promethean temperament. For the Intuitive Thinking types (NT), life is a search for competency. The Promethean desires to become competent, capable. They seek knowledge and wisdom. They search out the meaning of things. They desire to understand, explain, predict and control realities (Golay, 1982:19). There is a quest for power, not power over people but over nature - to control. They collect, organize, and classify, seeking principles and rules of order. They are the problem-solvers capable of logical and complex thought. They synthesize and develop theories. They are given to science, technology, philosophy, theology, and research. These are the lifelong learners (Keirsey and Bates, 1984:47-57, Golay, 1982:18-21). Myers portrayed them as abstract, analytic, complex, curious, efficient, exacting, impersonal, independent, ingenious, intellectual, inventive, logical, scientific, theoretical, research-oriented and systematic (1962). The core is the analytic, curious, efficient, inventive, logical pattern (Keirsey, 1987:10).

The Dionysian temperament. The Sensible Perceiving types (SP) desire freedom and action. Their action is not goal directed. Action is its own end. They are the adventurers, the pathfinders. They function by impulse and spontaneity, living for the moment. They are natural risk-takers and enjoy challenges and competition. They are experientially oriented. Experience gives meaning and provides life's significance for them. They are fun-loving, exciting, unpredictable, generous, congenial, and sharing. They tend to be fearless and face danger with courage and precision. They may produce radical breakthroughs and great entrepreneurial successes as the by-product of their drives (Keirsey and Bates, 1984:30-39, Golay, 1982:13-16). Myers described the Sense Perceptives as adaptable, artistic, athletic, realistic, easy-going, good-natured, amenable, non-theoretical, open-minded, persuasive, mediating, observant, immediate, tolerant, unprejudiced, sensitive to visual and haptic input, seeking first-hand experience (1962). The core of this depiction is the artistic, athletic, cheerful, mechanical, realistic pattern (Keirsey, 1987:10).

The Epimethean temperament. The Sensible Judging types (SJ) desire to be useful. They have a strong sense of duty and belonging. Their belonging must be earned. They are compelled to be bound and obligated, parental.

They are industrious. They are the maintainers, sustainers, and stabilizers of social institutions. Traditions and their maintenance are central. Structure, order and planning, rules and regulations, thought and care are all part of their managerial drive. There is a low tolerance of uncertainty with a reluctance to accept the unfamiliar, the different, or the innovative. They are stable, dependable, and practical. They are the natural accountants, bankers, managers, servers, teachers and business people (Keirsey and Bates, 1984:39-47, Golay, 1982:16-18). Myers described them as dependable, factual, painstaking, routinized, thorough, conservative, consistent, detailed, hard-working, patient, persevering, sensible, stable, not impulsive or distractable, and good at maintenance, at citing cases, at meeting the visible needs of others (1962). The core of this definition is the dependable, factual, painstaking, routinized, thorough pattern (Keirsey, 1987:10).

Four Types of Learners

An apparent logical consequence of the temperament model is that each temperament style would inherently generate its own way of being motivated, being satisfied, relating to others, and most importantly, learning. Golay made just this assertion. The four temperament styles describe four basic types of learners, each with a dis-

tinct learning pattern (1982:27). He renames the four temperaments according to their pattern of learning as follows: Dionysian--Actual-Spontaneous Learner (ASL), Epimethean--Actual-Routine Learner (ARL), Promethean--Conceptual-Specific Learner (CSL), and Apollonian--Conceptual-Global Learner (CGL) (1982:27).

Dionysian--actual-spontaneous learner (ASL). These learners learn by doing, by experience. They are "uninterested in theoretical concepts, the abstract, and formal intellectual structures" (Golay, 1982:28). Knowledge for its own sake is of little interest to them and it is most significant when it has immediate relevance. They dislike repetition and drill, preferring variety and randomness. Their preferences are "not compatible with the traditional system of education" (Golay, 1982:28).

Epimethean--actual-routine learner (ARL). These learners focus on responsibility, developing good study habits, and proper social attitudes (Golay, 1982:32). Golay noted that they gain:

. . . knowledge through identifying and memorizing facts and procedures, through repetition and drill, and through sequenced, step-by-step presentation of material" (1982:32).

They are most interested in the practical or mechanical aspects of a subject, the particulars. Abstractions and theoretical principles are not as meaningful as the funda-

mentals. They are neat, conscientious, and punctual. They are very interested in pleasing the instructor and in receiving approval by so doing.

Promethean--conceptual-specific learner (CSL). These learners seek "to understand, explain, predict and control realities" (Golay, 1982:35). They seek to discover and comprehend principles and collect rules to structure their cognitive world. They want to know how ideas are conceived, structured, and developed. Rather than isolated facts, they seek theories and principles which explain facts. They search out hidden assumptions and compare new ideas with old. Golay suggested:

His is a life of serious research and exploration. He learns by creative thinking; each task mastered is discovery. His play is work and his work is play. He is basically serious and is happy being serious (1982:36).

They are curious and pursue intellectual inspirations and ideas. Learning concrete information or following a routine task is of little interest for this type. They are intellectually competitive while being detached and objective. They show little emotion and can become social isolates.

Apollonian--conceptual-global learner (CGL). These learners search for the significance of things and events. They seek personal significance that enhances personal meaning and self-actualization. They are more subjective

than objective and follow hunches and impressions. They live in a paradox. "They need to be known, recognized and acknowledged by others, especially by the teacher. Yet, they demand individuality, to be autonomous" (Golay, 1982:40). They have particular insight into people and human nature. They understand attitudes and relationships and display warmth and responsiveness that draws others. They seek to avoid conflict and are very sensitive to criticism and rejection. They thrive in a caring, warm, personal atmosphere, but will wither in the presence of hostility, conflict, sarcasm and ridicule (Golay, 1982:42). They are the natural empaths.

Learning Style Modalities

One approach to learning style has thus far been excluded, learning style modality. One of the approaches to learning styles suggests that learning style is composed of a series of different modalities that together make up each person's unique style (French, 1975a, 1975b). James and Galbraith wrote that "possible modalities include, but are not limited to, the perceptual, cognitive, emotional, and social modes" (1985:20).

Modalities defined. The above-mentioned modalities would be defined as follows: Perceptual modality has to do with the means through which information is extracted from the environment by the senses; Cognitive modality

refers to the mental processing of that information; Emotional modality includes personal feelings, attitudes, and personality states which inform information gathering, knowledge building, and the application of knowledge (James and Galbraith:20); Social modality refers to social values and norms (sets) which either inhibit or enhance the learning process (Cherry,1981).

Seven elements of perceptual modality. Perceptual modality is comprised of seven elements which are categorized as follows: Print, Aural, Interactive, Visual, Haptic, Kinesthetic, and Olfactory (James and Galbraith:20). These elements are seen as aspects of one's perceptual learning style and are explained as follows:

Print--learn best through reading and writing, have tremendous facility for remembering what is read.

Aural--learn best through listening, benefit from lecture and audiotapes, remember what is said.

Interactive--learn best through verbalization, enjoy talking and discussing ideas with others, benefit from small group discussions.

Visual--learn best through observation, enjoy visual stimuli-graphs, pictures, slides, demonstrations.

Haptic--learn best through sense of touch, need to feel and touch objects if possible, assimilate information through a hands on approach (haptic refers to whole hand, tactile to fingers only).

Kinesthetic--learn best while moving, information processing is enhanced by body motion, will often do something with hands while listening (eg. knit).

Olfactory--learn best through senses of smell and taste, vividly associate information with particular smell or taste (James and Galbraith, 1985:20-21).

Interaction of Learning Style and Hemisphericity

Research in the interaction of learning style and brain dominance processing has revealed that brain dominance affects learning style. Hagan asserted:

Persons who are left hemisphere dominant tend to learn in a verbal linear mode, and others who are right brain dominant tend to learn visually and sensorially. It is essential for educators to know how to determine brain dominance and to learn whether the dominant hemisphere is accessible or blocked (1984:2)

The four temperament types variously described would be paralleled by brain dominance specialization. Hagan suggested the four categories of brain dominance as far left (SJ), patterns left (NT), patterns right (NF) and far right (SP).

McCarthy developed the 4Mat System, an eight-step cycle of instruction that capitalizes upon the individuals' learning styles and brain dominance modality (Educational Leadership, April, 1985:61). She provided both a theoretical and research base and practical formats (4mats) for developing typological instructional materials.

Learning Style Assessment

There are many and varied instruments available for ascertaining learning style. Keefe has stated:

No current learning style instrument provides a truly comprehensive assessment of the cognitive, affective, and physiological domains of learning style. To say this is not to criticize the many

excellent first generation instruments presently available. ...The time is ripe for researchers and psychometricians to collaborate in identifying those elements of style that are most important to the teaching-learning environment and to develop a workable second generation instrument (1982:53).

Assuming the correlation between temperament and learning style as described by Keirsey and Golay, then assessment may be made through the MBTI. Lawrence, while using Jungian types as a basis for learning style categories, employed the use of the MBTI in determining such learning styles (1982). There is some disparity as to whether Jungian types (NT, NF, ST, SF) (Lawrence, 1982;1983) or Keirseyan temperaments (NT, NF, SJ, SP) are predominant in assessing and predicting learning style (Keirsey and Bates, 1984:27; Golay, 1982). Regardless of the outcome, both temperament and type may be assessed through the MBTI and similar instruments.

Various means of ascertaining brain dominance have been developed. Among them is the excellent and non-invasive HIPS developed by Torrance and Taggart (1984). This instrument provides descriptive categorizations for left, right, mixed and integrated brain dominance.

CHAPTER III

PROCEDURES OF THE STUDY

Population and Selection of Subjects

The population for this study was all new students beginning course work at State Technical Institute at Knoxville (State Tech). A sample was taken from new students enrolled during the 1987-1988 academic year. The total population for a quarter was approximately 340 students. Procedures established for random samples, indicated that a population of 340 required a sample size of 181 for adequate statistical representation (Research Division of National Education Association, 1960:99). Therefore, using this number as a guideline, the sampling technique was to procure a representative sample of 181 students.

Intact classes were selected at the discretion of the department head at State Tech until the number of students participating in the study exceeded the target sample size of 181. As a result of this technique, 187 students were obtained to participate in the study. The identity of the students who participated remained anonymous. Participi-

pation was voluntary and was encouraged by explaining to the students that their individual results would be determined and made available to them to facilitate personal awareness and direction.

From this sample, the test results of 23 students were eliminated from the final analysis as unusable for the following reasons: ten students had incomplete or missing results from the MBTI, three students had incomplete or missing results from the HIPS, seven students had XX (inconclusive) temperament results, one had XP (inconclusive) temperament results, one had NX (inconclusive) temperament results, and one had SX (inconclusive) temperament results. Thus the actual sample size used for statistical evaluation was 164 students.

Instrumentation

Along with the demographic data required for analysis, two primary measures were obtained: brain dominance and learning style preference. Learning style as delineated by Keirseyan temperaments was obtained through use of the MBTI. Brain dominance was determined by means of the HIPS. These instruments identify two independent variables: brain dominance and learning style. Each of the instruments included a booklet with the test items and an answer sheet.

The MBTI is used to identify, from self-reported easily recognized reactions, people's basic preferences with regard to perception and judgment (Myers and McCaully, 1985:1). Myers and McCaully stated:

The main objective of the MBTI is to identify four basic preferences. The indices EI, SN, TF, and JP are designed to point in one direction or the other. They are not designed as scales for measurement of traits or behaviors. The intent is to reflect a habitual choice between rival alternatives, . . . every person is assumed to use both poles of each of the four preferences, but to respond first or most often with preferred functions or attitudes (1985:3).

The MBTI produces interval data along four indices. These measurements consist of continuous scores for each of the four indices. These in turn may be used to identify categories (nominal data) for types or temperaments. The four temperaments thus derived are 1-SJ, 2-NT, 3-NF, 4-SP.

There are three forms of the MBTI published. Each consists of a different number of forced choice items: Form F (166 items), Form G (126 items), and Form AV (50 items). Form G is arranged so that those items which best predict total type are at the beginning. In the event that respondents should not finish the inventory, an accurate report of their type would still be indicated. Form G is currently the standard form of the MBTI and was used as the instrument for this investigation.

The HIPS is an instrument for assessing brain dominance processing preference (Taggart and Torrance,

1984:1). The self-report survey consists of 40 items with three forced-choice selections each. Two of the three choices are "opposites" while the third choice combines the essence of the other two. One choice is associated with the left hemisphere, one with the right and one indicates no preference (Taggart and Torrance, 1984:5). Those choices indicating no preference, depending on the number, indicate either integrated or mixed hemisphericity.

The HIPS produces interval data which is used to represent brain dominance. This information in turn is used to establish classifications (nominal data) of hemisphericity 1-left, 2-integrated, 3-right, 4-mixed.

The hemispheric dominance of an individual is determined by identifying a test score greater than or equal to a standard score, in one of three possible categories. This standard score corresponds to a percentile rank of 84. The mixed category is assigned when no single category score satisfies the selection criterion (Taggart and Torrance, 1984).

Procedures

Each of the subjects was tested while at State Tech under the supervision of the researcher. A short explanation was provided concerning the personal benefit of participating in this study. The individuals received a

brief introduction to the instruments and to the amount of time allotted for each. Instructions and an explanation of the testing procedures were provided. It was explained that there are no right or wrong answers or good or bad preferences. The subjects were asked to provide the most fitting answer to each question.

Each subject was given both instruments. First-test, second-test interaction bias was controlled. Half the subjects received the MBTI as their first activity and then the HIPS. The other half received the HIPS first and then the MBTI. After the test results were scored and recorded, each participant received a copy of his or her results along with an informative explanation for personal use.

Analysis of Data

The four preferences derived from the MBTI indices of Extraversion-Introversion (EI), Sensing-Intuition (SN), Thinking-Feeling (TF), and Judgment-Perception (JP) were determined. Using these results from the MBTI, the Jungian type of each subject was identified. The Keirseyian temperament of each subject was also determined using the MBTI results. Hemisphericity was ascertained using the data from the HIPS; each subject was placed into one of four categories: Left, Integrated, Right, or Mixed.

Frequency distributions were calculated for Jungian types, Keirseyian temperaments and brain dominance. Bar charts were then graphed for Keirseyian temperaments and brain dominance. Frequency distribution was also calculated and bar charts plotted for the temperament types against the brain dominance classifications. To test the independence of temperament and brain dominance, a chi square was used. A 4 X 4 contingency table was created. To determine which cells contributed most to the chi square, the cells with the largest individual chi squares were examined.

The interval data from the brain dominance scores were then evaluated. First, the brain dominance percentiles were examined for each of the four temperaments. Their number, mean, and standard deviation were determined. A series of one-way ANOVAS were then performed, comparing temperament with mean left percentile scoring, mean integrated percentile scoring, and mean right percentile scoring.

All statistical analyses were performed for this study using SAS (Statistical Analysis System) on the VAX Cluster at the University of Tennessee Computing Center. The following SAS procedures were performed: PRINT, PLOT, SORT, CHART, MEANS, FREQ, AND GLM.

CHAPTER IV

DATA ANALYSIS AND RESULTS

Introduction

The major research hypotheses for this study involved the postulated association of brain dominance and learning style as described by the Keirseyan temperament model. The study focused on three questions: 1) The possible relationship between learning styles, as determined through Keirseyan temperament types, and brain dominance; 2) Tentatively positing a left-right continuum for brain dominance (left, integrated, right), the existence of a parallel temperament continuum of the four temperaments (left, near left, near right, right), which mapped onto the brain dominance continuum; and 3) The observation of such correlation and mapping in adult learners at the technical institute level of education. To obtain answers to these questions, a suggested theoretical framework was offered. A null hypothesis and two alternative hypotheses were formulated.

Two primary measures were calculated from the instruments employed: brain dominance percentiles and MBTI pre-

ference indices. From these interval measures, nominal categories were determined for further analysis. From the MBTI preferences, temperament (learning style, as described by Keirseyian temperament) and Jungian type were derived. Brain dominance was determined by means of the HIPS.

Two independent variables, brain dominance and temperament (learning style) were examined through chi square. Based upon the results which showed a significant chi square and contingency coefficient, a decision was made to use the interval data of the brain dominance percentiles as a dependent variable. A series of one-way analyses of variance (ANOVAS) were then performed comparing temperament with brain dominance mean left percentile scoring, mean integrated percentile scoring, and mean right percentile scoring.

Chapter III described the methods and procedures utilized to determine the population, collect the data and analyze the data. This chapter offers the analysis of that data.

Distribution of Types

The MBTI produces data along four indices: Extraversion-Introversion (EI), Sensing-Intuition (SN), Thinking-Feeling (TF), and Judgment-Perception (JP). The scores from these indices are then used to ascertain both

Jungian types and Keirseyian temperaments. The distribution of the sixteen Jungian types as determined by the MBTI is seen in Table 1. Eight students had inconclusive type results. There was one each of the following: XNTP, XSTP, XSXP, XNFP, ESXP, ENFX, ENTX, INTX. While these results were inconclusive for determining the full Jungian type, the Keirseyian temperaments were still discernible.

The Distribution of Keirseyian Temperaments

The distribution of Keirseyian temperaments is detailed in Table 2. The four temperaments were distributed in the following way: there were 59 SJ temperaments or 36 percent, 30 NT temperaments or 18.3 percent, 33 NF temperaments or 20.1 percent and 42 SP temperaments or 25.6 percent. This frequency distribution was illustrated through the Frequency Bar Chart in Figure 3.

The Distribution of Brain Dominance

The distribution of brain dominance is delineated in Table 3. The four brain dominance categories were distributed in the following way: there were 33 Left or 20 percent, 41 Integrated or 25 percent, 34 Right or 20.7 percent and 56 Mixed or 34.1 percent. This was depicted through the Frequency Bar Chart in Figure 4.

Table 1

Distribution of Subjects Among the Sixteen
Jungian Types as Determined by the MBTI

<u>Jungian Type</u>	<u>Number</u>	<u>Percentage</u>
ISTJ	13	7.9
ISFJ	21	12.8
INFJ	2	1.2
INTJ	4	2.4
ISTP	9	5.4
ISFP	10	6.1
INFP	8	4.9
INTP	6	3.7
ESTP	9	5.5
ESFP	11	6.7
ENFP	19	11.6
ENTP	11	6.7
ESTJ	7	4.3
ESFJ	18	11.0
ENFJ	2	1.2
ENTJ	6	3.7
Inconclusive	8	4.9
<u>Total</u>	164	

Table 2
Distribution of Subjects among the
Four Keirseyan Temperaments

<u>Keirseyan Temperament</u>	<u>Number</u>	<u>Percentage</u>
SJ	59	36.0
NT	30	18.3
NF	33	20.1
SP	42	25.6
<u>Total</u>	164	

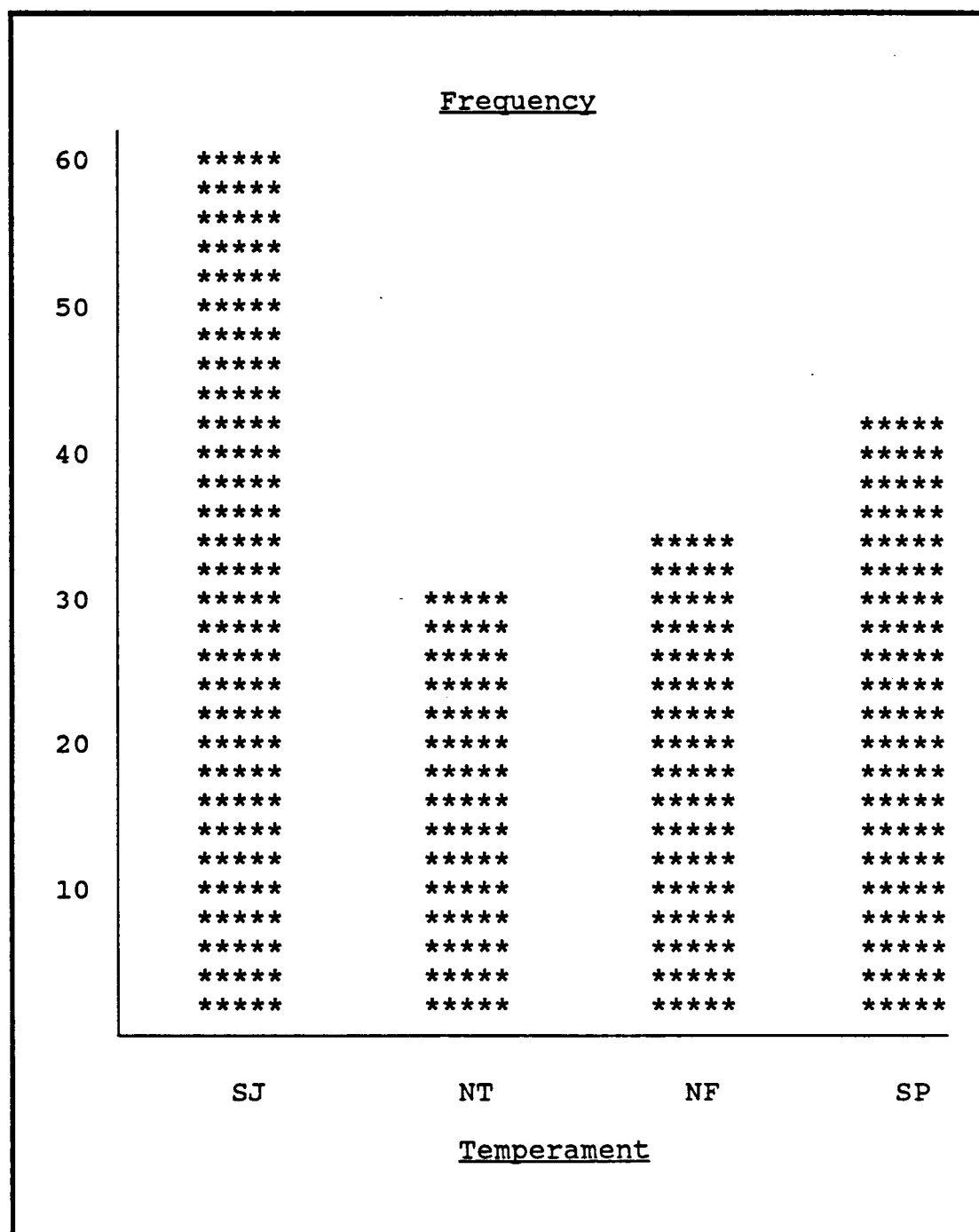


Figure 3 - Frequency Bar Chart of the Distribution of Subjects Among the Four Keirseyan Temperaments

Table 3

Distribution of Subjects among the
Four Brain Dominance Categories

<u>Brain Dominance</u>	<u>Number</u>	<u>Percentage</u>
Left	33	20.1
Integrated	41	25.0
Right	34	20.7
Mixed	56	34.1
<u>Total</u>	164	

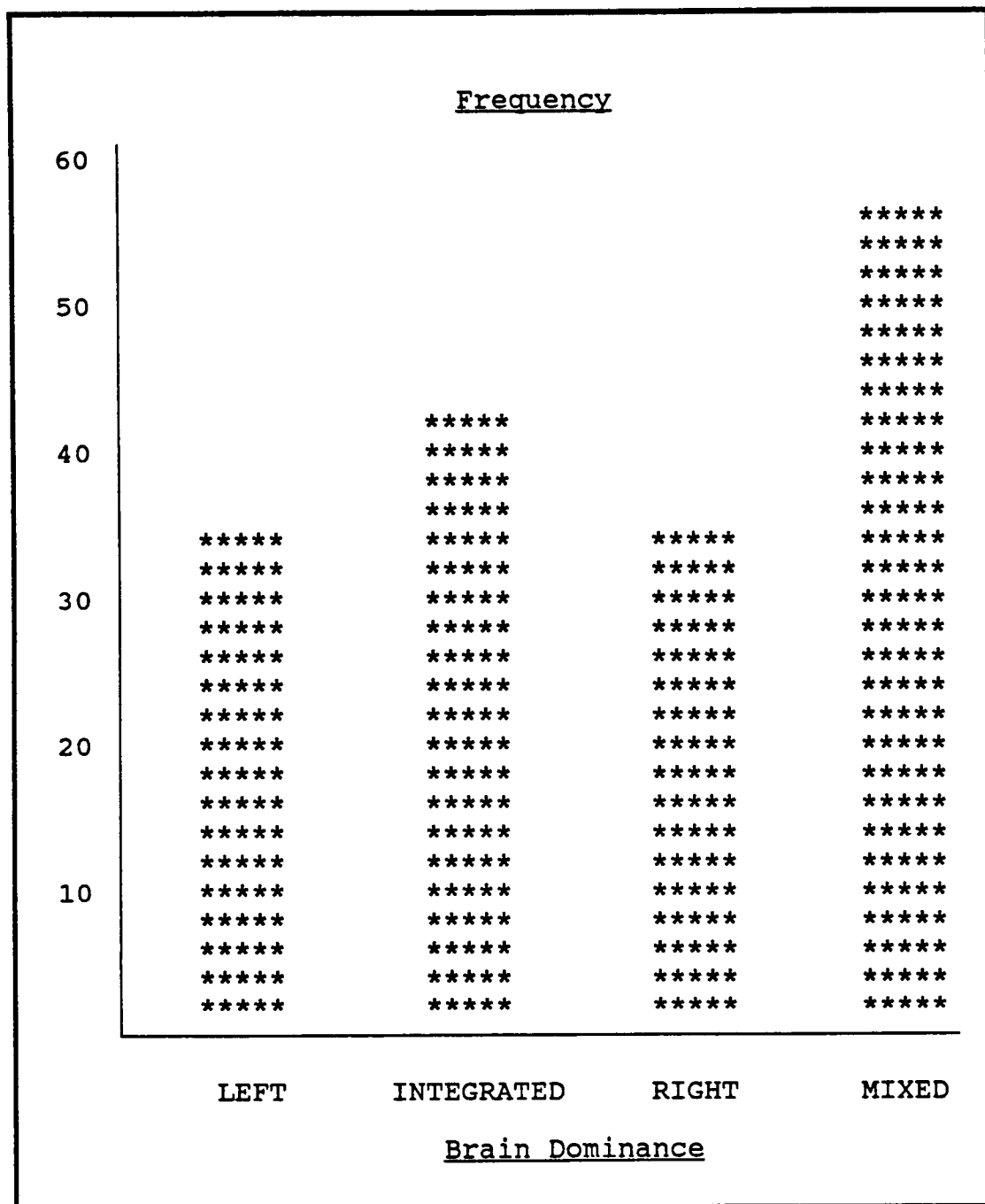


Figure 4 - Frequency Bar Chart of the Distribution of Subjects Among the Four Brain Dominance Categories

Results

Chi Square Contingency and Independence

The null hypothesis of this study focused on the potential relationship between hemisphericity and learning style as described by Keirseyan temperament. The null hypothesis stated:

HO₁: There is no significant relationship between brain dominance and learning style as described by Keirseyan temperament, for adult learners at the technical institute level of education.

To examine the association between temperament and brain dominance, a 4 x 4 contingency table was established (Table 4). This table revealed the relationship between the four Keirseyan temperament types and the four measures of brain dominance (left, integrated, right and mixed). The SJ-Mixed was the most frequently occurring combination with 20 subjects or 12.2 percent and the NT-Left was the least frequent with only one occurrence and 0.61 percent. The SJ-Left was the second most frequently occurring combination with 19 subjects or 11.6 percent and the NF-Left was the second least frequent with three occurrences and 1.83 percent. The analysis of independence resulted in a contingency coefficient or degree of association of 0.39 and a chi square of 28.677 with 9 degrees of freedom (Table 5). This was significant at the

Table 4

The Frequency and Percentage of
Occurrence of the Four Keirseyan Temperaments
with the Four Brain Dominance Categories

<u>Temperament</u>		<u>Brain Dominance</u>				
		Left	Integ	Right	Mixed	Total
<u>SJ</u>	Freq	19	15	5	20	59
	Perc (Expt)	11.59 (11.87)	9.15 (14.75)	3.05 (12.23)	12.20 (20.15)	35.98
<u>NT</u>	Freq	1	5	7	17	30
	Perc (Expt)	0.61 (6.04)	3.05 (7.50)	4.27 (6.22)	10.37 (10.24)	18.29
<u>NF</u>	Freq	3	7	12	11	33
	Perc (Expt)	1.83 (6.64)	4.27 (8.25)	7.32 (6.84)	6.71 (11.27)	20.12
<u>SP</u>	Freq	10	14	10	8	42
	Perc (Expt)	6.10 (8.45)	8.54 (10.50)	6.10 (8.71)	4.88 (14.34)	25.61
<u>TOTAL</u>	Freq	33	41	34	56	164
	Perc	20.12	25.00	20.73	34.15	100.00

Table 5

Chi Square Independence Analysis for
Temperament by Brain Dominance

<u>Statistic</u>	<u>DF</u>	<u>Value</u>
Chi Square	9	28.677 *
Likelihood ratio Chi Square	9	31.101
Phi		0.418
Contingency Coefficient		0.386 *

* Indicates Significance at 0.05 Level
(P.05 = 16.919 with 9 degrees of freedom)

.05 level. Therefore, it was concluded that dependence existed between the different levels of learning style, as defined by Keirseyan temperament, and brain dominance. Consequently, the null hypothesis was rejected, and the first alternative hypothesis was accepted. The first alternative hypothesis stated:

HA₁: There is a significant relationship between brain dominance and learning style as described by Keirseyan temperament for adult learners at the technical institute level of education.

Six cells with the greatest difference between their observed and expected values were identified for further investigation of their individual contribution to chi square of the contingency table (Table 6). At 1 df and a probability of .05, the value for significance was 3.841. Of the six cells investigated, five had significant chi squares. The SJ-Right combination had the greatest difference between the observed and expected values of -7.23 and a significant chi square of 4.27. The SJ-Left combination had the second greatest difference between the observed and expected values of 7.13 and a significant chi square of 4.28.

Descriptive Statistics for Brain Dominance Percentiles

The second alternative hypothesis of this study focused on the potential relationship between the four

Table 6

Chi Square Analysis for the Six Cells
Containing the Greatest Differences Between
the Observed and Expected Results

<u>CELL</u>	<u>O-E</u>	<u>(O-E)² / E</u>
SJ x LEFT	7.13	4.28 *
NF x LEFT	-5.04	4.21 *
SJ x RIGHT	-7.23	4.27 *
NF x RIGHT	5.16	3.89 *
NT x MIXED	6.76	4.46 *
SP x MIXED	-6.34	2.80

* Indicates significance at 0.05 level
(P.05 = 3.841 with 1 degree of freedom)

learning styles, as delineated by Keirseyian temperament, and their position upon the left-right brain dominance continuum. The second alternative hypothesis stated:

HA₂: There is a significant relationship between the four learning styles and their position upon the left/right continuum of brain dominance, for adult learners at the technical institute level of education.

This relationship was first explored using descriptive statistics for the brain dominance percentiles. Means and standard deviations were derived for the three brain dominance percentiles of each of the four temperaments, for each of the four levels of brain dominance. This provided insight into the distribution of the brain dominance percentile scores.

Frequency distribution charts were produced for each of the four levels of brain dominance. These charts plotted the frequency of the four temperaments that occurred for each type of brain dominance.

The distribution of scores with means and standard deviations by percentiles of left brain dominance showed that a preponderance of SJ temperaments were also left brain dominant (Table 7). The greatest number of subjects, 19, with left brain dominance were of the SJ temperament. The least number of subjects, one, with left

Table 7
Distribution of Scores with Means
and Standard Deviations by Percentile for
Left Brain Dominance

<u>Temperament</u>	<u>Variable</u>	<u>N</u>	<u>Mean</u>	<u>Standard Deviation</u>
SJ	Left Percentile	19	83.95	17.53
	Integ Percentile	19	25.16	20.79
	Right Percentile	19	37.79	20.76
NT	Left Percentile	1	99.00	
	Integ Percentile	1	9.00	
	Right Percentile	1	21.00	
NF	Left Percentile	3	82.67	2.89
	Integ Percentile	3	17.67	14.57
	Right Percentile	3	58.00	22.52
SP	Left Percentile	10	78.90	25.57
	Integ Percentile	10	16.70	10.75
	Right Percentile	10	43.20	26.90

brain dominance was of the NT temperament. These frequency distributions were illustrated through a bar chart for temperament by left brain dominance (Figure 5).

The distribution of scores with means and standard deviations by percentiles of right brain dominance showed that a majority of NF and SP temperaments were also right brain dominant. Further, it showed that SJ temperaments were least likely to be right brain dominant. The greatest number of subjects, 12, with right brain dominance were of the NF temperament. The second greatest number of subjects, 10, with right brain dominance were of the SP temperament. The least number of subjects, five, with right brain dominance were of the SJ temperament (Table 8). These frequency distributions were illustrated through a bar chart for temperament by right brain dominance (Figure 6).

One Way Analysis of Variance

The second alternative hypothesis was next tested using one-way ANOVAS of the brain dominance percentile means for the four temperament classifications. For the purpose of this analysis, the four classes of temperament were viewed as independent variables. The interval data of the brain dominance percentiles were then taken as

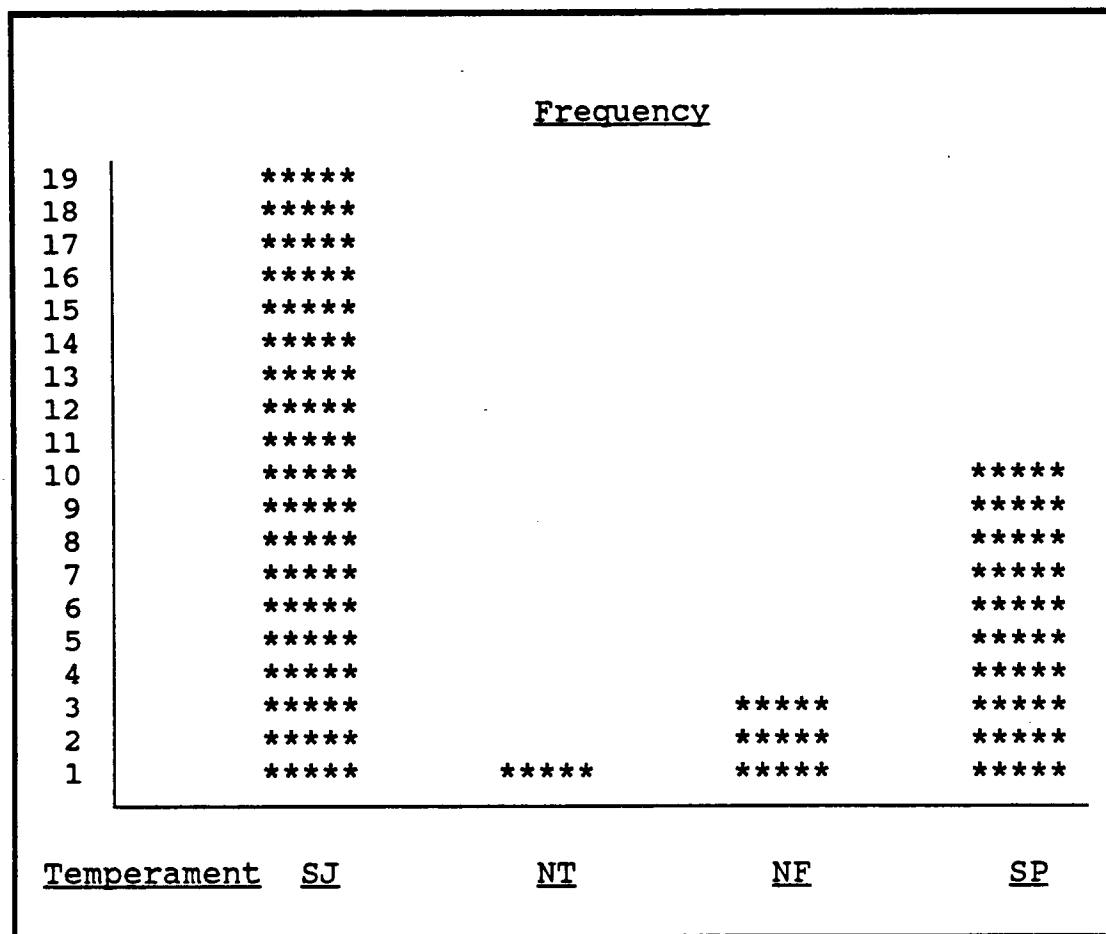


Figure 5 - Frequency Bar Chart of the Distribution
of Subjects Among the Four Temperaments
by Left Brain Dominance

Table 8
 Distribution of Scores with Means
 and Standard Deviations by Percentile for
 Right Brain Dominance

<u>Temperament</u>	<u>Variable</u>	<u>N</u>	<u>Mean</u>	<u>Standard Deviation</u>
SJ	Left Percentile	5	42.20	24.47
	Integ Percentile	5	22.40	10.57
	Right Percentile	5	83.40	14.38
NT	Left Percentile	7	34.14	21.52
	Integ Percentile	7	21.00	12.30
	Right Percentile	7	86.71	6.55
NF	Left Percentile	12	27.92	18.06
	Integ Percentile	12	27.42	19.55
	Right Percentile	12	90.00	7.41
SP	Left Percentile	10	41.50	28.41
	Integ Percentile	10	37.70	20.41
	Right Percentile	10	77.20	25.00

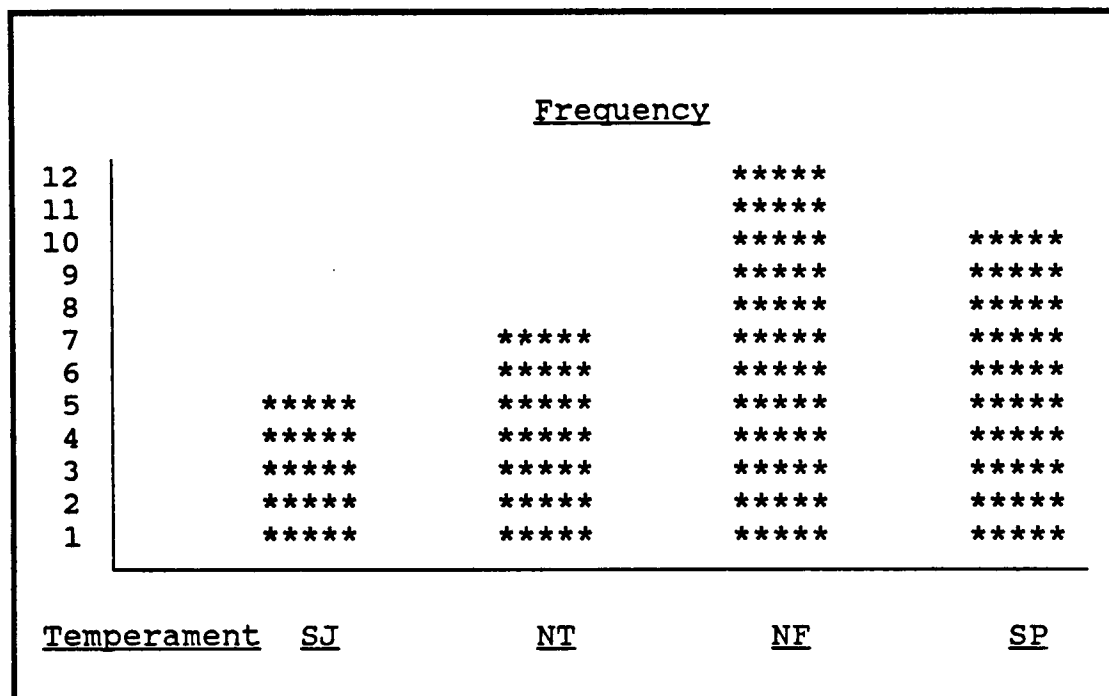


Figure 6 - Frequency Bar Chart of the Distribution
of Subjects Among the Four Temperaments
by Right Brain Dominance

dependent. Mean differences were obtained and significant mean variations determined with an alpha of 0.05 with 3, and 160 degrees of freedom.

With left brain dominance as the dependent variable, as compared with temperament types, an overall F Value of 3.70 was obtained. This was significant at the .05 level (Table 9). The mean differences as compared simultaneously for four temperament types revealed that the least square means of the SJ temperament were 19.32 points higher than those of the NF temperament and were significant at the .05 level (Table 10).

With right brain dominance as the dependent variable, as compared with temperament types, an overall F Value of 6.30 was obtained. This was significant at the .05 level (Table 11). The mean differences as compared simultaneously for four temperament types revealed that the least square means of the NF temperament were 16.12 points higher than those of the SP temperament and were significant at the .05 level. Also for the right percentile scores, the least square means of the NF temperament were 23.77 points higher than those of the SJ temperament, and were significant at the .05 level (Table 12).

There were no significant results ascertained with the integrated brain dominance as the dependent variable.

Table 9

Overall Analysis of Variance for Left Brain
Dominance as Compared with Keirseyian Temperament

<u>Source</u>	<u>DF</u>	<u>Sum of Squares</u>	<u>Mean Square</u>	<u>F</u>	<u>Value</u>
Model	3	8576.83	2858.95	3.70 *	
Error	160	123590.17	772.44		
Corrected	163	132166.99			
Total					

Dependent Variable: Left Percentile

* Significant at 0.05 level
(P.05 = F value of 2.60 with 3 and 160 degrees of freedom)

Table 10

Individual Least Square Mean Difference
for Left Brain Dominance as Compared
Simultaneously with Keirseyan Temperament

<u>Temperament Comparison</u>	<u>Simultaneous</u>		<u>Difference Between Means</u>	<u>Upper Confidence Limit</u>
	<u>Lower Confidence Limit</u>	<u>Upper Confidence Limit</u>		
SJ - SP	-7.61	6.95		21.52
SJ - NT	-3.97	12.21		28.39
SJ - NF	3.63	19.32		35.00 *
SP - SJ	-21.52	-6.95		7.61
SP - NT	-11.10	5.25		22.50
SP - NF	-4.42	12.36		29.15
NT - SJ	-28.39	-12.21		3.97
NT - SP	-22.50	-5.25		11.10
NT - NF	-11.09	7.11		25.31
NF - SJ	-35.00	-19.32		-3.63 *
NF - SP	-29.15	-12.36		4.42
NF - NT	-25.31	-7.11		11.09

* Comparisons Significant at 0.05 level

Table 11

Overall Analysis of Variance for Right Brain
Dominance as Compared with Keirseyan Temperament

<u>Source</u>	<u>DF</u>	<u>Sum of Squares</u>	<u>Mean Square</u>	<u>F</u>	<u>Value</u>
Model	3	12782.85	4260.95	6.30	*
Error	160	108289.41	676.81		
Corrected	163	121072.26			
Total					

Dependent Variable: Right Percentile

* Significant at 0.05 level
(P.05 = F value of 2.60 with 3 and 160 degrees of freedom)

Table 12

Individual Least Square Mean Difference
for Left Brain Dominance as Compared
Simultaneously with Keirseyan Temperament

<u>Temperament Comparison</u>	<u>Simultaneous Lower Confidence Limit</u>	<u>Difference Between Means</u>	<u>Upper Confidence Limit</u>	
NF - NT	-7.23	9.81	26.85	
NF - SP	0.41	16.12	31.84	*
NF - SJ	9.09	23.77	38.46	*
NT - NF	-26.85	-9.81	7.23	
NT - SP	-9.83	6.31	22.46	
NT - SJ	-1.18	13.96	29.11	
SP - NF	-31.84	-16.12	-0.41	*
SP - NT	-22.46	-6.31	9.83	
SP - SJ	-5.99	7.65	21.29	
SJ - NF	-38.46	-23.77	-9.09	*
SJ - NT	-29.11	-13.96	1.18	
SJ - SP	-21.29	-7.65	5.99	

* Comparisons significant at 0.05 level

CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

The preceding chapters of this study presented the statement of the problem, review of research and related literature, the procedures of the study and the analysis of the data. This chapter presents a brief review of the study and conclusions based upon the findings. In addition, recommendations are made for further research.

Summary

The purpose of this study was to examine the possible relationship of learning styles, as defined by Keirseyan temperaments, and brain dominance. It investigated whether or not individuals with a particular temperament tended to have a particular brain dominance. Three issues were essential: 1) The possible relationship between learning styles, as determined through Keirseyan temperament types, and brain dominance; 2) Tentatively positing a left-right continuum for brain dominance (left, integra-

ted, right), the existence of a parallel temperament continuum of the four temperaments (left, near left, near right, right), which mapped onto the brain dominance continuum; and 3) The observation of such correlation and mapping in adult learners at the technical institute level of education.

Two standardized testing instruments were employed: the MBTI and the HIPS. Two primary measures were obtained: brain dominance using the HIPS, and MBTI preferences using the MBTI. Jungian types and Keirseyian temperaments were derived from the MBTI preferences. Learning style was determined, based upon Keirseyian temperament. Two independent variables, brain dominance and temperament (learning style), were derived from these instruments for statistical analysis.

Findings

1. The distribution of Keirseyian temperaments were as follows: there were 59 SJ temperaments or 36 percent, 30 NT temperaments or 18.3 percent, 33 NF temperaments or 20.1 percent and 42 SP temperaments or 25.6 percent.

2. The four brain dominance categories were distributed as follows: there were 33 Left or 20 percent, 41 Integrated or 25 percent, 34 Right or 20.7 percent and 56 Mixed or 34.1 percent.

3. The distribution of the Keirseyian temperament types in combination with the four measures of brain dominance indicated: the SJ-Mixed was the most frequently occurring combination with 20 subjects or 12.2 percent and the NT-Left was the least frequent with only one occurrence and 0.61 percent, the SJ-Left was the second most frequently occurring combination with 19 subjects or 11.6 percent and the NF-Left was the second least frequent with three occurrences and 1.83 percent.

4. The analysis of independence resulted in a contingency coefficient of 0.39 and a chi square of 28.677 with 9 degrees of freedom. This was significant at the .05 level. These results indicated that association of brain dominance and learning style existed. Therefore, the null hypothesis was rejected. The null hypothesis stated:

HO₁: There is no significant relationship between brain dominance and learning style as described by Keirseyian temperament for adult learners at the technical institute level of education.

The first alternative hypothesis was accepted. The first alternative hypothesis stated:

HA₁: There is a significant relationship between brain dominance and learning style as described by Keirseyian temperament for adult learners at the technical institute level of education.

5. Five cells of the contingency table had significant chi squares at 1 df and a probability of .05. The SJ-Right combination had the greatest difference between the observed and expected values of -7.23 and a significant chi square of 4.27. The SJ-Left combination had the second greatest difference between the observed and expected values of 7.13 and a significant chi square of 4.28.

6. The distribution of scores with means and standard deviations by percentiles of left brain dominance showed that a preponderance of SJ temperaments were also left brain dominant. The greatest number of subjects, 19, with left brain dominance were of the SJ temperament. The least number of subjects, one, with left brain dominance was of the NT temperament.

7. The distribution of scores with means and standard deviations by percentiles of right brain dominance showed that a majority of NF and SP temperaments were also right brain dominant. Further, it showed that SJ temperaments were least likely to be right brain dominant. The greatest number of subjects, 12, with right brain dominance were of the NF temperament. The second greatest number of subjects, 10, with right brain dominance were of the SP temperament. The least number of subjects, five, with right brain dominance were of the SJ temperament.

8. An overall F Value of 3.70 was obtained by Analysis of Variance for Left Brain Dominance as Compared with

Keirseyan Temperament with an alpha of 0.05 with 3, and 160 degrees of freedom. This was significant at the .05 level.

9. For the left percentile scores, the mean differences as compared simultaneously for four temperament types indicated that the least square means of the SJ temperament were 19.32 points higher than those of the NF temperament and were significant at the .05 level.

10. An overall F Value of 6.30 was obtained by analysis of variance for right brain dominance as compared with Keirseyan temperament with an alpha of 0.05 with 3, and 160 degrees of freedom. This was significant at the .05 level.

11. For the right percentile scores, the mean differences as compared simultaneously for four temperament types showed that the least square means of the NF temperament were 16.12 points higher than those of the SP temperament and were significant at the .05 level.

12. For the right percentile scores, the mean differences as compared simultaneously for four temperament types showed that the least square means of the NF temperament were 23.77 points higher than those of the SJ temperament, and were significant at the .05 level.

13. An overall F Value of 0.03 was obtained by analysis of variance for integrated brain dominance as compared with Keirseyan temperament with an alpha of 0.05

with 3, and 160 degrees of freedom. This was not significant at the .05 level.

14. There were no significant results ascertained with the integrated brain dominance as the dependent variable.

15. There was partial support for the second alternative hypothesis from the frequency distributions and the ANOVAS for the second alternative hypothesis. The far left consisted primarily of the SJ temperaments. The near right and far right consisted primarily of NF and SP temperaments. The SJ temperament scored on the average far higher than the NF temperament in the left percentile of brain dominance. Conversely, the NF temperament scored significantly higher on the average than the SJ temperament on the right percentile of brain dominance. There was no evidence in support of the second alternative hypothesis from the results regarding either the NT temperament or Integrated Brain Dominance.

Therefore the evidence was inconclusive and the second alternative hypothesis was rejected. The second alternative hypothesis stated that:

HA₂: There is a significant relationship between the four learning styles and their position upon the left/right continuum of brain dominance for adult learners at the technical institute level of education.

Conclusions

Based upon the student responses to the MBTI and HIPS instruments, the following conclusions were drawn:

1. There is a relationship between a subject's learning style, as delineated by Keirseyian temperament, and their brain dominance.
2. There is a relationship between the SJ temperament and left brain dominance.
3. There is a relationship between the NF temperament and right brain dominance.
4. There is a relationship between the SP temperament and right brain dominance.
5. There appears to be no relationship between the NT temperament and brain dominance.
6. There was partial support for the suggestion of a temperament/learning style continuum which paralleled and mapped onto the brain dominance continuum. Such a continuum may exist; however, due to the mixed nature of the results this remains indeterminate.

Recommendations

A number of problems and questions emerged through the course of this study which invite further study. Several of these issues are presented in the following suggestions.

1. The results of this study could be utilized by adult educators to enhance their understanding of individual learning differences. This would allow them to better match their teaching techniques with the unique learning styles of their students.

2. Further investigation of the relationship of brain dominance and learning styles as described by Keirseyan temperaments should be pursued to build on the results of this study.

3. The existence of a continuum across the four temperaments (SJ-left, NT-near left, NF-near right, SP-right), which maps onto the brain dominance continuum (left, integrated, right) needs further investigation. Replication would provide data which would either support this suggestion and permit acceptance of the hypothesis or confirm rejection.

4. The actual correlation of the levels of brain dominance and the levels of temperament was not evaluated. Further research should include correlation measures performed through Pearson's r .

5. Association of left brain dominance and the SJ temperament, as well as, right brain dominance and the NF temperament was found. No association was found for the NT temperament and integrated brain dominance. It might prove useful to reevaluate and reconceptualize the initial questions. The second alternative hypothesis could be

separated into its component parts and restated as individual hypotheses. These hypotheses could then be examined separately.

6. Research should be conducted to examine the positive association of the SJ temperament with left brain dominance and the NF temperament with right brain dominance and conversely the negative association of the SJ temperament with right brain dominance and the NF temperament with left brain dominance.

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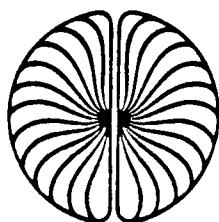
APPENDICES

APPENDIX A

INSTRUMENT 1

HUMAN INFORMATION PROCESSING SURVEY

RESEARCH EDITION



human information processing™ SURVEY

Developed By
E. Paul Torrance, Ph.D.
with
Barbara Taggart, M.S.
&
William Taggart, Ph.D.



Published by:
SCHOLASTIC TESTING SERVICE, INC.
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In the right-hand column, select the one choice which is most descriptive of you. Do this for each item on the Survey. Follow the instructions of the Survey administrator for marking your choices.

- | | | |
|-------|---|---|
| 1. A | usually learn or remember only those things specifically studied | A |
| B | good memory for details and facts in the environment not specifically studied | B |
| C | have noticed no difference in my abilities in these areas | C |
| 2. A | like to read fantasy stories | A |
| B | like to read realistic stories | B |
| C | no preference between fantasy and realistic stories | C |
| 3. A | equally as much fun to dream as to plan realistically | A |
| B | more fun to dream | B |
| C | more fun to plan realistically | C |
| 4. A | listen to music or radio while reading or studying | A |
| B | must have total quiet in order to read or study | B |
| C | listen to music or radio only if reading for enjoyment, not if studying | C |
| 5. A | would like to write fiction books | A |
| B | would like to write non-fiction books | B |
| C | no preference between writing fiction and non-fiction | C |
| 6. A | if seeking mental health counseling, would prefer group counseling and sharing feelings with others | A |
| B | if seeking mental health counseling, would prefer the confidentiality of individual counseling | B |
| C | have no preference for group over individual counseling | C |
| 7. A | enjoy drawing my own images and ideas | A |
| B | enjoy copying and filling in details | B |
| C | enjoy drawing my own images and copying and filling in equally | C |
| 8. A | believe I could be easily hypnotized | A |
| B | could probably be hypnotized but it would be difficult | B |
| C | do not believe I could be hypnotized | C |
| 9. A | no preference between mystery stories and action stories | A |
| B | prefer action stories | B |
| C | prefer mystery stories | C |
| 10. A | no preference between algebra and geometry | A |
| B | prefer algebra | B |
| C | prefer geometry | C |

Go on to the next page.

- | | | |
|-------|--|---|
| 11. A | like to organize things sequentially | A |
| B | like to organize things to show relationships | B |
| C | no preference for sequential over relational organization | C |
| 12. A | good at remembering verbal materials | A |
| B | good at tonal (musical sound) memory | B |
| C | equally good at verbal and tonal memory | C |
| 13. A | pace personal activity to time limits with ease | A |
| B | use time to organize self and personal activities | B |
| C | have difficulty in pacing personal activities to time limits | C |
| 14. A | have frequent mood changes | A |
| B | have few mood changes | B |
| C | stable, almost no mood changes | C |
| 15. A | skilled in communicating with animals | A |
| B | moderately good in communicating with animals | B |
| C | cannot communicate very well with animals | C |
| 16. A | no preference for cats over dogs or vice versa | A |
| B | preference for cats | B |
| C | preference for dogs | C |
| 17. A | enjoy clowning around | A |
| B | can clown or be serious depending upon the occasion | B |
| C | do not enjoy clowning around | C |
| 18. A | frequently somewhat absent-minded | A |
| B | occasionally absent-minded | B |
| C | almost never absent-minded | C |
| 19. A | when viewing advertisements, am most often influenced by attractive signs, pleasant scenes, and sensual overtones | A |
| B | when viewing advertisements, am most often influenced by the information comparing several products and demonstrating which works the best | B |
| C | primarily influenced by the advertising medium only when accompanied by information on the quality of the product | C |
| 20. A | no preference for demonstration over verbal instructions | A |
| B | prefer demonstration | B |
| C | prefer verbal instructions | C |

Go on to the next page.

- | | | | |
|-----|---|--|---|
| 21. | A | equally valuable to discuss stories and illustrate them | A |
| | B | more valuable to discuss stories read | B |
| | C | more valuable to illustrate stories read | C |
| 22. | A | equally valuable to tell stories and to act out stories | A |
| | B | more valuable to tell stories | B |
| | C | more valuable to act out stories | C |
| 23. | A | moving rhythmically and rhyming are equally enjoyable | A |
| | B | moving rhythmically is more fun | B |
| | C | rhyming is more fun | C |
| 24. | A | would like to do impromptu interpretive dancing | A |
| | B | would like to do ballet dancing | B |
| | C | no preference for ballet over impromptu interpretive dancing | C |
| 25. | A | enjoy interacting affectively with others | A |
| | B | enjoy interpreting the affective interaction of others | B |
| | C | equal preference for affective interaction and interpretation of the affective interaction of others | C |
| 26. | A | can think better while lying down | A |
| | B | can think better while sitting up straight | B |
| | C | equal preference for thinking while lying down or sitting up straight | C |
| 27. | A | would like to be a music critic | A |
| | B | would like to be a music composer | B |
| | C | would enjoy equally music criticism and composition | C |
| 28. | A | skilled in the intuitive prediction of outcomes | A |
| | B | skilled in the statistical, scientific prediction of outcomes | B |
| | C | equally skilled in intuitive and statistical/scientific prediction | C |
| 29. | A | generally attentive to verbal explanations | A |
| | B | generally restless during verbal explanations | B |
| | C | can control attention during verbal explanations | C |
| 30. | A | enjoy analyzing stories | A |
| | B | enjoy creative storytelling | B |
| | C | enjoy equally analyzing stories and creative storytelling | C |

Go on to the next page.

31.	A	conforming or nonconforming depending upon the situation	A
	B	generally conforming	B
	C	generally nonconforming	C
32.	A	no preference for well-structured over open-ended assignments	A
	B	preference for open-ended assignments	B
	C	preference for well-structured assignments	C
33.	A	prefer to learn through free exploration	A
	B	prefer to learn systematically through ordering and planning	B
	C	no preference between learning through free exploration and learning through more systematic ways	C
34.	A	strong in recalling verbal materials (names, dates, etc.)	A
	B	strong in recalling spatial imagery	B
	C	equally strong in recalling verbal and spatial imagery	C
35.	A	read for main ideas	A
	B	read for specific details and facts	B
	C	read for main ideas and for details and facts equally	C
36.	A	skilled in sequencing ideas	A
	B	skilled in showing relationships among ideas	B
	C	equally skilled in sequencing and showing relationships	C
37.	A	no preference between outlining and summarizing readings	A
	B	preference for outlining over summarizing	B
	C	preference for summarizing over outlining	C
38.	A	producing ideas and drawing conclusions are equally enjoyable	A
	B	drawing conclusions is more fun	B
	C	producing ideas is more fun	C
39.	A	solve problems logically, rationally	A
	B	solve problems intuitively	B
	C	equally skilled in solving problems intuitively and logically	C
40.	A	just as exciting to me to improve something as to invent something new	A
	B	more exciting to improve something	B
	C	more exciting to invent something new	C

When you have completed all forty items, follow the instructions of your Survey administrator.



human information processing® survey

RESEARCH EDITION

Response Sheet

Name _____ Date _____

For each item of the Survey, select the one alternative that best describes you. Indicate your choice by *circling* the letter "A," "B," or "C" next to the number of that item in the list below.

When you have completed all forty items, follow the instructions of your Survey administrator for completion of this sheet.

- | | | | | | | | | | |
|-----|---|---|---|-------|-----|---|---|---|-------|
| 1. | A | B | C | _____ | 21. | A | B | C | _____ |
| 2. | A | B | C | _____ | 22. | A | B | C | _____ |
| 3. | A | B | C | _____ | 23. | A | B | C | _____ |
| 4. | A | B | C | _____ | 24. | A | B | C | _____ |
| 5. | A | B | C | _____ | 25. | A | B | C | _____ |
| 6. | A | B | C | _____ | 26. | A | B | C | _____ |
| 7. | A | B | C | _____ | 27. | A | B | C | _____ |
| 8. | A | B | C | _____ | 28. | A | B | C | _____ |
| 9. | A | B | C | _____ | 29. | A | B | C | _____ |
| 10. | A | B | C | _____ | 30. | A | B | C | _____ |
| 11. | A | B | C | _____ | 31. | A | B | C | _____ |
| 12. | A | B | C | _____ | 32. | A | B | C | _____ |
| 13. | A | B | C | _____ | 33. | A | B | C | _____ |
| 14. | A | B | C | _____ | 34. | A | B | C | _____ |
| 15. | A | B | C | _____ | 35. | A | B | C | _____ |
| 16. | A | B | C | _____ | 36. | A | B | C | _____ |
| 17. | A | B | C | _____ | 37. | A | B | C | _____ |
| 18. | A | B | C | _____ | 38. | A | B | C | _____ |
| 19. | A | B | C | _____ | 39. | A | B | C | _____ |
| 20. | A | B | C | _____ | 40. | A | B | C | _____ |

Your Raw Scores → $\square + \square + \square = 40$

L_s
 I_s
 R_s

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APPENDIX B

INSTRUMENT 2

MYERS-BRIGGS TYPE INDICATOR - FORM G

MYERS-BRIGGS TYPE INDICATOR™

FORM G

by Katharine C. Briggs and Isabel Briggs Myers

DIRECTIONS:

There are no "right" or "wrong" answers to these questions. Your answers will help show how you like to look at things and how you like to go about deciding things. Knowing your own preferences and learning about other people's can help you understand where your special strengths are, what kinds of work you might enjoy and be successful doing, and how people with different preferences can relate to each other and be valuable to society.

Read each question carefully and mark your answer on the separate answer sheet. *Make no marks on the question booklet.* Do not think too long about any question. If you cannot decide on a question, skip it but be careful that the *next* space you mark on the answer sheet has the same number as the question you are then answering.

Read the directions on your answer sheet, fill in your name and any other facts asked for and, unless you are told to stop at some point, work through until you have answered all the questions you can.



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**PART I. Which Answer Comes Closer to Telling How
You Usually Feel or Act?**

1. When you go somewhere for the day, would you rather
 - (A) plan what you will do and when, or
 - (B) just go?
 2. If you were a teacher, would you rather teach
 - (A) fact courses, or
 - (B) courses involving theory?
 3. Are you usually
 - (A) a "good mixer," or
 - (B) rather quiet and reserved?
 4. Do you prefer to
 - (A) arrange dates, parties, etc., well in advance, or
 - (B) be free to do whatever looks like fun when the time comes?
 5. Do you usually get along better with
 - (A) imaginative people, or
 - (B) realistic people?
 6. Do you more often let
 - (A) your heart rule your head, or
 - (B) your head rule your heart?
 7. When you are with a group of people, would you usually rather
 - (A) join in the talk of the group, or
 - (B) talk with one person at a time?
 8. Are you more successful
 - (A) at dealing with the unexpected and seeing quickly what should be done, or
 - (B) at following a carefully worked out plan?
 9. Would you rather be considered
 - (A) a practical person, or
 - (B) an ingenious person?
 10. In a large group, do you more often
 - (A) introduce others, or
 - (B) get introduced?
 11. Do you admire more the people who are
 - (A) conventional enough never to make themselves conspicuous, or
 - (B) too original and individual to care whether they are conspicuous or not?
 12. Does following a schedule
 - (A) appeal to you, or
 - (B) cramp you?
 13. Do you tend to have
 - (A) deep friendships with a very few people, or
 - (B) broad friendships with many different people?
 14. Does the idea of making a list of what you should get done over a weekend
 - (A) appeal to you, or
 - (B) leave you cold, or
 - (C) positively depress you?
 15. Is it a higher compliment to be called
 - (A) a person of real feeling, or
 - (B) a consistently reasonable person?
 16. Among your friends, are you
 - (A) one of the last to hear what is going on, or
 - (B) full of news about everybody?
- [On this next question *only*, if two answers are true, mark both.]
17. In your daily work, do you
 - (A) rather enjoy an emergency that makes you work against time, or
 - (B) hate to work under pressure, or
 - (C) usually plan your work so you won't need to work under pressure?
 18. Would you rather have as a friend
 - (A) someone who is always coming up with new ideas, or
 - (B) someone who has both feet on the ground?

19. Do you
(A) talk easily to almost anyone for as long as you have to, or
(B) find a lot to say only to certain people or under certain conditions?
20. When you have a special job to do, do you like to
(A) organize it carefully before you start, or
(B) find out what is necessary as you go along?
21. Do you usually
(A) value sentiment more than logic, or
(B) value logic more than sentiment?
22. In reading for pleasure, do you
(A) enjoy odd or original ways of saying things, or
(B) like writers to say exactly what they mean?
23. Can the new people you meet tell what you are interested in
(A) right away, or
(B) only after they really get to know you?
24. When it is settled well in advance that you will do a certain thing at a certain time, do you find it
(A) nice to be able to plan accordingly, or
(B) a little unpleasant to be tied down?
25. In doing something that many other people do, does it appeal to you more to
(A) do it in the accepted way, or
(B) invent a way of your own?
26. Do you usually
(A) show your feelings freely, or
(B) keep your feelings to yourself?

Go on to Part II.

PART II. Which Word in Each Pair Appeals to You More?

Think what the words mean, not how they look or how they sound.

- | | |
|---|---|
| 27. (A) scheduled unplanned (B) | 50. (A) sensible fascinating (B) |
| 28. (A) gentle firm (B) | 51. (A) forgive tolerate (B) |
| 29. (A) facts ideas (B) | 52. (A) production design (B) |
| 30. (A) thinking feeling (B) | 53. (A) impulse decision (B) |
| 31. (A) hearty quiet (B) | 54. (A) who what (B) |
| 32. (A) convincing touching (B) | 55. (A) speak write (B) |
| 33. (A) statement concept (B) | 56. (A) uncritical critical (B) |
| 34. (A) analyze sympathize (B) | 57. (A) punctual leisurely (B) |
| 35. (A) systematic spontaneous (B) | 58. (A) concrete abstract (B) |
| 36. (A) justice mercy (B) | 59. (A) changing permanent (B) |
| 37. (A) reserved talkative (B) | 60. (A) wary trustful (B) |
| 38. (A) compassion foresight (B) | 61. (A) build invent (B) |
| 39. (A) systematic casual (B) | 62. (A) orderly easygoing (B) |
| 40. (A) calm lively (B) | 63. (A) foundation spire (B) |
| 41. (A) benefits blessings (B) | 64. (A) quick careful (B) |
| 42. (A) theory certainty (B) | 65. (A) theory experience (B) |
| 43. (A) determined devoted (B) | 66. (A) sociable detached (B) |
| 44. (A) literal figurative (B) | 67. (A) sign symbol (B) |
| 45. (A) firm-minded warm-hearted (B) | 68. (A) party theater (B) |
| 46. (A) imaginative matter-of-fact (B) | 69. (A) accept change (B) |
| 47. (A) peacemaker judge (B) | 70. (A) agree discuss (B) |
| 48. (A) make create (B) | 71. (A) known unknown (B) |
| 49. (A) soft hard (B) | |

Go on to Part III

**PART III. Which Answer Comes Closer to Telling How
You Usually Feel or Act?**

72. Would you say you
 - (A) get more enthusiastic about things than the average person, or
 - (B) get less excited about things than the average person?
73. Do you feel it is a worse fault to be
 - (A) unsympathetic, or
 - (B) unreasonable?
74. Do you
 - (A) rather prefer to do things at the last minute, or
 - (B) find doing things at the last minute hard on the nerves?
75. At parties, do you
 - (A) sometimes get bored, or
 - (B) always have fun?
76. Do you think that having a daily routine is
 - (A) a comfortable way to get things done, or
 - (B) painful even when necessary?
77. When something new starts to be the fashion, are you usually
 - (A) one of the first to try it, or
 - (B) not much interested?
78. When you think of some little thing you should do or buy, do you
 - (A) often forget it till much later, or
 - (B) usually get it down on paper to remind yourself, or
 - (C) always carry through on it without reminders?
79. Are you
 - (A) easy to get to know, or
 - (B) hard to get to know?
80. In your way of living, do you prefer to be
 - (A) original, or
 - (B) conventional?
81. When you are in an embarrassing spot, do you usually
 - (A) change the subject, or
 - (B) turn it into a joke, or
 - (C) days later, think of what you should have said?
82. Is it harder for you to adapt to
 - (A) routine, or
 - (B) constant change?
83. Is it higher praise to say someone has
 - (A) vision, or
 - (B) common sense?
84. When you start a big project that is due in a week, do you
 - (A) take time to list the separate things to be done and the order of doing them, or
 - (B) plunge in?
85. Do you think it more important to be able
 - (A) to see the possibilities in a situation, or
 - (B) to adjust to the facts as they are?
86. Do you think the people close to you know how you feel
 - (A) about most things, or
 - (B) only when you have had some special reason to tell them?
87. Would you rather work under someone who is
 - (A) always kind, or
 - (B) always fair?
88. In getting a job done, do you depend on
 - (A) starting early, so as to finish with time to spare, or
 - (B) the extra speed you develop at the last minute?
89. Do you feel it is a worse fault
 - (A) to show too much warmth, or
 - (B) not to have warmth enough?
90. When you are at a party, do you like to
 - (A) help get things going, or
 - (B) let the others have fun in their own way?
91. Would you rather
 - (A) support the established methods of doing good, or
 - (B) analyze what is still wrong and attack unsolved problems?

92. Are you more careful about
 - (A) people's feelings, or
 - (B) their rights?
93. If you were asked on a Saturday morning what you were going to do that day, would you
 - (A) be able to tell pretty well, or
 - (B) list twice too many things, or
 - (C) have to wait and see?
94. In deciding something important, do you
 - (A) find you can trust your feeling about what is best to do, or
 - (B) think you should do the *logical* thing, no matter how you feel about it?
95. Do you find the more routine parts of your day
 - (A) restful, or
 - (B) boring?
96. Does the importance of doing well on a test make it generally
 - (A) easier for you to concentrate and do your best, or
 - (B) harder for you to concentrate and do yourself justice?
97. Are you
 - (A) inclined to enjoy deciding things, or
 - (B) just as glad to have circumstances decide a matter for you?
98. In listening to a new idea, are you more anxious to
 - (A) find out all about it, or
 - (B) judge whether it is right or wrong?
99. In any of the ordinary emergencies of everyday life, would you rather
 - (A) take orders and be helpful, or
 - (B) give orders and be responsible?
100. After being with superstitious people, have you
 - (A) found yourself slightly affected by their superstitions, or
 - (B) remained entirely unaffected?
101. Are you more likely to speak up in
 - (A) praise, or
 - (B) blame?
102. When you have a decision to make, do you usually
 - (A) make it right away, or
 - (B) wait as long as you reasonably can before deciding?
103. At the time in your life when things piled up on you the worst, did you find
 - (A) that you had gotten into an impossible situation, or
 - (B) that by doing only the necessary things you could work your way out?
104. Out of all the good resolutions you may have made, are there
 - (A) some you have kept to this day, or
 - (B) none that have really lasted?
105. In solving a personal problem, do you
 - (A) feel more confident about it if you have asked other people's advice, or
 - (B) feel that nobody else is in as good a position to judge as you are?
106. When a new situation comes up which conflicts with your plans, do you try first to
 - (A) change your plans to fit the situation, or
 - (B) change the situation to fit your plans?
107. Are such emotional "ups and downs" as you may feel
 - (A) very marked, or
 - (B) rather moderate?
108. In your personal beliefs, do you
 - (A) cherish faith in things that cannot be proved, or
 - (B) believe only those things that can be proved?
109. In your home life, when you come to the end of some undertaking, are you
 - (A) clear as to what comes next and ready to tackle it, or
 - (B) glad to relax until the next inspiration hits you?
110. When you have a chance to do something interesting, do you
 - (A) decide about it fairly quickly, or
 - (B) sometimes miss out through taking too long to make up your mind?

111. If a breakdown or mix-up halted a job on which you and a lot of others were working, would your impulse be to
 (A) enjoy the breathing spell, or
 (B) look for some part of the work where you could still make progress, or
 (C) join the "trouble-shooters" in wrestling with the difficulty?
112. When you don't agree with what has just been said, do you usually
 (A) let it go, or
 (B) put up an argument?
113. On most matters, do you
 (A) have a pretty definite opinion, or
 (B) like to keep an open mind?
114. Would you rather have
 (A) an opportunity that may lead to bigger things, or
 (B) an experience that you are sure to enjoy?
115. In managing your life, do you tend to
 (A) undertake too much and get into a tight spot, or
 (B) hold yourself down to what you can comfortably handle?
116. When playing cards, do you enjoy most
 (A) the sociability, or
 (B) the excitement of winning, or
 (C) the problem of getting the most out of each hand, or
 (D) or don't you enjoy playing cards?
117. When the truth would not be polite, are you more likely to tell
 (A) a polite lie, or
 (B) the impolite truth?
118. Would you be more willing to take on a heavy load of extra work for the sake of
 (A) extra comforts and luxuries, or
 (B) a chance to achieve something important?
119. When you don't approve of the way a friend is acting, do you
 (A) wait and see what happens, or
 (B) do or say something about it?
120. Has it been your experience that you
 (A) often fall in love with a notion or project that turns out to be a disappointment—so that you "go up like a rocket and come down like the stick", or do you
 (B) use enough judgment on your enthusiasms so that they do not let you down?
121. When you have a serious choice to make, do you
 (A) almost always come to a clear-cut decision, or
 (B) sometimes find it so hard to decide that you do not wholeheartedly follow up either choice?
122. Do you usually
 (A) enjoy the present moment and make the most of it, or
 (B) feel that something just ahead is more important?
123. When you are helping in a group undertaking, are you more often struck by
 (A) the cooperation, or
 (B) the inefficiency, or
 (C) or don't you get involved in group undertakings?
124. When you run into an unexpected difficulty in something you are doing, do you feel it to be
 (A) a piece of bad luck, or
 (B) a nuisance, or
 (C) all in the day's work?
125. Which mistake would be more natural for you:
 (A) to drift from one thing to another all your life, or
 (B) to stay in a rut that didn't suit you?
126. Would you have liked to argue the meaning of
 (A) a lot of these questions, or
 (B) only a few?

Characteristics frequently associated with each type

Sensing Types				Intuitive Types			
Introverts		Extraverts		Introverts		Extraverts	
ISTJ	Serious, quiet, main success by concentration and thoroughness. Practical, orderly, matter of fact, logical, realistic, and dependable. See to it that everything is well organized. Take responsibility. Make up their own minds as to what should be accomplished and work toward it steadily, regardless of protests or distractions.	ISFJ	Quiet, friendly, responsible, self-reliant, serious. With tendency to neglect their own needs. Loyal, steady, to any project or group. Thorough, conscientious, and careful. Their interests are usually not too broad. Can be patient with non-essentials. Loyal, considerate, their negative concerns with those of other people feel.	INFJ	Successful by perseverance, originality and desire to do what is needed or wanted. They are the best efforts into their work. Quietly forceful, clear, serious, concerned for others. Respected for their firm principles. Likely to be turned and followed for their clear convictions as to how best to serve the common good.	INTJ	Usually have original needs and great drive for their own ideas and purposes. In fields that appeal to them, they have a long drive to organize a job and carry it through with or without help. Strategic, clear, independent, determined. Sometimes stubborn. Must learn to yield less important points in order to win the most important.
ISTP	Cool, unbothers, quiet, reserved, observing and analyzing life with detached curiosity and unexpected flashes of original humor. Usually interested in cause and effect, how and why mechanical things work, and in organizing facts using logical principles.	ISFP	Feeling, quietly friendly, sensitive and modest about their abilities. Shun disagreements, do not force their opinions or values on others. Usually do not care to lead but are often loyal followers. Often relaxed about getting things done. But, when they enter the picture, they are not to be taken for granted. They are hard to shake and hard to change.	INFP	Full of enthusiasm and loyalties, but seldom take of these until they know you well. Care about learning, ideas, language, and independent projects of their own. Tend to undertake too much, then somehow get it done. Friendly, but often has difficulty in what they are doing in the "real world." Little concerned with possessions or physical surroundings.	INTP	Quiet and reserved. Especially enjoy theoretical or scientific pursuits. Like solving problems with logic and analysis. Usually interested mainly in ideas with little having for fun or small talk. Tend to have sharply defined interests. Need careers where strong interests can be used and useful.
ESTP	Great at solving the same problem, solving. Do not worry, enjoy whatever comes along. Tend to be mercenary about things and sports, with friends on the side. Adaptative, tolerant, generally conservative in values. Think they are right. Are best with real things that can be worked, handled, taken apart or put together.	ESFP	Charming, easygoing, accepting, friendly, enjoy everything and make things more fun for others. Try their enjoyment, like sports and making things happen. Know what's going on and fun in life. Find enjoyment in life, easier than making theories. Are best at situations that need strong common sense and practical ability with people as well as with things.	ENFP	Warmly enthusiastic, high spirited, ingenious, imaginative. Able to do almost anything that interests them. Quick with a solution for any difficulty and ready to help anyone with a problem. Often rely on their ability to improvise instead of preparing in advance. Can usually find compelling reasons for whatever they want.	ENTP	Quick, ingenious, good at many things. Stimulating, curiously alert and outspoken. May argue for fun on either side of a question. Resourceful in solving new and challenging problems, but may neglect routine assignments. Apt to turn to one new interest after another. Skilled in finding logical reasons for what they want.
ESTJ	Practical, reliable, matter of fact, with a natural bent for facts and figures. Not interested in subjects they have no use for. But can apply themselves when they see the value. Like to organize and run a business. May make good administrators, especially if they remember to consider others' feelings and points of view.	ESFJ	Warm, hearty, helpful, popular, considerate. Good organizers, at the same time, they are always ready to help. Always doing something for someone. Warm, friendly, with encouragement and praise. Main interest is in things that directly and visibly affect people's lives.	ENFJ	Respectful and responsible. Generally keep to the end of what others think is right, and try to handle things with the respect for the other person's feelings. Can present a proposal or lead a group discussion with ease and tact. Sociable, popular, sympathetic. Responsive to praise and criticism.	ENTJ	Headsly, frank, clear, logical, with a business-like approach to anything that requires reasoning and intelligent talk. Such as public speaking. Are usually well informed and enjoy adding to their fund of knowledge. May sometimes appear more positive and confident than their experience in an area warrants.

MYERS-BRIGGS TYPE INDICATOR™ (FORM G)

PURPOSE: This is a set of questions for finding out how you like to look at things and to go about deciding things. The questions are not important in themselves but your preferences are, because these preferences make people different in a lot of valuable ways — interested in different things, good at different things, and likely to enjoy and succeed in different kinds of work.

HOW TO TAKE THE INDICATOR: Read one question at a time, with both (or all) its answers, and choose the way you more often feel or act. Don't try to be consistent. If you find a question where you cannot choose, don't mark both answers or flip a coin for it. Skip that question and go on.

FACTS TO FILL IN: Before starting to answer questions, fill in, on the other side of this sheet:

1. **Name:** At top left you will find directions for completing this section.
2. **Date of birth:** Using 01 for Jan., 02 for Feb., etc., print the number for the month of your birth in the two boxes below MO. In the two boxes below DAY, print the day of the month on which you were born. In the two boxes below YR, print the last two numbers of the year you were born. For example, March 8, 1960, would be printed

MO	DAY	YR
03	08	60

Below each box, blacken the circle that is numbered the same as the box.

3. **Today's Date:** Use the same system to give today's date.
4. **Highest Grade Completed:** Blacken the numbered circle beside the highest grade you have completed in school. For example, if you are now in 8th grade, blacken 7.
5. **Sex:** Women and girls blacken ♀. Men and boys blacken ♂.
6. **Are You A Student?** Blacken Y for Yes, and N for No.
7. **Best-Liked Subject:** Decide which one of the seven subject areas you have liked best, and blacken the circle before that one. The "Practical Skills" area includes any course where you learn to do something with your hands or with a tool or machine.
8. **Are You Working?** Blacken Y for Yes, and N for No.
9. **Occupation or Major:** If you are working, write in the kind of work you are doing. If you are in college, write your major.
10. **Do You Like It?** (This section is optional.) If you like it a lot, blacken +. If you just think it is O.K., blacken ⊙. If you really don't like it much, blacken -.

HOW TO MARK YOUR ANSWERS: To mark your answers to the Indicator questions, find the number of the question, then find the circle next to it that has the same letter as the answer you chose and blacken that circle completely. Use a No. 2 lead pencil; do not use pen.

SAMPLE QUESTION

167. Would you rather see a movie
(A) at home on TV
(B) at a movie theater

SAMPLE ANSWER SHEET

A	B
167	A

In the sample question above, if you would rather see the movie at home on TV, you would blacken the circle marked "A". If you would rather see the movie at a movie theater, you would blacken the circle marked "B".

Be sure that your marks are black and completely fill the circle. If you make a mistake, erase it; don't cross it out.



Consulting Psychologists Press
577 College Avenue, Palo Alto, CA 94306

PLEASE READ THE INSTRUCTIONS ON THE OTHER SIDE OF THIS SHEET										USE LEAD PENCIL ONLY										MARK ONLY IN RESPONSE BOXES OR CIRCLES MARKS MUST COMPLETELY FILL THE CIRCLE																																																																																																																	
Print your last name first in these boxes. Skip one box, then print as much of your first name, etc., as fits. Blacken each box blacken the circle having the same letter as that box. For spaces, blacken a blank circle.																				TO MARK YOUR ANSWERS TO THE TYPE INDICATOR QUESTIONS FIND THE NUMBER OF THE QUESTION BELOW AND BLACKEN THE CIRCLE THAT HAS THE SAME LETTER AS THE ANSWER YOU CHOSE. ERASE COMPLETELY ANY STRAY MARKS OR CHANGED ANSWERS.																																																																																																																	
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VITA

Fredrick Irwin Holtzman was born in Los Angeles, California on December 10, 1946, the son of Mr. and Mrs. Maurice B. Holtzman. He attended public schools in California and graduated from high school in 1964. He attended the University of California at Los Angeles for two years and transferred to Biola University where he received a Bachelor of Arts with a major in Bible in 1969. He then attended Dallas Theological Seminary where he received a Master of Theology with a major in Old Testament. For several years he taught college courses at various institutions.

He then moved to Tennessee where in 1982 he began taking courses in computer science and related areas. He received a Master of Science with a Major in Adult Education at the University of Tennessee in 1985. He received his Doctor of Education Degree with a major in Technological and Adult Education in December of 1988.

He is a member of Pi Lambda Theta National Honor and Professional Association in Education and was elected to Who's Who Among American College Students.