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**A comparative study of the learning styles of Southeast Asian
and American Caucasian college students on two Seventh-day
Adventist campuses**

Lam-Phoon, Sally Chow-Hin, Ph.D.

Andrews University, 1987

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A COMPARATIVE STUDY OF THE LEARNING STYLES OF SOUTHEAST ASIAN
AND AMERICAN CAUCASIAN COLLEGE STUDENTS ON
TWO SEVENTH-DAY ADVENTIST CAMPUSES

A Dissertation
Presented in Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

by
Sally Lam-Phoon
September, 1986

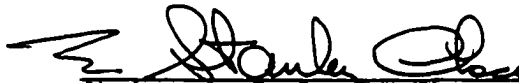
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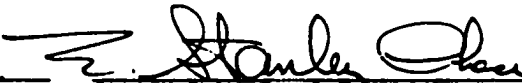
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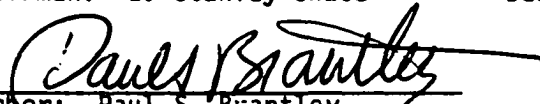
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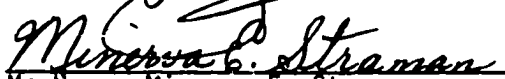

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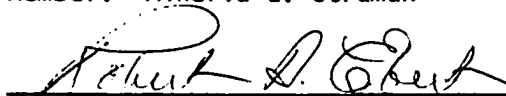

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Member: Wilfred G. A. Fletcher

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ABSTRACT

A COMPARATIVE STUDY OF THE LEARNING STYLES OF SOUTHEAST ASIAN
AND AMERICAN CAUCASIAN COLLEGE STUDENTS ON
TWO SEVENTH-DAY ADVENTIST CAMPUSES

by

Sally Lam-Phoon

Chairman: E. Stanley Chace, Ed.D.

ABSTRACT OF GRADUATE RESEARCH

Dissertation

Andrews University

School of Education

Title: A COMPARATIVE STUDY OF THE LEARNING STYLES OF SOUTHEAST ASIAN
AND AMERICAN CAUCASIAN COLLEGE STUDENTS ON TWO SEVENTH-DAY
ADVENTIST CAMPUSES.

Name of researcher: Sally Lam-Phoon

Name and degree
of faculty advisor: E. Stanley Chace, Ed.D.

Date completed: September, 1986

Problem

While much research has been conducted on learning style in the United States, no known empirical study has been done to compare the learning styles of Asian and Caucasian students on Seventh-day Adventist campuses. Therefore, the purpose of this study was to investigate the differences in learning-style preferences between a group of Asian students at Southeast Asia Union College in Singapore and Caucasian students at Andrews University in Michigan.

Method

This study employed the Productivity Environmental Preference Scale to measure the learning styles of the two groups. The data

which were computed and analyzed to test seven null hypotheses were provided by a total of 309 undergraduate students (143 Asians and 166 Caucasians).

Findings

1. Caucasians appear to have a higher preference for warmth, responsibility, intake, learning in the morning, and mobility. They exhibit a lower preference for auditory and visual learning than the Asians.

2. Males as compared to females have a higher preference for noise, tactile learning experiences, intake, responsibility, and warmth; they have a lower preference for learning in several ways, peer-oriented learning, and persistence.

3. Caucasian males, as compared to Asian males, appear to have a stronger preference for warmth, responsibility, persistence, and intake, and a lower preference for auditory learning and learning in the late morning.

4. Caucasian females have a higher preference for responsibility, warmth, mobility, learning in the morning, and intake than the Asian females; and they have a lower preference for visual and auditory learning experiences.

Conclusions

From an analysis of the findings, it appears that culture is a determinant of learning style as Asians are significantly different from Caucasians in their preferences. Sex appears to be a contributing factor as well.

DEDICATION

THIS DISSERTATION IS LOVINGLY DEDICATED TO MY HUSBAND,
CHEK-YAT PHOON, WHOSE UNFAILING SUPPORT AND DEEP INTEREST
IN MY PERSONAL GROWTH HAS ALWAYS BEEN AN INSPIRATION TO ME.

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Above all, my Heavenly Father, whose constant presence provided me with the assurance, peace, and confidence that this undertaking was all a part of His great plan. To Him be the glory and honor.

CHAPTER I

INTRODUCTION

Ever since the publication of Dewey's School and Society in 1900, educators have been reminded of the adverse effects of educating students en masse. The decades in the present century since Dewey have echoed the cry of prominent educators to seek that ideal in education --to afford every individual the opportunity of realizing his/her own potential instead of teaching or administering according to what is most convenient or most economically feasible for the entire student populace.

Bruner (1966) believed that individual differences should be considered in formulating a theory of instruction. It appears that the cries for individualization of instruction fell on listening ears in the 60s and 70s, for these two decades saw the mushrooming of alternative schools and programs to cater to differences in students. Somehow, teachers approached individualization without first developing adequate skills in diagnosis, prescription, efficient record keeping and conferencing (Talbert & Frase, 1972). This led to many aborted or unsuccessful attempts; nevertheless, the idea of meeting individual differences has continued to be seriously studied into the 1980s.

At the turn of this decade, Shane and Tabler (1981) called for educators to depart from traditional routines, recipes, and formulas, and to replace them with unique approaches created for each individual student. At about the same time, new directions in education were considered as fresh knowledge and insights were gained about learning styles. Emphasis was given to increased individualization of instruction and enriched flexibility of choice among varied program options (Messick & Associates, 1976). Research has generated various instruments designed as diagnostic tools to assist teachers in identifying the unique preferences and modes of functioning of their students (Gregorc, 1982). The Executive Director of NASSP, Scott Thompson (1979/1980), hailed the ability to determine learning styles as "the most promising development in curriculum and instruction in a generation. It is the most scientific way we know to individualize classroom instruction" (p. 75). Despite the abundance of literature and considerable dialogue on the subject of individualization, there still remains a huge chasm between theory and practice, a chasm that needs to be bridged if students are to find personal meaning in their learning.

Unfortunately, individualization has been limited in discussion primarily to elementary and secondary instruction, but colleges with their changing ethnic student compositions need to take a closer look at this significant approach to education. Particularly is this true of Seventh-day Adventist college campuses that have always attracted international students from feeder schools outside of the United States. According to the Committee for Foreign Students and International Policy (an arm of the American Council on Education),

the number of international students in American higher education will swell from the present 312,000 to over a million in the early 1990s (Wayman, 1984). Within a decade from now, 10 percent of all American college enrollment may be international students. Richard Berendzen, chairman of the Committee and president of American University, predicted that "by the 1990's the presence of foreign students could be one of the most powerful themes in American higher education" (p. 336). Further, Berendzen added that few colleges are prepared to cope with such an ~~influx of foreign students~~, and educators have a great deal to learn before they can teach international students effectively (cited in Scully, 1981, p. 1). An understanding of culture and its influence on learning and information processing is vital before educators can perceive the expectations that students bring to the classroom so that they can interpret the cultural signals their pupils are sending (Kneller, 1966).

As educators of the 1980s look forward to the next decade, it is considered imperative that researchers step forward in search of answers to the question of culture and student learning styles despite the politically sensitive nature of the subject, as pointed out by Gordon (1976) and Lesser (1976). Unless such an understanding exists, there will continue to be a lack of congruence between traditional instruction and cultural preferences, and the outcomes of the learning process will probably fall far short of its ultimate goal--the realization of individual potential.

New technologies are available--multimedia materials and classrooms, language laboratories, audio-listening centers, instructional television, videotapes, programmed texts, computer-aided

instruction, computer-managed instruction, and the fascinating range of electronic means for storing, transmitting, and displaying information--which provide educators with a rich variety of avenues by which to individualize instruction to match the diversity and pluralism of the college student population.

Statement of the Problem

Many different cultures of the world are represented by the student bodies of Seventh-day Adventist colleges. At Andrews University, 195 Asians (Andrews University, Opening Reports, 1985-1986), in addition to many other groups among its undergraduate and graduate students, registered. Seventh-day Adventists from Southeast Asia who have intentions of completing a degree in the United States usually attend Southeast Asia Union College for two to four years before transferring. Many Asians who are not able to enter their local universities, which are based on the British system, seek further education in the United States. Thus, Southeast Asia Union College in Singapore is a feeder school for Seventh-day Adventist colleges and universities in the United States since it is based on the American system of education.

The enrollment of international students has always been a unique feature of Seventh-day Adventist colleges. While support is often extended to assist the international students in settling down in their physical and social environment, much remains to be done in helping these students to settle into the academic environment. Anthropological studies have established the fact that cultural perspectives provide the screen through which information and

experience are filtered and interpreted (Roberts & Akinsanya, 1976). Therefore, it becomes imperative that professors in Seventh-day Adventist colleges understand such cultural differences by utilizing some objective tool so that their planning and instruction can be based upon valid empirical evidence to maximize learning by these students.

Purpose of the Study

The purpose of this study was to compare and contrast the learning styles of Asians at Southeast Asia Union College in Singapore and undergraduate Caucasians at Andrews University in Berrien Springs, Michigan, so that teachers might have a better understanding of their respective learning preferences. Based upon this information, teachers can plan more effectively for the instruction of these students. The instrument used for identification of these learning style preferences was the Productivity Environmental Preference Survey (PEPS) developed by Price, Dunn, and Dunn (1982).

Further, the study sought answers to the following questions:

1. Are Asians and Caucasians different in their learning-style preferences?
2. Do differences in learning-style preferences exist between the sexes in the entire sample?
3. Do differences exist in learning-style preferences between the sexes among the Asians or Caucasians?
4. Are there differences in learning-style preferences among the freshmen, sophomores, juniors, and seniors?

Statement of the Research Hypotheses

This study sought to answer one primary question as stated in the first research hypothesis and further considered six secondary research hypotheses.

1. There is a significant difference between the centroids of Asians and Caucasians on the 20 subscales found on the Productivity Environmental Preference Survey:

a. Noise level		
b. Light		
c. Temperature		
d. Design		
		ENVIRONMENTAL ELEMENTS
e. Motivation		
f. Persistence		
g. Responsibility		
h. Structure		EMOTIONAL ELEMENTS
i. Learning Alone/Peer Oriented		
j. Authority Figures Present		
k. Learning in Several Ways		SOCIOLOGICAL ELEMENTS
l. Auditory		
m. Visual		
n. Tactile		
o. Kinesthetic		
p. Intake Required		PHYSICAL ELEMENTS
q. Evening-Morning		
r. Late Morning		
s. Afternoon		
t. Mobility Needed		

2. There is a significant difference between the centroids of males and females in the entire sample on the 20 PEPS subscales.
3. There is a significant difference between the centroids of Asian and Caucasian males on the 20 PEPS subscales.
4. There is a significant difference between the centroids of Asian and Caucasian females on the 20 PEPS subscales.
5. There is a significant difference between the centroids of male and female Asians on the 20 PEPS subscales.
6. There is a significant difference between the centroids of male and female Caucasians on the 20 PEPS subscales.
7. There are significant differences in learning-style preferences among freshmen, sophomores, juniors, and seniors in the entire sample.

Significance of the Study

In a review of the literature on the subject of learning styles, there appeared to be no research as yet conducted regarding the differences between Asian and Caucasian students in Seventh-day Adventist colleges, although many cross-cultural studies have been conducted both within and outside the United States (Van Leeuwen, 1978). It is anticipated that this study will provide a springboard for further studies that will study other cultures that are represented in the student bodies on American Seventh-day Adventist college campuses.

In addition, the results of this study should provide faculty with an understanding of the differences between the Asian and Caucasian student so instructional techniques can be altered to accommodate

these students. Also, faculty who plan to go as missionary teachers to Southeast Asian countries may gain an insight into "how" Asian students learn. On the other hand, Asian students who plan to attend an American college will be more aware of the preferences of Caucasian students and might better understand them upon their arrival.

Theoretical Framework

Bloom (1976) contended that only one-third of all students really master the skills and knowledge presented in school, while 95 percent are capable of doing so. Though the problem was fully recognized by teachers and guidance workers, they misplaced the cause of learning failure as emotional blocks or personality conflicts while ignoring the concept of learning style. Riessman (1972) believed that a careful analysis of the way a child works and learns is of greater value than speculation about his emotional state which may not affect his learning as much as the methods his teacher uses to teach him. He felt that the important consideration was

. . . whether the methods of learning imposed by the teacher utilize sufficiently the strengths in a child's style of learning. . . . The challenge to every teacher is first how to identify the learning strengths in his pupils and then how to utilize them to overcome weaknesses. This is the central problem in the strategy of style. (pp. 87, 89)

Therefore, for the other 60 percent who are not responding as they should to instruction in the classroom, learning style, which research has established to be a significant factor in classroom achievement, could be the answer to the perplexing question of why they are not succeeding in school.

Mediation is the change that takes place when learning occurs. It refers to the process of how external stimuli are coded by the brain and connected with a set of responses in a new sequence. "The initial change is not one of building up a connection, but one of snapping into place an efficient mediating sequence" (Gagné, 1971, p. 24). This change is definitely internal and highly idiosyncratic, dependent very much upon the nature of the learner and his past experiences. In recent decades, research into learning styles has sought to answer the HOW of this mediation process.

Researchers such as Canfield and Lafferty, Dunn and Dunn, Gregorc, Hunt, Kolb, Ramirez and Castaneda, and Schmeck have developed varied definitions, models, instruments, and techniques for assessment of learning styles. Though differences exist among these models, essential similarities can be found (Dunn, DeBello, Brennan, & Murrain, 1981). James Keefe (1979) purports that there are three dimensions to learning style: cognitive style, affective style, and physiological style.

Cognitive Styles

Messick and Associates (1976) defined cognitive style as "information processing habits representing the learner's typical mode of perceiving, thinking, problem solving, and remembering" (p. 5). Cognitive style is different from mental ability, IQ, or aptitude. While abilities tell what kind of information is being processed (whether it be figural, symbolic, semantic, or behavioral), and by which operation (whether it be cognition, memory, divergent

production, or convergent production) (Guilford, 1967), styles tell HOW information is processed.

Keefe (1982) referred to cognitive styles as "preferred ways of perception, organization, and retention that are distinctive and consistent" (p. 45).

Affective Styles

Affective styles can only be inferred as they cannot be directly observed. They are the "motivational processes viewed as the learner's typical mode of arousing, directing, and sustaining behavior" (Keefe, 1979, p. 9), the result of culture, parental and peer pressure, school influences, values, and personality.

Physiological Styles

Physiological styles "are biologically-based modes of response that are founded on sex-related differences, personal nutrition and health, and accustomed reaction to the physical environment" (Keefe, 1979, p. 15).

Many researchers have studied cognitive style, but Kirby (1979) felt that, rather than concentrating on only one aspect, as many elements in learning style as possible should be included, especially for planning transfer strategies. Learning-style inventories provide educators with baseline information in designing instruction.

Dunn and Dunn and Price have combined the three broad categories of learning styles in their two instruments, the Learning Style Inventory (for students up to Grade 12) (1976) and the Productivity Preference Environmental Survey (Price, Dunn, & Dunn, 1982) for adults. They conceive learning to be affected by 20 elements from

five different sets of stimuli--the physical environment, the emotional frameworks in which the learners are functioning, the sociological setting, their own physical being and needs, and psychological factors. The last dimension mentioned is not part of the instruments as yet; the authors are considering inclusion of this psychological domain in the near future.

Since research into learning style is relatively new, many questions such as the following remain unanswered: Is learning style genetic or environmental? How early in the life of an individual are learning-style preferences formed? Does learning style change over the decades? Does an individual's learning style change in relationship to how she or he is taught, or does it remain constant? Can teachers effectively individualize instruction through modalities that they themselves do not prefer? Is there a relationship among the learning-style preferences of the culturally different, the learning disabled, the high and low achievers, and the talented? Do individuals with different styles learn at different rates? How does personality development relate to the development of learning styles? Which subjects are best taught through specific modalities? How can a knowledge of learning-style preferences be best applied in the classroom (does one match teacher and learner styles, or teach students to adapt to teacher styles, or train teachers to be flexible in their teaching approaches)?

This study seeks to determine the learning-style differences between two cultures within the Seventh-day Adventist dimension. Instead of confining it to one element of learning style, the environmental, emotional, sociological, and physical aspects will be studied.

As it appears that no previous studies have been conducted with this population, it was hoped that the results would refine the theoretical framework by adding to the existing body of knowledge about cultural differences in learning-style preferences. That refinement is discussed in Chapters 3 through 5.

Definition of Terms

Centroid is the multivariate equivalent of the center of gravity. The term "centroid," as used in this study, identifies a point in 20-dimensional space whose coordinates are the means of the 20 factors for the group.

Cognitive Style is one component of learning style that involves how the mind receives, perceives, processes, and stores information.

Culture is the learned and shared behavior (thoughts, acts, and feelings) of a certain group transmitted socially rather than genetically, and practiced either by the whole population or by some part of it (Kneller, 1966).

Learning Styles are characteristic cognitive, affective, and physiological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment (Keefe, 1979, p. 4).

According to the Price, Dunn, and Dunn instrument (1982), the Productivity Environmental Preference Survey, learning style is a composite picture of an individual's preferences in the environmental, emotional, sociological, and physical needs dimensions.

Negative Preference is indicated by a low score of 20-40 on the Productivity Environmental Preference Survey; a score of 0-19 indicates a strong negative preference. If an individual has a low score on the subscale of noise level, for example, it would mean that he has a negative preference for sound; i.e., he must have absolute quiet when he is learning.

Positive Preference is a definite preference that the individual has as is indicated by a score of 50 or more on the Productivity Environmental Preference Survey. A very strong positive preference is shown by a score over 80 which means that the person has to have this element present before learning is maximized.

Productivity Environmental Preference Survey (PEPS) is an instrument developed by Gary Price, and Kenneth and Rita Dunn (1982) that identifies adult personal learning preferences.

Seventh-day Adventist Colleges are colleges operated by the Seventh-day Adventist Church based on the Church's principles, aims, and objectives. They are referred to as "SDA colleges" in this study.

Southeast Asia Union Mission of Seventh-day Adventists comprises the countries of Malaysia, Singapore, Vietnam, the Khmer Republic, Laos, Burma, and Thailand.

Assumptions

This study was based on the following assumptions:

1. Though learning styles change in childhood and adolescence, they become more stable through the high-school years, and they indicate how a person can best perform in a learning situation.

2. When students are taught through their modality strengths, learning is maximized.
3. The Asian students included in this study are representative of the typical SDA Asian student who comes to the United States in search of higher education.
4. The Caucasian students included in this study are representative of the typical Caucasian student on SDA campuses in the United States.

Delimitations

The following criteria were used to establish the parameters of this study:

1. The study was restricted to two cultural groups, namely, Asian undergraduate students from Southeast Asia Union College and Caucasian undergraduate students from Andrews University.
2. All the students from Southeast Asia Union College participated in the study whereas only nine selected undergraduate classes at Andrews University were administered the survey.
3. To determine the learning styles of the two cultural groups, the Productivity Environmental Preference Survey was the only instrument used.
4. Learning-style variables were restricted to the 20 preferences indicated on the Productivity Environmental Preference Survey.

Limitations

1. The instrument was mailed to Southeast Asia Union College in Singapore for administration to the Asian students there. Though specific directions were given as to how it should be

administered, the fact remains that the researcher was not able to control the administration of the PEPS directly.

2. This study was also limited by the lack of knowing how much the westernized instruction at Southeast Asia Union College has modified the learning-style preferences of students there.
3. While the majority of the students at Southeast Asia Union College came from the countries of Indonesia, Malaysia, Singapore, and Thailand, three Koreans, two Cambodians, and one Filipino were included among the students.

Summary

Chapter 1 began with an introduction followed by a statement of the problem, the purpose of the study, the research hypotheses, and significance of the study. The theoretical framework for the study was presented; terms used were defined. Then the assumptions on which the study was based, the limitations and delimitations concluded Chapter 1.

Chapter 2 presents a review of the literature on the subject of learning styles; Chapter 3 discusses the sample used in this study, the instrumentation, procedure, the null hypotheses, and statistical analysis used. Chapter 4 summarizes the findings of the study, and Chapter 5 contains a discussion of the findings, conclusions, implications, and recommendations for further research.

CHAPTER II

REVIEW OF LITERATURE

An initial search of the literature was made via the Computer Reference Services available at the James White Library of Andrews University. A variety of descriptors were used, e.g., cultural differences, culture, cognitive style, learning style, college students, higher education, learning strategies, perceptual modes, and cross-cultural studies. Letters were written to the Learning Styles Network at St. John's University in New York, to author Rita Dunn, and to author Gary Price at Price Systems, Inc., in Lawrence, Kansas for material on the subject.

Additional sources which yielded information for this section include: Dissertation Abstracts International, Learning Styles Network: Annotated Bibliography: 1985, ERIC, and Current Index to Journals in Education.

The literature is discussed under the following main headings:

- (1) A Definition of Learning Style
- (2) A Brief History of Learning Style
- (3) Instruments Measuring Learning Style
- (4) Learning Style and Achievement

- (5) Learning Styles of Different Cultural Groups
- (6) Learning Styles of Males and Females
- (7) The Stability of Learning Style Preferences
- (8) Research with the PEPS

A Definition of Learning Style

Learning style has been conceptualized as a personally preferred way of dealing with information and experience for learning that crosses content areas (Della-Dora & Blanchard, 1979). It refers to HOW people move toward attaining a certain desired piece of information or skill. Gregorc (1979) defined it as consisting "of distinctive behaviors which serve as indicators of how a person learns from, and adapts to his environment. It also gives clues as to how a person's mind operates" (p. 234).

At the NASSP Task Force on Learning Style and Brain Behavior meeting in 1983, learning style was defined as a composite of three elements--cognitive, affective, and physiological behaviors--which indicate how learners perceive, interact with, and respond to the learning environment (Dunn, Dunn, & Freeley, 1984). Price, Dunn, and Dunn (1982) perceived it as the manner in which 20 elements from four basic stimuli (environmental, emotional, sociological, and physical) affect a person's learning. A fifth basic stimulus, the psychological, is currently being studied, and will soon be included as a part of their instruments: the Learning Style Inventory and the Productivity Environmental Preference Survey.

Learning style entails many elements, and they are not usually "either-or" extremes. The absence of one element does not necessarily

imply the presence of an opposite element. Some learning style inventories deal with the degree to which one possesses an element; others deal merely with the presence or absence of the element. A later section in this chapter takes a closer look at some popular instruments for determining learning style.

Cognitive Style

The terms "learning style" and "cognitive style" have often been used synonymously. Though both refer to HOW people move toward attaining a certain desired piece of information or skill, they should not be used interchangeably. The main difference between cognitive and learning styles lies in the specificity within the context. According to Kirby (1979), cognitive style is more specific, usually focusing on just one style dimension with two polar extremes, for example, field dependent or field independent.

"Cognitive style" has been defined by several researchers in different ways. Cross (1976) defined it as "the characteristic ways of using the mind" (p. 112); Messick (1976) saw it as "a person's typical modes of perceiving, remembering, thinking, and problem solving" (p. 5). Tyler (1978) said that it is a diverse assortment of characteristics having to do with the different ways people perceive and conceptualize the sights and sounds, words and meanings with which the world confronts them (p. 148).

Therefore, cognitive style pertains to how the mind perceives, processes, and stores information and is only one aspect of learning style. On the other hand, learning style encompasses a much broader

perspective which includes, in addition to the cognitive, other dimensions such as the affective, the physiological, and the psychological.

A Brief History of Learning Style

The history of learning style has its roots in the field of psychology and can be traced back to the late 1800s. Jung was considered an early contributor to cognitive-style research. While others saw behavior as random, Jung saw patterns which he called "psychological types." He believed that there are patterns according to which people prefer to perceive, direct their energy and attention, make judgments and handle situations (Jung, 1923).

Jung divided people into two categories (introverts and extroverts), with four functions: intuiting, sensing, thinking, and feeling. Based on Jung's theory, Katharine Briggs and her daughter, Isabel Myers, spent a lifetime developing and refining what is known as the Myers-Briggs Type Indicator (MBTI) which is an accurate and standardized measure of personality types (Lawrence, 1984). According to Myers (cited in DiTiberio, 1983), learning style is one facet of temperament. For example, extroverts focus on the outer world and like to be actively involved in it; they tend to respond to teachers' questions spontaneously. Because they enjoy action, they have to take frequent breaks from quiet study. Introverts, on the other hand, prefer to study alone in a quiet environment and often prefer writing to speaking.

Sensing types observe the world through their five senses and learn better through direct hands-on experiences, while the intuitive may look for implications, possibilities, the subtle, and the

intangible and neglect details. The thinking types learn best when "given a logical rationale and a set of performance objectives" (DiTiberio, 1983, p. 4); the feeling types care about human values and how people are affected by decisions. They are motivated by a warm and personal relationship with the teacher.

In 1937, Allport discussed the style of living and adapting as being influenced by distinctive personality types. He is the one who can be credited for coining the term "cognitive style" (Keefe, 1979; Kirby, 1979). Prior to the 1940s, relationships between memory and oral or visual teaching methods appeared to dominate the research, but findings were conflicting.

In the 1940s, a series of studies conducted by Thurstone and later by Guilford were related to learning style. These studies hypothesized that two factors, speed and flexibility, were closely related to personality and temperament (Sperry, 1972).

Witkin, the most famous researcher in the field, is known as "The Father of Cognitive Style" (Kirby, 1979). After World War II, Asch, Witkin, and their colleagues at Brooklyn College identified a perceptual trait--field-dependence-independence (an individual's ability to perceive and manipulate a figure with or without a ground)--and demonstrated its relationship to personality. Further studies led to the idea of the analytic versus global dimension in perceptual and cognitive functions. By 1962, Witkin and his associates came to believe that an individual's perceptions were a part of a constellation of components which could be referred to as a person's psychological differentiation towards learning (Sperry, 1972).

Three notable groups in the area of learning-style research were Brooklyn College, the Menninger Foundation, and the Fels Institute. Witkin, who studied field dependence and independence, was associated with Brooklyn College.

At the Menninger Foundation, Holtzman and Gardner (cited in Keefe, 1979) researched individual variations in assimilation in memory. To them, "levelers" tend to assimilate new information into previous categories, while "sharpeners" tend to differentiate old information from new.

Kagan and his associates at the Fels Institute focused their attention on analytic styles of thinking. In 1964, the group came to the conclusion that the analytic-nonanalytic style of a person was related to two important variables: reflection (the tendency to analyze a configuration into its component parts) and impulsivity (the tendency to make immediate and often inaccurate responses) (Sperry, 1972).

In the 60s, there was a broadening of interest in cognitive styles which led to the appearance of a number of instruments to measure learning/cognitive style preferences.

French developed a matrix for instructors to check off characteristics observed in their students. Ramirez and Castaneda based their research on the Witkin model. Canfield and Lafferty's Learning Style Inventory for both younger and older adults measured students' self-reported and rank preferences (all cited by Kirby, 1979).

In 1971, Joseph Hill looked at cognitive style primarily within the educational setting. His complex inventory (which is not commercially available as it requires training before anyone can use

it) yields a computer printout of a "cognitive style map" which displays a person's preferred ways of learning on 27 variables (Kirby, 1979).

Early research in adult learning styles was conducted by Tallmadge and Shearer (1969, 1971), especially as it related to learner characteristics, types of learning, instructional methods, and subject variables. In the first investigation, the authors were concerned primarily with relationships existing between adult learning styles and instructional methods. A battery of aptitude, interest, and personality tests was administered to 231 enlisted Navy men; a total of 28 individually different measures were obtained for each subject. Two distinct instructional techniques, inductive and deductive, were employed to teach the subject matter. The researchers reported a significant interaction (at the .001 level) among the variables and concluded that their data strongly suggested the existence of individual learning styles.

In a subsequent investigation in 1971, Tallmadge and Shearer tried to determine whether type of teaching (inductive or deductive) or type of learning (understanding or rote) was responsible for the interaction effects observed in their 1969 study. They substantiated that neither subject matter nor type of learning appeared to be related to the interaction evidenced between learner characteristics and instructional methods in their earlier work. Also, they projected that significant future developments in learning styles would involve non-cognitive characteristics measured on specifically designed instruments based on item analysis.

In the early 1970s, two books appeared on the market which focused on the emerging concept of learning styles. One was written by Kolb (1971) and the other by Dunn and Dunn (1972). Kolb's cognitive style concept was concerned with how the adult mind functioned, while the Dunns posited a model with 18 characteristics.

Based on the Jungian theoretical approach, Kolb's Learning Style Inventory (1977) is self-descriptive with two basic dimensions (abstract-concrete and active-reflective) and with four styles, namely, the converger, the diverger, the assimilator, and the accommodator. Several other investigators of learning style who share much in common with Kolb and Jungian typology are Hagberg and Leider (1978) who worked with "excursion styles" McKeeney and Keen (1974), McCarthy (1980), and Gregorc (1982). McCarthy's 4-MAT System (1980) is based on learning styles, right-left brain dominance, creativity, management, art, and dance movement.

Gregorc (1982), like Kolb, looked at the abstract-concrete dimension, but his main focus was on whether the learner used a random or sequential mode in processing information. McKeeney and Keen (1974) were concerned with how the individual's type of cognition fit the type of task he or she was involved in. They were interested in how different styles could be useful in different situations.

Hunt (1979) worked with a paragraph completion method for 15 years. In his instrument, the students are asked to complete the thought in several topics relating to their feelings and preferences and thus determine the conceptual levels they are in. He proposed three levels in his model, ranging from a highly structured environment at the "A" level, to a growing-towards-autonomy level at "C."

One of the most widely used instruments for testing learning style is the Learning Style Inventory by Dunn, Dunn, and Price (1976). Consisting of 104 items, this instrument is used for elementary and high-school students. In 1979, the Dunns adapted the instrument for college students and adults and published the Productivity Environmental Preference Survey (Price, Dunn, & Dunn, 1982).

The Learning Styles Network has been established at St. John's University, with Rita Dunn as director, to answer the need for a national network to disseminate information about developments in the field of learning and teaching style as well as to encourage research. The network publishes three annual newsletters that summarize the latest research, practical applications, and experimental programs; announce up-coming conferences, institutes, and in-service workshops for teachers and administrators; describe publications in the field; identify resource personnel and exemplary school sites; and provide an update of bibliographies of publications, films, tapes, and video-tapes.

The National Association of Secondary School Principals has shown great interest in the study of learning style and, in August 1983, the NASSP Task Force on Learning Style and Brain Behavior met for the first time. At the meeting, administrators were urged to test students and teachers for style so that complementary conditions could be effected in the learning environment in order to increase achievement (Dunn, Dunn, & Freeley, 1984).

Since the appearance of standardized instruments to measure learning style and cognitive style, much research has been conducted in these areas.

Instruments Measuring Learning Style

In the previous chapter, under the section, "Theoretical Framework," it was mentioned that learning style may be made up of three dimensions: cognitive style, affective style, and physiological style. Instruments are available to measure each or all of these aspects. This section describes some standardized instruments designed to measure learning style. They are grouped under: General Learning Style Instruments, Cognitive Style Instruments, Affective Style Instruments, and Physiological Style Instruments.

General Learning Style Instruments

There appear to be only two instruments that attempt to measure all three dimensions of learning style--The Learning Style Inventory by Dunn, Dunn, and Price (1976) and the adult version of it, the Productivity Environmental Preference Scale (Price, Dunn, & Dunn, 1982).

The Learning Style Inventory (LSI) and The Productivity Environmental Preference Scale (PEPS)

The Learning Style Inventory was developed to measure the learning styles of students in Grades 3 to 12. The 1978 version contained 104 items with a true-false format. In the 1983 version, the format was revised. Students in Grades 3 to 5 continued to use the inventory's original true-false format while students in Grades 6 to 12 responded by using a 5-point Likert scale (Price, 1983) similar to the one used on the PEPS.

The PEPS, which contains 100 items, is useful in analyzing the conditions under which an adult is most likely to produce or learn.

Both instruments are alike, except for the fact that, under the dimension of emotionality, where there is only one element in the PEPS for motivation, the Learning Style Inventory has four elements under motivation: self-motivated, adult-motivated, teacher-motivated, and unmotivated.

Both instruments can be administered within 30 minutes or less, and the answer sheets are computer-scored by Price Systems, Inc., in Lawrence, Kansas. Scores are indicated on a graph, using standard scores with a mean of 50 and a standard deviation of 10. The graph is divided into three sections: 20-40 indicating a strong negative preference, 40-60 indicating elements which do not affect a student's learning, 60-80 indicating a strong positive preference. In general, students respond strongly to between 6 and 14 elements of style (Dunn, 1984).

On the Learning Style Inventory, a consistency score indicates the degree to which the student responded consistently to questions which assessed the same learning-style preference. Any score below 70 indicates inconsistency on the responses, which are then of questionable value (Sage, 1984).

In 1980, the authors revised their paradigm to include the psychological aspects (analytic-global, left-right-brained, and reflective-impulsive). The next revision of the two instruments would incorporate this new dimension (Dunn, 1984).

Cognitive Style Instruments

Cognitive style instruments measure the learner's typical way of perceiving, thinking, problem solving, and remembering (Keefe, 1982).

Ramirez and Castaneda's Child Rating Form (cited by Kirby, 1979), the Edmonds Learning Style Identification Exercise by Reinert (1982), the Gregorc Style Delineator (Keefe, 1982), the Group Embedded Figures Test (Witkin, Oltman, Raskin, & Karp, 1971), Hill's Cognitive Style Mapping Inventory (1971), Kolb's Learning Style Inventory (1979), and the Swassing-Barbe Modality Index (Swassing & Barbe, 1979) are among the instruments that measure cognitive style.

Child Rating Form

Ramirez and Castaneda formulated a Child Rating Form that teachers can use with direct observation of the student. On a 1-5 rating scale, the teacher determines how the student functions in various specific situations. Both field-sensitive and field-independent behaviors are noted. Also available is an instructor rating form that students can use in determining the teacher's style. Basically, the instrument measures field dependence versus field independence (cited by Kirby, 1979).

Edmond's Learning Style Identification Exercise

ELSIE is concerned with how students internalize individual words and is a simple method of detecting perceptual modes. Administration of the instrument involves a set of 50 common English words read aloud to the students who are to indicate spontaneously their

reaction to each word according to the following responses:

1. Visualization--a mental picture of some object or activity
2. Written Word--a mental picture of the word spelled out
3. Listening--no mental picture but the sound of the word carries meaning
4. Activity--physical or emotional feeling about the word (Keefe, 1982).

The scores in the above categories are then profiled on a stanine scale arranged as bands above and below the median of a pilot group.

ELSIE's author, Reinert, originally developed the instrument to help him individualize his German classes more effectively. Since then, ELSIE has been used extensively by the Washington Literacy Council, and a Spanish version has been designed. Permission to use ELSIE is granted without charge to any non-commercial user (Reinert, 1982).

Gregorc Style Delineator

Gregorc's model (Keefe, 1982) looks at the following dimensions of learning style:

C O N C R E T E	V S .	A B S T R A C T
CS = Concrete Sequential		AS = Abstract Sequential
CR = Concrete Random		AR = Abstract Random

The instrument is a short self-report inventory consisting of 40 words in 10 sets of four each. The students rank their impressions of each word, identifying their spontaneous reactions with the learning environment. The scores are profiled on a bi-dimensional matrix that

shows the four styles (CS, CR, AS, or AR). It is reported that 90 percent of those tested have a definite preference in one or two of the four categories (ibid.).

Group Embedded Figures Test

A group figures test was developed by Witkin and his associates (1971) at Brooklyn College, which had as its origin the Embedded Figures Test which was designed originally to assess cognitive functioning and social behavior among other factors. The current group version uses picture mazes (optical illusions) to assess cognitive style. The GEFT is short and easy to administer and actually measures analytical ability; global ability is inferred. It has been widely used in research and in classrooms (ibid).

Hill's Cognitive Style Mapping Inventory

Hill's inventory (1971) was designed specifically for the educational setting. A preference inventory is utilized which yields a computer printout of a cognitive-style map. The map displays the student's preferred ways of learning. Hill believed that family background, life experiences, and personal goals make each person unique. He expressed cognitive style in terms of a mathematical set theory, simplified as follows:

Cognitive Style = Symbols & Meanings x Cultural Determinants x Modalities of Inference x Memory Functions

The fourth set, dealing with memory functions, has never been completed for lack of appropriate data, as Hill died in 1978. Thus, his present theory and practice of cognitive mapping is based on the interrelationship of the first three dimensions. Each dimension is

made up of several elements, e.g., symbols include words, numbers, sensory data, and psychomotor representations; cultural determinants refer to family and peer influences and personal-style preferences; and modalities of inference to the inductive and deductive reasoning processes.

This inventory remains unpublished; training is required before one can use it. It lacks a current research base and its application in schools is limited (DeNike & Strother, 1976; Hill, 1971; Keefe, 1982).

Kolb's Learning Styles Inventory

Kolb's self-descriptive inventory (Kolb, 1979; & Kirby, 1979) has a simple format, is adult-oriented, and is popularly used in business, management, and training concerns. Respondents rank-order nine sets of four words, each word representing one of four learning modes. Two basic dimensions are measured--abstract-concrete and active-reflective--with four styles: convergers, divergers, assimilators, accommodators.

Convergers are practical, choosing to deal with things rather than people. Their dominant learning ability is abstract reasoning, and they do best where they can focus on specific problems through hypothetical-deductive reasoning. They usually specialize in the physical sciences.

Divergers are the opposite of convergers. Their abilities lie in concrete experience and reflective observation; their greatest strength is imaginative ability. They are interested in people, artistically inclined, and often specialize in the arts. Divergers

tend to be emotional, and they enjoy working with ideas in areas such as the humanities and liberal arts.

Assimilators are less interested in people and more concerned with abstract concepts and theories though they are not very concerned about the practical use of such. Their dominant learning abilities are abstract conceptualization and reflective observation. This learning style is characteristic of the basic sciences and mathematics.

Accommodators have the opposite strengths of the assimilators. They are best at concrete experience and active experimentation and enjoy doing things, carrying out plans and experiments, and becoming involved in new experiences. They tend to be risk takers and excel in situations that call for adapting to specific, immediate circumstances. While they are at ease with other people, they may be perceived as impatient and "pushy" at times.

The Swassing-Barbe Modality Index

Barbe and Swassing (1979) developed a simple instrument which deals with a matching-to-sample task that involves four shapes--a square, a triangle, a circle, and a heart. A sequence of shapes is presented, and the person tested is expected to reproduce the sequence using a pool of loose shapes. The results of the SBMI are reported in percentage scores for the visual, auditory, and kinesthetic modalities. Administration and scoring are both easy. The instrument can be used both for young students as well as adults.

Affective Style Instruments

Few instruments have been developed to measure the affective dimension of learning style; two of them are Hunt's Paragraph Completion Method (1979) or the PCM and the I/E Scale by Julian Rotter (cited in Keefe, 1982).

The Paragraph Completion Method

The PCM is a semi-projective method to assess "conceptual level", a motivational trait identified by David Hunt at the Ontario Institute for the Study of Education. This trait describes the degree of structure a person needs for effective learning. Respondents are given six incomplete statements, and they are asked to write at least three sentences that reflect their feelings toward the subject. The topics dealt with in the instrument are:

1. What I think about rules
2. When I am criticized
3. What I think about parents
4. When someone does not agree with me
5. When I am not sure
6. When I am told what to do (Keefe, 1982, p. 40).

Responses are scored on a scale of 0-3 in terms of their conceptual complexity and personal maturity and the scoring requires the skill of trained personnel.

The I/E Scale

Developed by Rotter, the I/E scale is one instrument that assesses "locus of control" which is defined as:

. . . the forces within an individual's personality that direct or stimulate action. These perceptions of causality may be internal or external. The internal individuals think of themselves as responsible for their own behavior, deserving praise for successes and blame for failures. The external individuals see outer forces, circumstances beyond their

control, luck, or other people, as responsible for what happens. There is some evidence that a greater sense of internality can be developed. Internality is a highly desirable school-rated trait. (Keefe, 1982, p. 49)

The instrument contains 29 pairs of alternatives that describe certain events, and respondents are asked to select the one statement of each pair that they believe to be true. Examples of such statements are:

- a. Most of the problems in people's lives are a result of bad luck.
- b. People's problems come from the mistakes they make (Keefe, 1982, p. 49).

Scoring is simple with the I/E Scale.

Physiological Style Instruments

The third domain of learning style is the most discernible as it has to do with the physical environment, health and nutrition, and sexual differences. No specific instruments have been developed to measure physiological styles, but Dunn, Dunn, and Price (1976) have incorporated environmental elements and time rhythms in the Learning Style Inventory and the PEPS (Price, Dunn & Dunn, 1982).

Rita and Kenneth Dunn have developed a "Questionnaire on Time" that analyzes a person's preferred working times during the day (Keefe, 1982).

Learning Style and Achievement

From the 60s through the 80s, research into learning style and achievement has, with a few scattered exceptions, yielded consistent results: achievement scores increased when students were taught through their learning preferences or preferred modality strengths (Dunn, Price, Bacilious, & Zenhausern, 1982).

This is reflected in studies conducted from kindergarten through college levels. Carbo (1980), who was awarded the ASCD national award for the best dissertation of 1980, used kindergarteners in her study and found that, when taught through their perceptual strengths, kindergartners are more likely to learn and retain information.

At the elementary level, several researches indicated that achievement increased when students were taught through their modality strengths. Urbschat (1977) discovered that first graders performed better when they were matched to their preferred strengths. Carruthers and Young (1982), Kuchinskas (1979), Perrin (1982), Pizzo (1981), and Virostko (1983) all came to similar conclusions in their studies of elementary-school children. Della Valle (1984) analyzed the relationship between preferences for mobility and achievement among seventh graders. When students were placed in settings that were congruent with their diagnosed learning-style preferences for mobility, achievement scores increased beyond an impressive statistically significant .001 level. Krinsky (1982) also found that students who preferred bright light performed statistically better when tested in brightly lit areas; those who preferred dim light did equally as well in a low-light setting. Both groups failed to perform as well when tested in mismatched situations.

At the junior high-school level, Trautman (1979) reported statistically significant gains whenever instructional materials in social studies were matched correctly to the students' cognitive styles (whether global or analytic). Similarly, Douglass (1979) found that deductive students taught through deductive biology materials and

inductive students taught through inductive materials each achieved better than when mismatched. Tanenbaum (1982) studied the field-independent or dependent components of cognitive style on test scores received on a health science nutrition unit. Whenever cognitive style and learning activities were matched, students did significantly better.

Lynch (1981) evidenced that matching of scheduled academic classes of 136 secondary students with their time preferences had a statistically significant impact on the reduction of truancy among chronic and initial offenders. Other researchers who experimented with matching different elements such as design preferences (Hodges, 1985), perceptual strengths (Kroon, 1985), sociological preferences (DeBello, 1985), and intake (MacMurren, 1985) all found that students in an environment complementary to their preferences performed much better ($p < .001$ except in the case of Kroon where $p < .01$) than those in mismatched situations.

Another study conducted by Cafferty (1980) involved 1,689 matched or mismatched teacher-student pairs among sophomore and junior high-school students. The overall findings demonstrated that the greater the degree of congruence between the teachers' and students' styles, the higher the GPA. Conversely, the greater the dissonance between the two, the lower the GPA. Therefore, it does appear that, when students are taught through their preferred learning modes or placed in their preferred environments, achievement is increased significantly.

Domino (1970), who matched and mismatched college students and learning styles at the college level, discovered that students,

taught in ways in which they believed they learned, scored higher on tests, factual knowledge, and attitude than those taught in a manner dissonant from their perceived strengths. Farr (1971) and Brown (1978) reported that the college students in their investigations accurately predicted the modality in which they would achieve superior academic performance. Findings also evidenced that, where teaching and learning styles complemented each other, achievement was greater. Similarly, Adams (1983) found that among the 604 junior college students in his study, those who were well-matched with teachers received higher GPAs, fewer low grades, and required less individual attention. In an experiment conducted with teachers during in-service training, Freeley (1984) found that, when teachers' time and perceptual preferences were accommodated during training, they increased implementation of the strategies taught (significant at the .01 level) upon returning to their schools.

Six studies came up with insignificant results in achievement gains when teaching styles were matched with student preferences. Pascal (1971) matched 185 collegians with their preferred learning styles in a psychology course. The findings revealed no difference in achievement or in attitude towards the subject. Pascal attributed the lack of significant differences among the methods to the involvement of an instructionally well-liked lecturer.

In 1976, Scerba came to the conclusion that it was not worth the time and expense to match students to instruction based on his findings that matching student learning styles to comparable teaching strategies was not particularly effective under the limitations of using two self-report instruments--the Learning Style Inventory by

Canfield and Lafferty and the Teaching Styles Inventory by Canfield and Canfield--with a community college population. He discovered in his research that some teaching strategies were more effective than others and should be incorporated into instructors' teaching styles. Guild (1980) agreed that matching student learning styles to teaching style was not feasible. What she recommended was for teachers to have "style-flex" in order to accommodate the varied styles present among the students.

In another study, Cupke (1980) also found that matching students' learning preferences with compatible instructional styles did not result in increased achievement. The researcher worked with a population of ethnic minorities and women--164 freshmen and 24 sophomores. In a commentary on this study ("Diverse Populations of 'New' College Students Studied with Mixed Results"), the Learning Styles Network Newsletter (1982) noted the inadequacy of the research design and the failure of the researcher to control for variables like sample sizes, reentry adjustment problems, age, and sex of subjects.

Katz (1981) matched undergraduate and graduate college students' learning styles with two instructional methods. Undergraduates in complementary conditions scored higher on problem solving and required less study time than others in mismatched conditions. However, the graduate students did not seem to be affected by mismatched conditions; they scored higher and studied less regardless of how they were taught.

Bouldin (1982) utilized Hill's Cognitive Mapping Inventory to classify the cognitive learning styles of 74 students at Roane State Community College in Tennessee. Two treatments, consisting of a

visual and an auditory presentation of the same material, were employed for the instruction of basic math skills. The findings revealed no significant difference in skills acquisition. However, a very slight tendency was detected for subjects with an auditory cognitive style to find the visual treatment unacceptable. The researcher came to the conclusion that perhaps the relatively small gains for basic skills indicated that the use of the Hill inventory in that environment was suspect.

In conclusion, general research findings support the theory that responding to students' learning styles leads to increased achievement and that the reverse occurs when there is dissonance between students' learning preferences and teaching methods or types of materials.

Learning Styles of Different Cultural Groups

Scholars have argued that learning style emerges from the cultural upbringing (Goodman, 1970; Ramirez & Castenada, 1974). In his summary of cross-cultural research into individual styles, Triandis (1980) concluded that ecology, social structure, conformity, and biology all contribute to individual cognitive style.

It appears that individual reactions to sound, light and temperature variations, formal/informal design, perceptual strengths, time-of-day preferences, intake needs, and mobility are all biological. Sociological and emotional preferences, however, tend to be more developmental and related to life experiences (Restak, 1979; Schmeck & Lockhart, 1983; Thies, 1979, 1983; Zenhausern & Dunn, 1984).

Within the U.S., Witkin's hypothesis that cultural groups which stress traditional social values are more field dependent than American or Americanized groups in which these values are less rigidly enforced has been validated by several researches. Witkin and Berry (1975), Laosa (1978), and Ramirez and Castaneda (1974) all agree that societal child-rearing practices play a large role in determining an individual's style along the dimension of field independence or dependence. Studies suggest that where children grow up in a society that encourages them to identify with an extended family or some other form of shared function group, they tend to become field dependent. Strict disciplinary practices and authoritarian parents who maintain close family connections tend to produce field-dependent children, whereas parents who do not exercise strict control over their children tend to produce field-independent children.

Gay (1978) reported that nearly all minority children in the U.S. are field dependent. Black American children have been found to be more feeling-oriented and people-oriented because they grow up in large families characterized by intense personal human interaction. In contrast to this, research has suggested that white children are very object-oriented as they have numerous opportunities to manipulate objects. Hale (1978) cited Young who wrote about the physical closeness evident between black infants and adults. She noticed that in black families few objects were given to children. Even when toys were given them, the children were often redirected to feeling the holder's face as a substitute; the personal was often substituted for the impersonal. Perhaps this is one reason why black children do not perform as well in an environment that is filled with

cold educational hardware and technology; they need the warm interpersonal interaction they are accustomed to in the home environment.

Some scholars suggest that the people-orientation quality of black Americans is part of an African heritage. Hale (1978) reported that Dawson found greater field dependence among the people of the Temne tribe than among the members of the Mende groups in Sierra Leone, West Africa. He discovered that the same relationships articulated by Witkin about group socialization practices were evident in the cognitive styles of these tribes. Among the characteristics of the Temne were stress on conformity to adult authority, severe discipline, physical punishment, and maternal dominance in child rearing. While travelling through Africa, Hale, who was interested in the dolls with which African children play, surprisingly discovered that African children do not play with dolls but with their mother's babies! This may account for the field dependence trait found among Africans.

In a more recent study, Bowen (1984) used Hill's Cognitive Style Inventory and Witkin's Group Embedded Figures Test with students in two countries of Africa--Nigeria in the west and Kenya in the east. He discovered the Nigerians were 100 percent field dependent, and 84 percent of the Kenyans were field dependent. Theology students appeared to be more field dependent than non-theology students; students in the arts more field dependent than science students. The majority of the students in this study preferred visual and tactile modes of learning rather than the auditory mode. The researcher concluded that there were few differences between east and west African students.

Tappenden (1983) compared Afro-American and Caucasian 11th- and 12th-grade students. She found that Afro-American students had a preference for bright light while learning; had higher self-motivation, persistence, and responsibility; preferred learning alone but wanted adult motivation; preferred instruction through the visual mode; and functioned better in the afternoon. The Caucasians reported a high preference for warmer temperatures while learning, a greater desire for an informal environment that allowed them mobility, and learning with their peers.

Like black Americans, Mexican-American children (Chicanos) tend to be field dependent. In his observations of Chicano culture, Cortes (1978) found that traditional Mexican-American homes stress the importance of courtesy (the mark of a well-educated person), especially to authority figures like teachers. In working with Chicano university students with excellent English skills, he noticed the tendency for them to maintain their reserve and not speak out. Ramirez and Castaneda (1974) found that Chicanos preferred human-relational and incentive-motivational learning styles. They prefer to work with others to achieve a common goal rather than work alone; they are sensitive to the feelings and opinions of others, especially those of the teacher. They enjoy personal interaction with their teachers and look up to them as role models. Subject matter that is related to personal interests and experiences and concepts presented in a humanized format or story form are more easily grasped by Chicanos.

In a study of the learning styles of native Americans, Burgess (1978) found them non-competitive, preferring to learn by example rather than by precept. He observed the following contrasts

between the native Americans and the Anglo-Americans:

Anglo children were more concerned about their personal achievement, were more self-centered in describing happiness and pleasure, and were more troubled about getting their own way. They were less concerned about property and possessions, possibly an indication of their relative wealth. The possession of food and clothing was an important factor in the daily lives of the Native American children, while Anglos probably took these for granted.

Community members play a greater part in producing both pleasant and unpleasant emotions in Native American children. Both nuclear and extended families played a greater part in the experiences of life. Anglo children did associate family members with their feelings, but were much more likely to associate them with punishment or negative emotions. Apparently, the Native American community outside of the family has considerable influence on children, and Native American parents are less likely to be thought of in terms of punishment or unpleasantness. (p. 48)

Witkin, Price-Williams, Berini, Christensen, Oltman, Ramirez, and Van Meel (1974) compared a traditional and a modern village in each of three countries: Holland, Italy, and Mexico. They found that those from traditional villages characterized by conformity to family, religious, and political authority exhibited field-dependent traits. Along these same lines, Chiu (quoted in Hsi & Lim, 1977), who compared subjects in rural Taiwan with rural Americans, found the Chinese definitely more field dependent, while the Americans were field independent. Park and Gallimore's research (1975) with another group of Asians led to different conclusions. Though Asians appeared to be more field dependent in many studies, they found their sample of fourth- to eighth-grade Koreans field independent. Those from urban areas were more field independent than their rural counterparts due to the effects of westernization. The authors also attributed the findings to parental stress on educational achievement in deference to social conformity.

In 1981, Harvey et al. studied three sixth-grade classes with 90 students, using Hill's instrument. He found the Caucasians to be predominantly field independent while the Polynesian children (Tongan, Samoan and Hawaiian) exhibited field dependence in their cognitive style. The Samoan group were the least field dependent of the three groups as they exhibited a preference for working independently. In the multi-cultural setting of the classes involved in this study, the students preferred to learn by listening and to work under supervision. This may be reflective of Polynesian learning style as 56 percent of the sample were Polynesian. The group also enjoyed listening to music while studying math. There was no difference between boys and girls in their learning style.

Sue and Kirk (1972) observed that Asian Americans appeared less autonomous, more dependent on authority figures and structure, generally more obedient, conservative, conforming, and inhibited. This is attributed to Asian cultural values based on Confucian ethics which emphasize restraint of strong emotions, obedience to authority, dependence upon the family, formality, and interpersonal relations as contrasted to emphasis on spontaneity, assertiveness, and informality among Caucasians. They also found that Asian Americans were less oriented to theoretical, abstract ideas and concepts but tended to evaluate ideas on the basis of how practical they were, as is typical of field-dependent subjects.

Consistent with the above findings, Rukvichitkul (1984), who went to the provinces of northern Thailand (Chiengmai and Lumpang) in 1983 to collect data on cognitive style, discovered that Thai adult learners tended to have a low level of field independence. However,

the males had a higher level of field independence than the females. Another Asian researcher, Orumchian (1984), found that his group of Indochinese immigrant students, who were in Grades 10 to 12 and who had been in the United States from one to five years, demonstrated a distinct preference for field-dependence.

Dawson, Young, and Choi (1974) hypothesized that the more harsh the socialization process in a society the more field independent its citizens. On a continuum ranging from field independence to field dependence, they found that the Eskimos ranked first, followed by the Hong Kong Chinese, then the African Europeans, and, lastly, the African Blacks. According to MacArthur (1971) the Igloolik Eskimos are field independent as they are encouraged to be separate from family control, to exercise their own initiative and resourcefulness during their up-bringing, and to control their aggression.

As the composition of the student body in the U.S. moves towards greater diversity, the proposition of Gibbs (1981) to be actively engaged in looking at a cross-cultural distribution of learning styles should be taken more seriously. It is hoped that, within the next few decades, more investigations will be conducted with the heterogeneous populations of American schools and colleges.

Learning Styles of Males and Females

Research comparing the learning styles of male and female students has come to varying conclusions. Witkin, Moore, Goodenough, and Cox (1977) purport that in Western societies there are only small sex differences in field-dependence-independence, with women being more field dependent than men. Mebane and Johnson (1970) administered

two instruments--the Draw-a-Person Test and the Children's Embedded Figures Test--to 87 Mexican children. They confirmed Witkin's hypotheses that girls were more field dependent than boys, but there was no significant difference between Mexican boys and girls.

Cagley (1983) discovered that males are more field independent than females. Tucker (1983), using Kolb's Learning Style Inventory, found that eighth-grade boys scored significantly higher than girls in abstract conceptualization, preferring tasks that called for abstract rather than concrete ability (abstract ability being correlated with field independence and concrete ability with field dependence).

Barbe and Swassing (1979) found females just as kinesthetic as males, though there was a general opinion that males would learn better kinesthetically than females. Messer (1979), who used the Edmonds Learning Style Identification Exercise (ELSIE), found that males scored higher in visual image while females scored higher in kinesthetic reaction, but he found no overall significant difference between the males and females in his study with 350 ten- to fourteen-year-olds. However, Ray, Morell, Frediani, and Tucker (1976) suggested that adult males show greater right hemisphere specialization than females. Generally, men prefer to code information visually, recognizing it by its spatial (sight) or acoustic (listening) patterns. Women, on the other hand, who tend to show a left hemisphere specialization, prefer to code information phonologically (Williams, 1983).

The data in Marcus's study (1977) revealed several significant differences between the learning styles of male and female ninth-graders between the ages of 14 and 15. The males were much more

teacher motivated, preferred to work alone, liked cool temperatures, and needed mobility and intake while working. Female students, on the other hand, were more self-motivated, preferred to work with their peers, and liked a warm classroom with an informal design.

According to Witkin et al. (1977), cognitive style (field-dependence-independence) is closely related to sociological preferences. Field-dependent persons are drawn to people and like being with them. Therefore, males who tend to be field independent prefer working alone; females who are field dependent prefer working with their peers.

Tappenden (1983), who tested 844 males and 1,212 females in the 10th and 11th grades in Ohio, found that females preferred warmer temperatures, an informal design, were more self-motivated, persistent, and responsible, and preferred teacher motivation, learning alone, auditory learning, kinesthetic experiences, and learning in the afternoon more than the males. The male subjects reported a stronger preference in only one of the 14 variables--tactile learning experiences.

Roberts (1984), who studied West Indian students in the Bahamas and Jamaica in the 11th and 12th grades, turned up results that differed from Tappenden's. His study indicated that females are more kinesthetic, require more intake, function best in the morning, are less tactile, prefer to learn alone, and are less adult-motivated than the males. The male students had two strong preferences--learning with their peers and in several ways.

Orumchian (1984) found no statistically significant differences between males and females on three tests measuring field-

dependence-independence with his group of Indochinese and traditional students. Of interest is the fact that female Asians showed more pronounced tendencies toward field-dependence than traditional female students.

From the above literature review, it is difficult to come up with some definite conclusions regarding male and female learning styles. The one apparent finding is that males are more field independent while females are more field dependent. The other elements of learning style seem to vary according to the populations and environments of the subjects under study.

The Stability of Learning Style Preferences

Learning styles develop partly as a result of one's hereditary equipment and partly as a result of one's past life experience and the demands of the present environment. Several studies indicate that these style preferences tend to remain consistent through the years, though some evolve over time due to maturation. Dunn and Dunn (1978) noticed that the two elements, light and intake, were found to differ among the young children at different grade levels. Price (1980) investigated the stability of learning style elements using 3,972 students in Grades 3 through 12. Using a one-way ANOVA, he concluded that, as the students' grade level increased, preferences for light, sound, and informal design increased, and the need for teacher motivation, structure, and peer-oriented learning decreased. Price also reported that modality preferences appeared to follow a developmental pattern. Younger children preferred tactile/kinesthetic stimuli, then developed visual preferences, and finally began in the fifth and sixth

grades to develop auditory preferences. After the seventh grade, self-motivation increased. The rest of the other learning style characteristics appeared to be relatively stable over time. Hunt (1979) also noticed the decreased need for structure as the student matured.

Witkin, Goodenough, and Karp (1972) conducted a longitudinal study in 1972 of subjects between ages 10 to 24. Despite the many significant psychological changes that take place during this 14-year period, they found that there is individual consistency in perceptual functioning at the different ages. There is, however, a tendency for children to become less field dependent during development, but the rate of change slows with increasing age. In his research with cognitive style, one aspect of learning style, Kolb (1979) conceded that individuals tend to develop consistent and distinctive cognitive styles. In the editorial of the 1983 summer issue of the Learning Styles Network Newsletter, Rita Dunn stated that "style preferences tend to be consistent and, when they do change, it is over time; the stronger the preference, the less likely it is to vary" (p. 2).

In a study conducted by Price, Dunn, and Dunn (1982), utilizing the PEPS with 251 undergraduate students, 29 senior scholars over the age of 65, and 30 elderly people in the community who were not taking any classes, it was found that the senior scholars and the elderly scored significantly higher than the undergraduates on formal design and learning in the morning. The undergraduates were significantly more motivated and preferred to learn in a greater variety of ways than the elderly, but both groups preferred structure. The young people were definitely more peer-oriented, preferred oral intake while

learning, and desired auditory learning. In another study comparing undergraduate students by level, it was found that the higher the grade level the more responsible the individuals were (ibid.).

Research with the PEPS

Several researches are reported in the PEPS Manual (Price, Dunn, & Dunn, 1982) utilizing the PEPS with adults. With a group of 148 undergraduate students, Price, Dunn, and Dunn found that individuals having a high GPA were responsible, preferred to learn in the early morning, wanted mobility, preferred to use the auditory mode while learning, wanted to learn in several ways, were peer-oriented, and did not want to learn through the kinesthetic mode. Responsibility accounted for the most variance on the GPA.

In another investigation of graduate students at a large urban university, the Dunns attempted to determine whether there was any relationship between learning preferences and global/analytic, field dependent/independent, or right/left hemispheric inclinations. They found that high globals were highly motivated, preferred the late morning or afternoon, bright light, learning alone, and an informal design. They did not like mobility, were not persistent nor authority-oriented, and did not prefer to learn in several ways (Dunn, 1982).

Those who had right hemispheric inclinations (as determined by Zenhausern's Hemispheric Activation Test) preferred sound, were motivated, responsible, peer-oriented, and visual. They preferred to learn in the early morning or evening and were less persistent. Those who had left hemispheric inclinations preferred quiet, were less

motivated, less responsible, and more persistent than the "rights." They preferred to learn in several ways, preferred the auditory and tactile modes, and the late morning and afternoon were the times in which they performed best (ibid).

The results of Witkin's Embedded Figures Test to determine field-dependence-independence, indicated that those who were field dependent preferred structure, the late morning for learning, learning alone, learning kinesthetically, and were self-motivated. In contrast, those who were field independent preferred sound, mobility, a formal design, learning visually as well as in several ways, and were more responsible and persistent (ibid).

Kenneth Dunn (1982) employed the PEPS to test his administrative council on time preference. He found that 11 of his 12 administrators/supervisors preferred working early in the morning. When he switched all his council meetings which were previously scheduled for the early afternoon to the early morning, there were marked improvements. Instead of meeting for the usual two to three hours, the group was able to reduce their meeting time to an hour when it met in the morning.

Several dissertations mentioned in other sections have used the PEPS to measure adult learning style: Cupke (1980) used it with a group of ethnic minorities and women who were freshmen and sophomores; Freeley (1984) used it to identify the time and perceptual preferences of 124 secondary teachers at an inservice workshop; Kulp (1982) also used it with teachers; and Steinauer (1981) determined the learning style patterns of teachers in a vocational school. Guinta (1984), who used the PEPS to measure teachers' styles and the Learning Style

Inventory to determine students' styles, found that mismatches in teacher and student styles contributed to teacher stress.

Sieberman (1984) investigated the relationship between the Group Embedded Figures Test and the PEPS with 30 mature, nontraditional students and found that the two tests were related, but the results did not reach significance--probably due to the small population. However, relationships were evidenced between the two tests, and interviews with the respondents revealed that those who were field dependent held more positive views regarding their college experiences than their counterparts. She reported that all the subjects viewed the tests favorably and believed that they had assisted in student achievement. The researcher felt that the whole counseling process based on the results of the tests she administered made a big difference in the lives of the students involved.

Besides being used in the educational setting, the PEPS has been developed for use in business settings to help organize workers or design work environments for higher productivity (Peeples, 1981).

Summary

This chapter began with a definition of learning style which has often been confused with cognitive style. From the literature reviewed, it was established that learning style is a broader term that encompasses three dimensions--the cognitive, affective, and physiological elements. Therefore, cognitive style is only one of the components of learning style.

Learning style had its beginnings in the 19th century in the psychological domain, but it was Joseph Hill who introduced it to the

educational setting in 1971. As interest in learning style developed, more instruments became available for measuring various aspects. Some standardized instruments that are currently used in schools were briefly described.

This was followed by a discussion of research on how learning style affects school achievement at the elementary, secondary, and college levels. The consistent finding is that, where students' preferences were provided for, performance improved significantly.

Culture appears to be an important determinant of learning style. In various studies reviewed, the hypothesis that societal norms and child-rearing practices influence to a large extent an individual's learning style was upheld. Anglo-Americans tend to be more field independent than black Americans, Mexicans, Africans, and Asians.

Though one might assume that there would be differences in learning style between males and females, such differences are minimal and would definitely be dependent upon the population under study. On the whole, however, it does appear that males are more field independent than females and, therefore, prefer abstract learning and learning alone.

The next section discussed the stability of learning style. Most elements tend to remain consistent though a few do change as a result of maturation. The stronger the preferences, the more stable they become over time.

The last section reviewed on-going research with the PEPS both by the authors themselves as well as by other researchers with adult

populations. Attempts have been made to correlate the PEPS with other measures of learning style.

CHAPTER III

METHODOLOGY

Type of Study

This study sought to compare and contrast learning style preferences of Asian students at Southeast Asia Union College in Singapore and Caucasian students in selected undergraduate classes at Andrews University in the spring quarter of 1986. Ethnicity, sex, and class level constituted the independent variables. The dependent variables were made up of the 20 elements of learning style as measured by the PEPS.

Description of the Population Sample

The subjects of this study were drawn from the campuses of two SDA colleges, one located in Singapore and the other in the United States. Southeast Asia Union College is a four-year college operated by the Seventh-day Adventist Church in Singapore to serve particularly the higher education needs of Seventh-day Adventist youth from the countries under the auspices of Southeast Asia Union Mission. Most of the Asian students enrolled at Southeast Asia Union College in Singapore for the second quarter (corresponding with the spring quarter in the United States) of 1986 were administered the PEPS questionnaire during one of their assemblies. It should be noted

that, due to the political situation in 1985, the College had no students from Vietnam, Laos, or Burma though these countries are part of Southeast Asia Union Mission. The students, who originated mainly from the countries of Malaysia, Indonesia, Singapore, and Thailand, had been minimally, if at all, exposed to any kind of westernized instruction prior to enrolment at Southeast Asia Union College.

It should be noted also that of the 143 students, 92 were Chinese, 19 Indonesian, 12 Indian, 6 Kadazans (natives of Sabah in Malaysia), 5 Thai, 3 Dayaks (natives of Sarawak in Malaysia), and 2 Cambodians (from the Khmer Republic). Three Koreans and one Filipino, who were enrolled during the spring quarter of 1986, were included among the students.

Andrews University is an institution of higher education operated by the Seventh-day Adventist Church and located in Berrien Springs, Michigan. One outstanding characteristic that sets it apart from the surrounding colleges and universities is a student body representing 84 countries. In the 1985-86 school year, there were 109 Africans, 42 South Americans, 115 students from the West Indies, 101 Europeans, 195 Asians, 25 Australians, 146 Canadians, and 7 students from the Middle East (Andrews University, Opening Reports, 1985-86).

Caucasian students enrolled at Andrews University (Michigan) in selected undergraduate classes from each class level (freshman, sophomore, junior, and senior) during the spring quarter of 1986 were invited to participate in the study. The specific classes were selected in consultation with the teachers involved after arrangements had been made with the Dean of Student Affairs. Care was taken to

select general education classes at the different class levels where students from the different majors were represented.

According to Kendall's recommendation to have at least "ten times as many observations as variables" (1975, p. 11), this study which dealt with the 20 variables on the PEPS, therefore, should have at least 200 subjects. However, in order to be more confident of the stability of the variance-covariance matrix, this research was designed to have at least 15 subjects per variable:

$$15 \times 20 = 300 \text{ subjects}$$

Attempts were made to keep the number of Caucasian and Asian students as equal as possible; the targeted number was 160 students per group, with a total of 320 subjects.

Instrumentation

The instrument utilized in this study was the Productivity Environmental Preference Survey (PEPS) (see Appendix B) by Price, Dunn, and Dunn (1982) which measures how adults prefer to learn in four different areas as described below:

IMMEDIATE ENVIRONMENT comprises four elements--sound, light, warmth, and design--that an individual prefers to have in the environment when trying to learn something new, especially something difficult. These elements are thought to be biological and related to the physical being of individuals. Rita Dunn (1981) explained:

The preference for quiet or sound, and the ability to block out noise, are related to an individual's hearing sensitivity. Similarly, the need for bright, average, or dim light is a function of eye sensitivity, while temperature reactions depend on the thickness or thinness of one's skin. Whether a person remembers more when concentrating in a formal, rather than an informal, environment is undoubtedly an outgrowth of bodily needs. (p. 32)

EMOTIONALITY comprises four elements--motivation, persistence, responsibility, and the need for structure or flexibility--which are an outgrowth of each person's emotional makeup.

SOCIOLOGICAL NEEDS appear to be environmentally based and reflect whether a person prefers to learn alone or be peer-oriented, have authority figures present, or learn in several ways.

PHYSICAL NEEDS refer to the perceptual preferences of individuals, whether they be auditory, visual, tactile, or kinesthetic; to the need for intake or oral ingestion while at a learning task; to the time of day when they enjoy peak energy times (evening-morning, late morning or afternoon); and to the need for mobility (either staying in one position for a long period of time or having to move around).

The questionnaire, which originally had a True-and-False response format, now utilizes a Likert scale; strongly agree is scored 5, and strongly disagree scored 1. The authors felt that this revision would "improve each item's discriminatory ability and permit greater flexibility for the respondents" (Price, Dunn, & Dunn, 1982). Individuals are encouraged to give their immediate reactions to each of the questions. The estimated time for completion of the survey is 20 to 30 minutes.

Scoring of the instrument is done by computer, and Price Systems, Inc., provides this service which includes an individual printout of each subject's raw scores and standard scores. The standard scores are plotted on a profile that shows the preferred style of the individual. Also available are group summaries which assist instructors or supervisors in grouping individuals or in

designing work settings based on similarities among productivity elements.

Development of the PEPS

The authors began development of the PEPS by identifying the elements that appeared to describe the ways people learn or work. Items were then designed to assess each area, and these were subjected to factor analysis. The revised version was then administered to 589 adults from several states and various academic and industrial settings.

Reliability and Validity

The PEPS appears to be the first comprehensive approach to the diagnosis of adult learning styles, with high reliability and validity, even better than the version aimed at younger learners (Kirby, 1979; Price, Dunn, & Dunn, 1982).

Based on factor analysis, 31 factors were identified which had eigenvalues ranging from 7.89 to 1.02, explaining 65 percent of the total variance. No factors with eigenvalues of less than 1.00 were included.

These factors with their inter-item correlations were further analyzed by the BMDP4M computer program using

. . . varimax, an orthogonal rotation to maximize the variance of the squared factor loadings using Kaiser's normalization
. . . The number of iterations for the rotation was 50 and the gamma (precision) level was 1.00. The factors were rotated to identify which factors were orthogonal (independent) and to minimize cross loadings (Price, Dunn, & Dunn, 1982, p. 18)

It was found that some factors were "pure" or independent while overlap occurred in others like "learning in several ways" with

"self-oriented learner" and "colleague-oriented learner," and "authority-oriented learner." Where there was an apparent continuum, e.g., "learning in the morning" and "learning in the evening"; "self-motivated" and "unmotivated," the items were combined. Further revisions streamlined the instrument to its present 20 elements in four categories. Sixty-eight percent of the reliabilities are equal to or greater than .60; the PEPS manual reports an average reliability of .66 (Price, Dunn, & Dunn, 1982).

Kulp (1982) and Freeley (1984) used the PEPS to determine the learning preferences of teachers. Kulp then developed a teacher-training program based on the Dunn's concept of learning style while Freeley integrated the concept of learning style with her staff development model. Cupke (1980) used the instrument with ethnic minorities and women in a community college. Steinauer (1981) reported that the PEPS had greater test-retest reliability than the Learning Style Inventory, indicating that adult responses are more consistently reliable than those of younger subjects.

In addition to identifying students' learning styles, the authors of the PEPS designed the instrument for use in corporations and businesses to help in understanding the productivity style preferences of employees. Peebles (1981), Director of Instructional Services in the Antilles Consolidated School Systems in Puerto Rico, used the PEPS to identify the productivity styles of a group of media specialists. From the results, teams were organized according to their preferences. Peer-oriented learners worked in groups; those who preferred to learn alone took care of research and creative problem solving; individuals

who were authority-oriented emerged as thoughtful, task-oriented leaders. She reported:

The PEPS not only served as a key to team building and but also to time management for the Director of Instructional Services who has increased time to focus energy on other areas of instruction. (p. 1)

Procedure

Permission was obtained from the Dean of Student Affairs at Andrews University (see Appendix A) and arrangements made during the first week of April 1986 with the class teachers for the administration of the Productivity Environmental Preference Survey.

During the last two weeks of April 1986, the PEPS was administered to students enrolled in the following selected undergraduate classes at the four different class levels (freshman, sophomore, junior, and senior) at Andrews University:

<u>Class</u>	<u>Level</u>
Introduction to Psychology	Freshman
American Government	Freshman
Typewriting IV	Sophomore
Comparative Politics	Sophomore
Contemporary Issues	Junior
Introduction to Christian Ethics	Junior
Exercise Procedures	Junior
Literature of the English Bible	Senior
History & System of Psychology	Senior

The researcher visited each class personally to administer the PEPS. The students were asked to fill in their names, sex, ethnic origin (shading "1" for Caucasian and "3" for others in Column 1 under "Special Codes" on the instrument), and their class level (shading "1" for freshman, "2" for sophomore, "3" for junior, and "4" for senior in Column 2 under "Special Codes" on the instrument) before completing the responses to the 100 questions on the PEPS. Though the

instrument was administered to all the students in the classes, only the responses of the Caucasian students were utilized. A total of 171 questionnaires were completed by Caucasian students, but five of them were discarded due to unanswered questions or incomplete information.

The instrument was mailed to Southeast Asia Union College in Singapore the last week of March, and the PEPS was administered to all the Asian students enrolled there during the third week of April at one of their assemblies. Specific written instructions, identical to the oral instructions given to the students at Andrews University, accompanied the instrument, and the one administering the instrument was requested to read it to the students before they completed the survey (see Appendix A). Arrangements were made with the chairperson of the Education Department at Southeast Asia Union College who has an Ed.D. in Educational Psychology to administer the PEPS. Of the 146 questionnaires received, three, which were half completed, were discarded.

The completed surveys were mailed to Price Systems, Inc., in Kansas to be computer scored.

Statement of Null Hypotheses

The primary interest of this study was to compare the learning-style preferences of Asian students at Southeast Asia Union College and Caucasian students at Andrews University. Of secondary interest was a consideration of the differences in learning-style preferences between males and females and among the freshmen, sophomores, juniors, and seniors in the sample.

Hypothesis 1. There is no significant difference between the centroids of Asians and Caucasians on the 20 subscales found on the Productivity Environmental Preference Survey:

- a. Noise level
- b. Light
- c. Temperature
- d. Design
- e. Motivation
- f. Persistence
- g. Responsibility
- h. Structure
- i. Learning Alone/Peer Oriented
- j. Authority Figures Present
- k. Learning in Several Ways
- l. Auditory
- m. Visual
- n. Tactile
- o. Kinesthetic
- p. Intake Required
- q. Evening-Morning
- r. Late Morning
- s. Afternoon
- t. Mobility Needed

Hypothesis 2. There is no significant difference between the centroids of males and females in the entire sample on the 20 PEPS subscales.

Hypothesis 3. There is no significant difference between the centroids of Asian and Caucasian males on the 20 PEPS subscales.

Hypothesis 4. There is no significant difference between the centroids of Asian and Caucasian females on the 20 PEPS subscales.

Hypothesis 5. There is no significant difference between the centroids of male and female Asians on the 20 PEPS subscales.

Hypothesis 6. There is no significant difference between the centroids of the male and female Caucasians on the 20 PEPS subscales.

Hypothesis 7. There are no significant differences in learning style preferences among the freshmen, sophomores, juniors and seniors in the entire sample.

Statistical Analysis

From the computerized group summaries (obtained from Price Systems, Inc.) based on the standard scores of the subjects in the study, a two-way multivariate analysis of variance was run for Hypotheses 1 and 2, with ethnicity and sex as the independent variables and the 20 elements on the PEPS as the dependent variables. Since there was no significant interaction between ethnicity and sex in the two-way analysis, main effects could be studied. Four one-way multivariate analyses were run for Hypotheses 3, 4, 5, and 6. Where the results were significant, the tests were followed up by discriminant analyses to establish the direction of the differences between the following groups, and the variable(s) most strongly contributing to these differences:

Hypothesis 1: Asians and Caucasians

Hypothesis 2: Males and females in the entire sample

Hypothesis 3: Asian and Caucasian males

Hypothesis 4: Asian and Caucasian females

Hypothesis 5: Male and female Asians

Hypothesis 6: Male and female Caucasians

If the analysis of variance had been undertaken as six separate one-way analyses, the problem of instability of the correlation matrix could have arisen because none of the analyses would have contained 200 cases. The two-way analysis, however, enabled the "within-groups" correlation matrix to be developed from the full group of subjects. This could then be used as the error matrix for the one-way tests.

For Hypothesis 7, a one-way multivariate analysis of variance was run with the 20 subscales of the PEPS as the dependent variables, and class level as the independent variable. For each hypothesis, the alpha level was set at .05.

The data file (see Appendix D) included the ethnicity, sex, and class standing of the respondents as well as their standard scores on each of the 20 variables of the PEPS.

Summary

Chapter III has presented the research design and methodology of a study comparing the learning-style preferences of Asians and Caucasians. The population sample, the instrument used in the study, procedures in data collection, and the statistical analyses employed were discussed. The hypotheses were also stated in their null form.

CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

Introduction

This research compared the learning styles of Asians and Caucasians at Southeast Asia Union College and Andrews University, located respectively in Singapore and the United States. It is hoped that the results will provide empirical evidence that will benefit Asian and Caucasian students and their teachers in the learning and instructional process. Chapter IV presents information concerning the data-producing sample itself and basic statistics from the sample. This is followed by the tests of the hypotheses.

Sample

The study required that there be at least 15 subjects per variable to ensure stability of the variance-covariance matrix, coming to a total of 300 subjects. This figure was arrived at by multiplying 15 by 20 (number of subscales on the PEPS). It was, therefore, targeted to have 160 Asians and 160 Caucasians to be included in the study.

The number of Asians, however, was less than the desired 160 because of the currently low enrollment at Southeast Asia Union College. Also, the freshmen who were in the remedial English program

were not included in the study because of their limited understanding of the English language. Nevertheless, the total number of subjects still exceeded 300 as the sample of Caucasians in the nine selected classes came to a total of 166. Table 1 presents a summary of the sample group according to ethnicity and gender.

TABLE 1
SAMPLE GROUP ACCORDING TO ETHNICITY AND GENDER

	Male	Female	Total
Asian	60	83	143
Caucasian	77	89	166
Total	137	172	309

The Asian sample was predominantly Chinese (64 percent); there were 19 Indonesians (13 percent), 12 Indians (8 percent), and the rest (15 percent) was made up of other Malaysians, Thais, Koreans, Cambodians, and one Filipino.

As a secondary interest, the learning style of all the subjects in the study according to class level was considered to see if there were differences among the freshmen, sophomores, juniors, and seniors. The sample was broken down into the following levels:

Freshmen	103
Sophomores	74
Juniors	57
Seniors	75
Total	309

That the small sample sizes in each class group would tend to decrease the stability of the intercorrelation matrix should be noted in interpreting the data.

Basic Data

Price Systems, Inc., in Lawrence, Kansas, computer scored the responses of each individual which resulted in a printout containing each individual's standard scores on the 20 subscales of the PEPS. These scores were utilized in the analyses of the data. A copy of the datafile is found in Appendix D. The format of the data is explained in the introductory page to Appendix D.

Table 2 presents the means of all sub-groups and the total group on each of the variables of the PEPS. Table 3 gives a tally on the standard scores that indicate a negative preference (scores below 40) and a positive preference (scores above 60) for all sub-groups and for the total group.

From a study of the tally in Table 3, several interesting observations can be made of the various sub-groups (Asians, Caucasians, males, females, freshmen, sophomores, juniors, and seniors) and the total group. One should bear in mind the fact that the standard scores which are meaningful are those that are below 40, (indicating a strong negative preference for a certain element) and those that are above 60 (indicating a strong positive preference).

Asians. Of the 143 Asians who participated in this study, 46 percent of the subjects indicated a strong preference for having an authority figure present when learning, 41 percent had a strong preference for auditory learning, 31 percent preferred learning in the

TABLE 2
MEANS OF ALL SUB-GROUPS AND THE TOTAL GROUP ON THE 20 PEPS VARIABLES

PEPS SUBSCALE	ASIAN			CAUCASIAN			MALE	FEMALE	FRESH- MEN	SOPHO- MORES	JUNIORS	SENIORS	TOTAL GROUP
	M	F	TOTAL	M	F	TOTAL							
1 Noise	47.9000	47.6966	45.8951	48.6104	47.6966	48.1205	48.2993	46.1279	47.7281	46.5811	46.3684	47.2667	47.0906
2 Light	52.9667	55.1807	54.2517	49.7402	50.8090	50.3132	51.1533	52.9186	52.7184	52.3784	53.7544	49.8667	52.1359
3 Temperature	44.2000	43.0843	43.5524	52.0779	50.0225	50.9759	48.6277	46.6744	48.9126	46.0270	45.3684	48.8000	47.5405
4 Design	48.8500	50.5903	49.8601	48.8701	46.3371	47.5120	48.8613	48.3895	49.3301	47.7973	48.9474	48.1200	48.5987
5 Motivation	45.5667	47.3614	46.6084	48.7273	49.7303	49.2650	47.3431	48.5872	47.3204	47.7297	48.7544	48.7733	48.0356
6 Persistent	47.6833	48.7952	48.3287	51.2597	50.4382	50.8193	49.6934	49.6453	48.4757	50.2703	50.5088	50.0667	49.6667
7 Responsible	44.0500	42.9156	43.3916	50.2467	50.1348	50.1867	47.5328	46.6512	45.7184	47.6622	48.7719	46.9333	47.0421
8 Structure	50.6167	52.7831	51.8741	47.4805	48.0225	47.7111	48.8540	50.3198	50.7281	49.2838	50.5263	47.9467	49.6699
9 Learn A/Peer	53.0500	51.4337	52.1119	48.2208	49.7640	49.0482	50.3358	50.5698	52.0777	50.3649	50.1404	48.6000	50.4660
10 Auth Figs	56.1167	57.0964	56.6853	53.1429	52.9888	53.0602	54.4453	54.9709	55.1068	55.6757	55.7018	52.5733	54.7379
11 Sev Ways	48.9333	51.5060	50.4266	52.4026	55.2022	53.9036	50.8832	53.4186	50.2233	52.4595	51.8246	55.3333	52.2945
12 Auditory	57.5000	57.7590	57.6503	52.1558	53.0225	52.6205	54.4963	55.3081	55.5437	55.4189	54.2456	54.2000	54.9482
13 Visual	49.5833	49.5060	49.5385	49.4415	48.3932	43.8795	49.5036	48.9302	47.6214	50.3784	50.8421	48.8933	49.1845
14 Tactile	51.3000	50.4578	50.8112	50.7662	48.7753	49.6988	51.0000	49.5872	49.8641	49.1486	51.3333	50.8933	50.2136
15 Kinesthetic	51.4667	52.4819	52.0559	51.9610	51.1011	51.5000	51.7445	51.7674	50.1553	52.6216	52.3684	52.6400	51.7573
16 Intake	46.1167	44.1325	44.9650	51.1429	48.8427	49.9096	48.9416	46.5698	46.7476	49.3243	45.7895	48.5333	47.6214
17 Eve-Morn	46.4667	44.9036	45.5594	45.7143	48.2247	47.0602	46.0438	46.6221	46.9806	46.2162	44.6491	46.9733	45.3657
18 Late Morn	51.2167	50.7108	50.9231	46.3247	46.7416	46.5482	48.4671	48.6570	47.9806	48.9459	48.4561	49.1067	48.5728
19 Afternoon	51.4833	52.1205	51.8531	56.7273	56.2584	56.4759	54.4306	54.2616	53.7864	54.4324	55.2105	54.3333	54.3366
20 Mobility	53.3000	52.8675	53.0490	54.6493	55.0112	54.8434	54.0584	53.9767	52.6408	53.8378	54.8070	55.4667	54.0129

M = Male
 F = Female
 Learn A/Peer = Learning Alone/Peer Oriented
 Auth Figs = Authority Figures Present
 Sev Ways = Learn in Several Ways
 Eve-Morn = Evening-Morning
 Late Morn = Late Morning

TABLE 3
TALLY ON STANDARD SCORES INDICATING A NEGATIVE OR POSITIVE PREFERENCE
FOR ALL SUB-GROUPS & TOTAL GROUP

PEPS SUBSCALE	A S I A N			C A U C A S I A N			MALE	FEMALE	FRESH	SOPH	JRS	SRS	TOTAL													
	Male -Pf +Pf	Female -Pf +Pf	Total -Pf +Pf	Male -Pf +Pf	Female -Pf +Pf	Total -Pf +Pf	-Pf +Pf	-Pf +Pf	-Pf +Pf	-Pf +Pf	-Pf +Pf	-Pf +Pf	-Pf +Pf													
1 Noise	6	1	19	1	25	2	18	9	21	13	39	22	24	10	40	14	22	8	12	6	13	5	17	5	64	24
2 Light	4	9	3	26	7	35	12	12	18	23	30	35	16	21	21	49	7	21	10	15	4	19	16	15	37	70
3 Temperature	14	2	24	5	38	7	5	14	4	22	9	36	19	16	28	27	12	17	10	6	13	6	12	14	47	43
4 Design	10	6	11	16	21	22	11	14	20	11	31	25	21	20	31	27	13	17	13	9	12	8	14	13	52	47
5 Motivation	14	2	13	3	27	5	13	8	10	9	23	17	27	10	23	12	19	8	13	7	9	2	9	5	50	22
6 Persistent	8	2	5	5	13	7	6	12	8	9	14	21	14	14	13	14	13	10	6	9	3	3	5	6	27	28
7 Responsible	19	0	26	5	45	5	9	11	12	8	21	19	28	11	38	13	27	8	13	4	11	6	15	6	66	24
8 Structure	9	7	7	14	16	21	24	11	26	10	50	21	33	18	33	24	21	18	13	7	14	12	18	5	66	42
9 Learn A/Peer	6	16	9	14	15	30	15	11	13	14	28	25	21	27	22	28	11	22	9	9	10	15	13	9	43	55
10 Auth Figs	1	27	3	39	4	66	6	24	7	27	13	51	7	51	10	66	5	43	3	31	1	21	8	22	17	117
11 Sev Ways	9	10	8	21	17	31	5	20	4	32	9	52	14	30	12	53	12	21	6	20	5	15	3	27	26	83
12 Auditory	1	18	5	41	6	59	5	22	8	23	13	45	6	40	13	64	4	36	3	22	5	20	7	26	19	104
13 Visual	4	4	7	9	11	13	12	10	18	13	30	23	16	14	25	22	15	5	7	12	5	10	14	9	41	36
14 Tactile	4	4	5	7	9	11	5	11	14	9	19	20	9	15	19	16	10	7	9	5	3	8	6	11	28	31
15 Kinesthetic	2	7	1	13	3	20	5	12	6	10	11	22	7	19	7	23	8	14	1	9	2	7	3	12	14	42
16 Intake	14	4	27	5	41	9	7	22	16	20	23	42	21	26	43	25	26	13	9	17	12	4	17	17	64	51
17 Eve-Morn	15	4	23	3	38	7	24	12	26	22	50	34	39	16	49	25	21	11	21	9	19	6	27	15	88	41
18 Late Morn	8	12	5	7	13	19	12	3	19	5	31	8	20	15	24	12	19	9	10	7	7	3	8	8	44	27
19 Afternoon	8	16	13	20	21	44	3	34	4	30	7	64	11	50	17	58	17	35	3	28	4	21	4	24	28	108
20 Mobility	3	15	6	26	9	41	4	31	8	40	12	71	7	46	14	66	10	32	7	27	3	24	1	29	21	112
	N=60	N=83	N=143	N=77	N=89	N=166	N=137	N=172	N=103	N=74	N=57	N=75	N=309													

-pf = negative preference with standard scores below 40
+pf = positive preference with standard scores above 60
fresh = freshmen
soph = sophomores
jrs = juniors
srs = seniors

Learn A/Peer = Learning Alone/Peer Oriented
Auth Figs = Authority Figures Present
Sev Ways = Learn in Several Ways
Eve-Morn = Evening-Morning
Late Morn = Late Morning

afternoon, and 29 percent indicated a strong preference for mobility. Also, 31 percent had a negative preference for responsibility, and 29 percent indicated a negative preference for intake while learning.

Both Asian females (47%) and Asian males (45%) indicated a strong preference for having an authority figure present when learning. More Asian females (49%) indicated a strong preference for auditory learning than Asian males (30%). Similarly, more Asian females (34%) strongly prefer learning in the afternoon compared to Asian males (27%).

The same percentage (32%) of Asian females and Asian males showed a negative preference for responsibility, while 33 percent of the Asian females indicated a negative preference for intake while learning as compared to 23 percent of the males.

Caucasians. Of the 166 Caucasians who responded to the questionnaire, 43 percent indicated a strong preference for mobility, 39 percent strongly preferred learning in the afternoon, 39 percent strongly preferred to learn in several ways, and 31 percent strongly preferred the presence of an authority figure while learning. The same percentage of Caucasians (30%) indicated a strong negative preference for structure as well as learning in the morning.

A higher percentage of Caucasian females (45%) strongly preferred mobility than males (40%). Also, a higher percentage of Caucasian females (36%) have a strong preference for learning in several ways than Caucasian males (26%).

Males and Females. More than a third of the males (36%) indicated a high preference for learning in the presence of an authority figure and learning in the afternoon. Among the males, 29

percent strongly preferred auditory learning, and 28 percent indicated a strong preference for learning in the evening.

Among the females, 38 percent strongly preferred mobility and learning with an authority figure. Auditory learning and learning in the afternoon were two subscales on which 37 percent and 34 percent respectively of the females indicated a high preference. Like the males, 28 percent of the females preferred learning in the evening. Twenty-three percent indicated a negative preference for intake and noise. The area of greatest difference between males and females is on the subscale of light. Percentage-wise, almost twice as many females (28%) prefer bright light while studying as compared with the males (15%).

Freshmen. Of the 103 freshmen, 42 percent indicated a strong preference for the presence of an authority figure, 35 percent strongly preferred auditory learning, and 34 percent indicated a high preference for learning in the afternoon. Twenty-six percent indicated a negative preference for responsibility, and 25 percent indicated a negative preference for intake.

Sophomores. Among the 74 sophomores, 42 percent indicated a strong preference for the presence of an authority figure. Thirty-eight percent of the group preferred learning in the afternoon, and 36 percent had a strong preference for mobility. Twenty-eight percent of the sophomores preferred to learn in the evening.

Juniors. Of the 57 juniors, 42 percent had a strong preference for mobility, 37 percent preferred learning with an authority figure, and the same percentage indicated a strong preference for learning in the afternoon. Thirty-five percent of the

juniors showed a strong preference for auditory learning. One-third of the group indicated a definite preference for learning in the evening.

Seniors. Among the seniors, more than a third (39%) indicated strong preferences for mobility, learning in several ways (36%), and auditory learning (35%). Thirty-six percent of the seniors indicated a strong preference for learning in the evening.

Total Group. Out of the 309 subjects in the study, 38 percent indicated a strong preference for learning with an authority figure; 36 percent have a strong preference for mobility, 35 percent evidenced a strong preference for learning in the afternoon, and 34 percent strongly preferred auditory learning. Twenty-eight percent of the subjects indicated a strong preference for learning in the evening. Among the outstanding negative preferences were responsibility (21%), structure (21%), and noise (20%).

Testing the Hypotheses

Hypothesis 1

There is no significant difference between the centroids of Asians and Caucasians on the 20 subscales found on the Productivity Environmental Preference Survey.

Hypothesis 2

There is no significant difference between the centroids of males and females in the entire sample on the 20 PEPS subscales.

The centroid of the Asian group is the point in 20-dimensional space, whose coordinates are the means of that group on the 20 PEPS scales, as given in Table 2. Similarly, the centroid of the Caucasian

group is identified by their means on the 20 variables as given in Table 2. To compare the centroids of the Asians and Caucasians and males and females on the combination of all the 20 subscales of the PEPS, a two-way multivariate analysis of variance was run with ethnicity and sex as independent variables and the 20 subscales of the PEPS as the dependent variables. Before studying the main effects, called for by Hypotheses 1 and 2, it is necessary to note whether significant interaction is present. The test for interaction yielded an F-ratio of 0.95 with 20 and 286 degrees of freedom (df) which was not significant at the .05 level ($p = .5208$). It was, therefore, valid to study the main effects.

The multivariate test of the main effect of ethnicity, comparing the centroids of the Asians and Caucasians on the combination of the 20 PEPS subscales yielded an F-ratio of 9.26 (df = 20 and 286), with $p = .0001$. Since this was significant, it was followed up by discriminant analysis.

Discriminant analysis locates a new dimension along which two or more groups are maximally separated. The means of the groups on this axis were 4.7510 for the Asians and 6.3926 for the Caucasians. The standardized discriminant function (weights for the factors) is given in Table 4.

These weights indicate the relative contribution of each variable to the identification of the new axis. Where a weight has a positive sign, the group with the higher mean is farther to the right-hand end of that scale, indicating a higher preference than the other group (or the group with the lower mean is further to the left-hand end of that scale); where the weight has a negative sign the reverse

TABLE 4
 DISCRIMINANT FUNCTION WEIGHTS:
 ASIANS VS. CAUCASIANS

Category	PEPS Subscale	*Weight	Rank Order
Immediate environment	1 Noise	0.0469	
	2 Light	-0.2017	
	3 Temperature	0.6078	1
	4 Design	0.0138	
Emotionality	5 Motivation	0.1392	
	6 Persistence	0.0257	
	7 Responsibility	0.4698	2
	8 Structure	-0.0312	
Sociological needs	9 Learning Alone/Peer Oriented	-0.0096	
	10 Authority Figures Present	-0.0750	
	11 Learning in Several Ways	0.0912	
Physical needs	12 Auditory	-0.3332	4
	13 Visual	-0.3182	5
	14 Tactile	-0.1427	
	15 Kinesthetic	-0.0436	
	16 Intake Required	0.3957	3
	17 Evening-Morning	0.3140	6
	18 Late Morning	-0.1951	
	19 Afternoon	0.2423	
20 Mobility Needed	0.2977	7	

Mean for the Asians: 4.7510
 Mean for the Caucasians: 6.3926

*Weight=Standardized discriminant function

situation holds true. As the mean for the Asians (4.7510) was lower than that for the Caucasians (6.3926), the positive weights in Table 4 indicate a greater preference on the part of the Caucasians and the negative weights indicate the reverse. The left- and right-hand ends of each scale are defined in Appendix C.

Several of the weights in Table 4 are given ranks. An accepted criterion is to identify the greatest (absolute) weight and take note of any others which are at least half as large. Hence, in Table 4, subscales 3, 7, 16, 12, 13, 17, and 20 are ranked 1, 2, 3, 4, 5, 6, and 7, respectively. No other standardized weight is sufficiently large to be considered of importance. Therefore, the discriminant function indicates that Caucasians, as compared to Asians, have a stronger preference for warmth, responsibility, intake, learning in the morning, and mobility; and a lower preference for auditory and visual learning experiences.

Since there was no interaction in the two-way multivariate analysis of variance run with ethnicity and sex and the 20 PEPS subscales, the main effects for sex (Hypothesis 2), comparing the centroids of males with females in the entire sample, were considered. The analysis yielded an F-ratio of 1.63 with 20 and 286 degrees of freedom, with a probability of 0.0459, which is significant. This was followed up with discriminant analysis to determine which of the 20 subscales are essentially different between the centroids. The means of the groups on this axis were -1.6113 for the males and -2.2711 for the females. The standardized discriminant function (weights for the subscales) is given in Table 5.

TABLE 5
DISCRIMINANT FUNCTION WEIGHTS:
MALES VS. FEMALES

Category	PEPS Subscale	*Weight	Rank Order
Immediate environment	1 Noise	0.4386	2
	2 Light	-0.2446	
	3 Temperature	0.3096	8
	4 Design	0.2795	
Emotionality	5 Motivation	-0.2245	
	6 Persistence	-0.3133	7
	7 Responsibility	0.3656	6
	8 Structure	-0.2138	
Sociological needs	9 Learning Alone/Peer Oriented	-0.3711	5
	10 Authority Figures Present	0.0624	
	11 Learning in Several Ways	-0.6208	1
Physical needs	12 Auditory	-0.1824	
	13 Visual	0.0419	
	14 Tactile	0.4252	3
	15 Kinesthetic	-0.0078	
	16 Intake Required	0.3783	4
	17 Evening-Morning	-0.1972	
	18 Late Morning	-0.1234	
	19 Afternoon	-0.2970	
	20 Mobility Needed	0.0462	

Mean for the Females: -2.2711
Mean for the Males: -1.6114

*Weight=Standardized discriminant function

As the mean for the females (-2.2711) was lower than that for the males (-1.6114), the positive weights in Table 5 indicate the greater preference on the part of the males, and the negative weights indicate the reverse. The left- and right-hand ends of each scale are defined in Appendix C.

Several of the weights in Table 5 are given ranks. According to the accepted criterion, subscales 11, 1, 14, 16, 9, 7, 6, and 3 in Table 5 are ranked 1, 2, 3, 4, 5, 6, 7, and 8 respectively. No other standardized weight is sufficiently large to be considered of importance. Therefore, the discriminant function indicates that males as compared to females have a stronger preference for noise, tactile learning experiences, intake, responsibility, and warmth; and a lower preference for learning in several ways, peer-oriented learning, and persistence.

Hypothesis 3

There is no significant difference between the centroids of Asian and Caucasian males on the 20 PEPS subscales.

This hypothesis was tested by a one-way multivariate analysis of variance, comparing the centroids of Asian males with Caucasian males. In the breakdown by ethnicity and gender, it should be noted that the small sample sizes (60 Asian with 77 Caucasian males, making a total of 137) might affect the stability of the intercorrelation matrix. This limitation should be considered in the interpretation of the data.

The test of significance yielded a chi-square of 71.4197 (df = 20), and a probability < .00005. Therefore, the two centroids are significantly different. To study which of the 20 PEPS subscales

are of greatest importance in this difference between the centroids, discriminant analysis was used.

The means on the new axis were 22.282 for the male Asians and 36.178 for the male Caucasians. The standardized discriminant function (weights for the factors) is given in Table 6. Because the mean for the Asian males was lower than that of the Caucasian males, the positive weights in Table 6 indicate the greater preference on the part of the Caucasian males, and the negative weights indicate the reverse.

In Table 6, subscales 3, 12, 18, 7, 6, and 16 are ranked 1, 2, 3, 4, 5, and 6, respectively. No other standardized weight is sufficiently large to be considered of importance.

Therefore, the discriminant function indicates that Caucasian males as compared to Asian males have a stronger preference for warmth, responsibility, persistence, and intake, and a lower preference for auditory learning and learning in the late morning.

Hypothesis 4

There is no significant difference between the centroids of Asian and Caucasian females on the 20 PEPS subscales.

This hypothesis was also tested by a one-way multivariate analysis of variance, comparing the centroids of Asian females and Caucasian females. In the breakdown by ethnicity and gender, it should be noted that the small sample sizes (83 Asian females with 89 Caucasian females, making a total of 172) might affect the stability of the intercorrelation matrix. This limitation should be considered in the interpretation of the data.

TABLE 6
 DISCRIMINANT FUNCTION WEIGHTS:
 ASIAN MALES VS. CAUCASIAN MALES

Category	PEPS Subscale	*Weight	Rank Order
Immediate environment	1 Noise	-18.209	1
	2 Light	-16.838	
	3 Temperature	57.040	
	4 Design	- 6.829	
Emotionality	5 Motivation	17.815	5
	6 Persistence	30.026	
	7 Responsibility	30.943	
	8 Structure	- 0.547	
Sociological needs	9 Learning Alone/Peer Oriented	- 3.016	
	10 Authority Figures Present	3.874	
	11 Learning in Several Ways	17.405	
Physical needs	12 Auditory	-35.233	2
	13 Visual	-22.413	
	14 Tactile	- 8.599	
	15 Kinesthetic	-18.031	6
	16 Intake Required	28.237	
	17 Evening-Morning	11.891	
	18 Late Morning	-33.347	3
	19 Afternoon	15.528	
	20 Mobility Needed	15.147	

Mean for Asian Males: 22.282
 Mean for Caucasian Males: 36.178

*Weight=Standardized discriminant function

The test of significance yielded a chi-square of 96.236 (df = 20), and a probability $< .00005$. Therefore, the two centroids are significantly different. To study which of the 20 PEPS subscales are of greatest importance in this difference between the centroids, discriminant analysis was used. The means of the groups on this axis were 47.675 for the Asian females and 61.445 for the Caucasian females. The standardized discriminant function (weights for the subscales) is given in Table 7.

Hence, in Table 7, subscales 7, 3, 20, 17, 16, 13, and 12 are ranked 1, 2, 3, 4, 5, 6, and 7, respectively. No other standardized weight is sufficiently large enough to be considered of importance. Therefore, the discriminant function indicates that Caucasian females, as compared to Asian females, have a stronger preference for responsibility, warmth, mobility, learning in the morning, and intake; and a lower preference for visual and auditory learning experiences.

Hypothesis 5

There is no significant difference between the centroids of male and female Asians on the 20 PEPS subscales.

To test this hypothesis, a one-way multivariate analysis of variance was used. This yielded an F-ratio of 1.0822 with 20 and 122 degrees of freedom and a probability of 0.3764. As Hypothesis 5 was retained, no discriminant analysis was undertaken. There is no significant difference between the male and female Asians on the 20 PEPS subscales.

TABLE 7
 DISCRIMINANT FUNCTION WEIGHTS:
 ASIAN FEMALES VS. CAUCASIAN FEMALES

Category	PEPS Subscale	*Weight	Rank Order
Immediate environment	1 Noise	21.171	
	2 Light	-26.822	
	3 Temperature	50.022	2
	4 Design	6.884	
Emotionality	5 Motivation	8.064	
	6 Persistence	-10.385	
	7 Responsibility	56.031	1
	8 Structure	- 7.990	
Sociological needs	9 Learning Alone/Peer Oriented	13.143	
	10 Authority Figures Present	-12.634	
	11 Learning in Several Ways	14.384	
Physical needs	12 Auditory	-30.106	7
	13 Visual	-32.336	6
	14 Tactile	-22.636	
	15 Kinesthetic	- 2.705	
	16 Intake Required	36.921	5
	17 Evening-Morning	38.544	4
	18 Late Morning	- 6.587	
	19 Afternoon	26.641	
	20 Mobility Needed	47.641	3
	Mean for the Asian Females:		47.675
Mean for Caucasian Females:		61.445	

*Weight=Standardized discriminant function

Hypothesis 6

There is no significant difference between the centroids of the male and female Caucasians on the 20 PEPS subscales.

In testing this hypothesis with a one-way multivariate analysis of variance, it was found that the F-ratio of 1.1385, with 20 and 145 degrees of freedom, and a probability of 0.3172 was not significant. Therefore, no discriminant analysis was undertaken as there is no significant difference between the male and female Caucasians on the 20 PEPS subscales. This hypothesis was retained.

Hypothesis 7

There are no significant differences in learning-style preferences among the freshmen, sophomores, juniors, and seniors in the entire sample.

Again, the one-way multivariate analysis of variance was used to compare the centroids of the four groups. The test yielded an F-ratio of 1.2079 with 60.0 and 854.1018 degrees of freedom, and a probability of 0.1399. Thus, no discriminant analysis was undertaken as there is no significant difference among the centroids of the freshmen, sophomores, juniors, and seniors. The hypothesis was, therefore, retained.

Summary

Using multivariate analysis of variance and discriminant analysis, the first four of the seven null hypotheses were rejected. In testing Hypothesis 1, it was revealed that Asians were significantly different from Caucasians in their learning style. The test of Hypothesis 2 indicated a significant difference between Asian females and Caucasian females. Hypothesis 3 was also rejected because there were

significant differences between Asian males and Caucasian males. In testing Hypothesis 4, differences were found between males and females in the entire sample.

The last three hypotheses, 5, 6, and 7, were retained as no significant differences were found between male and female Asians, male and female Caucasians, and among the four undergraduate class levels.

CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Summary

This chapter presents the summary and conclusions of the study, implications of the findings, and recommendations for further research. The study was undertaken with the aim of discovering whether there were differences between the learning styles of Asians and Caucasians.

Purpose

The main purpose of this study was to examine the areas in learning style where Asians differed from Caucasians. Hopefully, the results of this study will be of assistance to faculty on SDA campuses in accommodating the learning styles of both these groups of students so that achievement in learning can be increased. Also, the results might aid Asian students who transfer to U.S. colleges to be cognizant of the learning styles of Caucasian students to promote better understanding of students in a different culture.

One main hypothesis and six secondary hypotheses were formulated and tested for this study. The main hypothesis dealt with the difference in learning style between Asians and Caucasians. The

second noted the differences in learning style between males and females. The third considered learning-style differences between Asian and Caucasian males, and the fourth between Asian and Caucasian females. The fifth hypothesis dealt with learning-style differences between male and female Asians; and the sixth between male and female Caucasians. The final hypothesis was concerned with differences in learning style among the four class levels in the sample.

An Overview of Related Literature

The chapter on literature review was divided into eight sections, beginning with a definition of learning style which has often been confused with cognitive style. Learning style is a broader, more encompassing concept made up of three dimensions--the cognitive, the affective, and the physiological. Cognitive style is but one element related to the way the mind functions in the learning process.

The second section presented a brief history of learning style which began in the psychological domain with research in temperaments and personality types. Witkin, who was associated with Brooklyn College, related personality to field-dependence-independence, a cognitive style. Many more studies followed this in the area of cognitive style. In 1971, Hill carried this over into the educational domain, and research into learning style gained momentum in the 70s and 80s as more standardized instruments were developed to measure the three different components.

The third section dealt with a survey of learning-style instruments. Only two of them, the Learning Style Inventory and the

Productivity Environmental Preference Survey, attempt to measure all three dimensions of learning style. Some standardized instruments that measure cognitive style are the Child Rating Form, the Edmond's Learning Style Identification Exercise, the Gregorc Style Delineator, the Group Embedded Figures Test, Hill's Cognitive Style Mapping Inventory, Kolb's Learning Style Inventory, and the Swassing-Barbe Modality Index. Examples of affective style instruments are Hunt's Paragraph Completion Method and the I/E Scale. Instruments measuring physiological style are not available though this aspect has been included in the Learning Style Inventory and the Productivity Environmental Preference Survey by Dunn, Dunn, and Price.

The fourth section reviewed research with learning style, the majority of which verified the notion that where learning style preferences were accommodated, achievement was increased at all educational levels; where there was dissonance, students performed poorly.

The fifth section reviewed studies with the learning style of different cultural groups. Researchers found that culture appeared to be one outstanding determinant of learning style. Societal child-rearing practices seemed to determine, to a large extent, an individual's learning preferences. Generally, Anglo-Americans tended to be more field independent than the black Americans, Mexicans, Africans, and Asians.

In the sixth section, the differences in learning style between males and females were considered. Few differences were found between the sexes though several researches established that males tended to be more field independent and preferred abstract conceptualization.

The seventh section was concerned with the stability of learning style. Learning style tends to remain consistent though a few elements may change as a result of maturation. Most of the changes take place between childhood and adulthood, but the rate of change slows down with age. Strong preferences, however, tend to be more resistant to change even over time.

The final section reviewed some studies utilizing the PEPS in determining adult learning style in both educational and work settings.

Sampling and Instrumentation

The sample for this study was made up of most of the Asian students enrolled at Southeast Asia Union College in Singapore during the spring quarter of 1986, and Caucasian students in nine selected undergraduate classes at Andrews University during the spring quarter of 1986. A total of 309 subjects participated in the study; 143 of them were Asians and 166 Caucasians. Of the 143 Asians, 60 were male and 83 female; of the 166 Caucasians, 77 were male and 89 female. In the entire sample, there were 103 freshmen, 74 sophomores, 57 juniors, and 75 seniors.

The instrument employed for the study was the Productivity Environmental Preference Survey. It was chosen for its comprehensiveness in measuring learning style, and its brevity, clarity, and simplicity of administration as well as the economy of time on the part of the respondents.

Summary and Discussion of Findings

The findings of this study are summarized according to each of the seven null hypotheses, which were tested by one-way or two-way

multivariate analysis of variance and followed up by discriminant analysis where appropriate.

Hypothesis 1

There is no significant difference between the centroids of Asians and Caucasians on the 20 subscales found on the Productivity Environmental Preference Survey.

This hypothesis was rejected. The results indicate that there is a significant difference between Asians and Caucasians on the 20 variables of the PEPS.

From the results of the discriminant analysis, Caucasians appear to have a greater preference for warmth, responsibility, intake, learning in the morning, mobility; and exhibit a lower preference for auditory and visual learning than the Asians. Few studies have been undertaken with college populations, and different populations have evidenced different learning styles. The findings of this study are in agreement with Tappenden's (1983) who found that her group of Caucasian high-school seniors have a high preference for warmth and mobility in addition to an informal setting and learning with their peers. However, White (1979) reported that Brainard and Ommen found that Caucasian students over age 25 preferred auditory experiences.

The subscale on which the Asians and Caucasians differ the most is that of temperature. According to Table 2, Caucasians have a higher preference for warmth than Asians (mean for Caucasians--50.9759, mean for Asians--43.5524). On Table 3, a tally of the positive and negative preferences indicate that 22 percent of the Caucasians have a positive preference for warmth while 27 percent of

the Asians have a negative preference (meaning that they prefer a cool environment in which to study). Only 5 percent of the Caucasians indicated a negative preference for warmth, and only five percent of the Asians indicated a positive preference for warmth.

The five questions on temperature found on the PEPS do not define the words "cool" or "warm" (see Items 8, 25, 46, 82, and 100 on the PEPS in Appendix B). It is important to note the connotation of the words "cool" and "warm" in both cultures. Singapore enjoys a hot equatorial type of climate where temperatures vary between 79 to 86 degrees Fahrenheit year round due to its close proximity to the equator. Therefore, its inhabitants often seek respite from the heat in air-conditioned settings wherever possible. This could be the reason why Asian students would evidence a lower preference for warmth when learning.

Caucasian students, on the other hand, would prefer a warmer environment, taking into consideration the cold weather (below freezing in winter) that characterizes Michigan much of the year except for the summer months. Therefore, if the questions had been better defined, the temperature preference may very well not be a difference of any significance between Asians and Caucasians. Further, this may be more appropriately considered an environmental rather than a cultural factor.

It is interesting to note that Caucasians prefer responsibility more than Asians do. Perhaps this can be explained by the social structure in both cultures. Caucasian children are allowed considerable freedom and encouraged to be independent early in life. In a society where both parents work, many children learn to assume

responsibility early within the home. Also, Hsu (1970) observed that American parents do not allow their children to trespass into their social and commercial affairs. They maintain a front before their children even when things go wrong. While parents face a world of reality, many children "live in the near-ideal, unreal realm where the rules of the parental world do not apply, are watered down, or are even reversed" (p. 86). Therefore, the children grow up protected from the stark realities of life, convinced that they can accomplish what they set out to achieve. This "confidence" may explain their higher preference for responsibility.

The Asians, on the other hand, are more involved in the world of the grown-ups. Extended families are common, and Hsu observed that children share the same world with their families, and that parents do not hide their problems and failures from their children. Children are expected to behave like little adults, and they are sometimes included even in business gatherings. Thus, the Asian child is fully aware of his own shortcomings (it is customary for adults, in the course of their conversations, to exaggerate the weaknesses and downplay the strengths of their children as a mark of humility), and this, perhaps, contributes to the apparent lack of self-confidence in accepting responsibility. Tong (1978) wrote about the "shaky convictions" Asian students have about their own abilities, though they scored higher than the Caucasians in their motivation.

Another two elements that Caucasians prefer more than Asians are intake and mobility. This can probably be accounted for in the type of classroom environment they are accustomed to. Caucasians enjoy a more relaxed classroom atmosphere, often with plenty of room

to move around. Different corners in the room allow students to engage in varied activities throughout the day, so that Caucasians are used to moving around. Gum chewing is a well-accepted habit on most college campuses. Asians, in contrast, come from very strictly disciplined classes where teachers expect students to sit still and pay attention. Spartan classrooms are often crowded with 40 to 50 students, and may have a couple of decorated bulletin boards--if the teacher is interested enough--and a huge blackboard for the teacher to write on. Students are not allowed to move freely about the room except when necessary. Gum chewing is frowned upon in schools, and is a habit that is discouraged in Singapore. All these factors may explain why the Asians indicate a lower preference than the Caucasians on the elements of mobility and intake.

The Caucasians have a lower preference for auditory and visual learning in comparison to the Asians. This finding parallels that of Tappenden's study (1983) with Caucasians, where she found the highest preference was for kinesthetic experiences, next highest for tactile experiences, third for auditory experiences, and last for visual learning experiences. Here again, the classroom environment may have helped to shape perceptual preferences. Caucasians enjoy the privilege of learning through varied approaches, whereas their Asian counterparts are taught mainly through lectures and the use of visual aids shown up front. As mentioned above, Asian classrooms are spartan with few devices for students to manipulate and experiment with. Thus, Asian students have probably adjusted to preferring the auditory and visual modes of learning through their years in school.

Hypothesis 2

There is no significant difference between the males and females in the entire sample on the 20 PEPS subscales.

Again, this hypothesis was rejected. The results show a significant difference between males and females on the 20 PEPS subscales.

From the results of the discriminant analysis, males as compared to females have a higher preference for noise, tactile learning experiences, intake, responsibility, and warmth; and a lower preference for learning in several ways, peer-oriented learning, and persistence. The same preference for tactile learning experiences was found among Afro-American and Caucasian males in Tappenden's study (1983). The male preference for responsibility may be explained by their sex-role typing in being the ones to take the lead.

The lower preference of the males for peer-oriented learning is associated with their tendency towards field independence. According to Witkin et al. (1977), field-independent individuals prefer working alone. However, it should be noted that in this sample under study, the means for both males and females on this element were high--50.3358 and 50.5698 respectively. Although it appears that both groups enjoy peer-oriented learning, the males who tend to be more field independent have a lower preference in comparison to the females.

Hypothesis 3

There is no significant difference between the centroids of Asian and Caucasian males on the 20 PEPS subscales.

This hypothesis was also rejected. The results show that there is a significant difference between Asian and Caucasian males on the 20 subscales of the PEPS.

From the results of the discriminant analysis, Caucasian males, as compared to Asian males, appear to have a stronger preference for warmth, responsibility, persistence, and intake; and a lower preference for auditory learning and learning in the late morning.

Though it may appear that there is a difference between Asian and Caucasian males in the preference for warmth, the semantics involved and the different climates they experience may mean that there is, in actuality, no difference at all (see explanation under Hypothesis 1).

Caucasian males show a higher preference for responsibility than Asian males. As mentioned above, Caucasians generally display greater self-confidence than their Asian counterparts. Another possible explanation for this is the element of modesty or "humility" that is typical of Asians.

Caucasian males appear to be more persistent than Asian males. Opportunities that are available to Caucasians to try and try again in the American system of education encourage persistence. In the Asian setting, students who fail are seldom given another chance in the public school system. They have to enroll in private schools which charge higher fees and cater to "failures" in society. Besides, there

is the lack of self-confidence which is typical of Asians (referred to earlier) that often interferes with trying again and again until they make it. In addition, Huang (1971) noticed that the Chinese subjects in his study seemed to select responses in the middle of the range rather than at the extremes.

Caucasian males more often require intake when learning than Asian males. As mentioned, Caucasians enjoy a more relaxed learning environment where they may be allowed to chew gum or sip beverages, but Asians generally do not permit these activities in their classrooms. Caucasian males also evidence a lower preference for auditory learning and learning in late morning.

Hypothesis 4

There is no significant difference between the centroids of the Asian females and Caucasian females on the 20 PEPS subscales.

This hypothesis was also rejected. The findings indicate a significant difference between Asian females and Caucasian females on five of the 20 PEPS subscales. Caucasian females prefer responsibility, warmth, mobility, learning in the morning, and intake more than the Asian females; and they have a lower preference for visual and auditory learning experiences.

These results were identical to those for the entire group of Asians and Caucasians except that the order of the preferences were different. While Caucasian females in this study have a lower preference for the auditory mode of learning, Tappenden (1983) found that Caucasian females in her study chose the auditory mode as the second highest preference among the four perceptual modes (auditory, visual,

kinesthetic, and tactile). From the tally in Table 3, it can be noted that 59 or 41 percent of the 143 Asians indicated a strong preference for auditory learning as compared with 45 or 27 percent of the 166 Caucasians.

As noted earlier, temperature may not be a discriminating factor between Asian and Caucasian females. For reasons discussed, it is not surprising that Caucasian females prefer responsibility, mobility, and intake while learning more than Asian females do and Caucasians have a lower preference for the auditory and visual modes of learning.

Hypothesis 5

There is no significant difference between the centroids of male and female Asians on the 20 PEPS subscales.

This hypothesis was retained. The results of this study indicate no difference between male and female Asians on the 20 PEPS subscales.

An analysis of the main effects for sex resulted in significance, and because of the lack of interaction, it would be expected that the male-female differences should be found consistently in the sub-groups. A study of the means of Asian males and females in Table 2 reflects this expected consistency. The differences in style preferences between male and female Asians are similar to the differences in the total group of males and females as shown on Table 5. In this case, however, it must be remembered that the size of these two small sub-groups has decreased the power of the test, hence the absence of any difference between male and female Asians.

Hypothesis 6

There is no significant difference between the centroids of the male and female Caucasians on the 20 PEPS subscales.

This null hypothesis was also retained. The results indicate no difference between male and female Caucasians on the PEPS subscales. Again, the sample size has decreased the power of the test, and a study of the means of these two sub-groups in Table 2 reveals differences similar to those found between the total group of males and females in Table 5.

Hypothesis 7

There is no significant difference in learning-style preferences among the freshmen, sophomores, juniors, and seniors in the entire sample.

This null hypothesis was retained. The results indicate no difference in learning style among the four groups of undergraduate students. This may be due to the small age range between the four groups and the small sample size. These findings are in disagreement with those of Price, Dunn, and Dunn (1982) who found that the higher the grade level, the more responsible the undergraduates were.

Conclusions

From an analysis of the findings, the following conclusions were drawn:

1. Asians are different from Caucasians in their learning styles. Culture, therefore, appears to be a determinant of learning style.
2. Sex appears to be a contributing factor to learning-style preferences.

3. With the qualifications necessarily inherent in a small sample, class level does not appear to influence learning-style preferences.

Implications

The findings of this study support the following implications:

1. Teachers' understanding of individual learning styles, aids in better communication with individual students, increases student competence and interest in the classroom, and develops potential for a healthier self-concept.

2. When students understand their own individual positive and negative preferences, they can learn more easily and remember better by capitalizing on their unique learning characteristics and structuring the environment, wherever possible, to accommodate their own style preferences.

3. The fact that cultural differences exist has implications for professional development in the area of instruction. In-service training for teachers as well as administrators in the understanding of their own styles and the assessment and interpretation of their students' styles would aid in improved learning environments in the classroom.

Recommendations

Based on the foregoing findings and conclusions of the study, the following recommendations are proposed in two major areas: for practice and for further research.

Practice

1. Learning style emerges from the cultural background, and to ensure academic success, teachers should strive to accommodate cultural differences in learning style.

2. Teachers should recognize the importance of style-flex. Instead of using lecture with visual aids only, varied approaches to every learning situation would help to accommodate the different learning styles found in every classroom.

3. In working with Asian students, teachers would do well to reassure them of their abilities in helping them to develop their self-confidence.

4. It is strongly recommended that the PEPS be administered to students upon registration, and that counselors/faculty assist students in understanding their learning-style preferences which may then be utilized when learning is undertaken.

Research

1. This study should be replicated with other cultural groups that are found on college campuses for a better understanding of cross-cultural differences in learning style.

2. Since significant differences were found between the sexes in the entire sample, but no significant differences were found between the sexes among the Asians and the Caucasians separately, the study could be replicated with larger samples of Asians and Caucasians to test the findings.

3. Another question that needs further exploration with larger sample sizes is whether there is a difference in learning-style

preferences between different class levels among undergraduate students.

4. A further possibility for research lies in comparing undergraduate students with graduate or post-graduate students to determine the difference in learning styles.

5. In this study, no differences were found in sociological preferences between the two groups. This appears to contradict the many studies conducted on field-dependence-independence. This area needs to be studied in greater depth.

6. The PEPS might be further validated against other standardized instruments that measure different components of learning style.

7. Finally, research might be done to find out how individualization has been related to the components of the PEPS.

APPENDICES

**APPENDIX A
PERMISSION FORM
AND CORRESPONDENCE**

Andrews University

REQUEST FOR PERMISSION TO MAKE A SURVEY OF STUDENT OPINION

Sully Lam-Phoon April 3, 1986
 Name Date of Request

EDUC Dissertation Spring 86
 Course Number and Title if Survey is for a Class Date Survey will be Taken

Policies:

1. All questionnaires used at Andrews University for student opinion surveys must be approved by the Vice-President for Student Affairs after counseling with the person in charge of the area where the survey will be taken. If the survey is for a class, the approval of the teacher and dean of the school must also be secured before the Vice-President for Student Affairs gives final approval. Surveys conducted by student organizations must be approved by the faculty sponsor and the Vice-President for Student Affairs.
2. The student making the survey agrees not to release information publicly about the results of the survey without the permission of the teacher, the dean, and the Vice-President for Student Affairs. A report of the survey will be given to these three individuals.
3. The questionnaire should be clearly identified as to the purpose for making the survey, the name of the class, and the name of the teacher who has approved the questionnaire and the project.

Request for Information about Survey:

1. Describe the project proposed for which the survey is taken and attach a copy of the questionnaire to be used.

A Comparative Study of the Learning Style Preferences of Southeast Asian and Caucasian Students

E. Stanley Price 4/3/86
 Teacher's Signature Date

E. Stanley Price 4/3/86
 Dean's Approval Date

[Signature] 4/4/86
 Vice-President for Student Affairs' Approval Date

March 24, 1986

Dr. Linda Koh, Chairperson
Education Department
Southeast Asia Union College
273 Upper Serangoon Road
Singapore 1334

Dear Linda:

Thank you in advance for your help in this important part of my dissertation. I was so glad when my committee strongly suggested that you be the one to help with the administration of the instrument. If anyone can be counted on, it's you!

Attached are the directions which I hope : u will read to the students prior to the administration which should take 20-30 minutes. Since I cannot be there in person, the first part is couched in the form of a letter to the students. After the administration, please check every sheet to see that students have filled in the data correctly (I'd hate to have to discard any of the responses as everyone of these is important). Please send me a list of the students, their nationality and country of origin as I will need this information as well.

Thanks again, Linda; I appreciate your help very much.

Sincerely,



Sally Phoon

Enclosure

Dear Students:

At present, I am doing a research into how Asian students learn as compared with Caucasian students in the U.S., and I'd like to invite you to participate in this study by responding to the Productivity Environmental Preference Survey, a standardized instrument that measures how adults learn. If you are interested in an individual profile, please indicate that in the upper left-hand corner of the instrument, and I'll be glad to get it to you. Thank you very much for your cooperation.

(Please hand out the instrument to the students)

I N S T R U C T I O N S

First, fill in your name at the top left-hand corner, surname first. Leave a space between your surname and first name. Blacken the bubbles below it corresponding with the alphabets that make up your name.

Next, indicate your sex by blackening the bubble next to either "male" or "female." Lastly, fill in your birthday (only the year and month) and blacken the appropriate bubbles beneath the numbers.

Under the section, "Special Codes", first column, darken bubble 1 if you are Caucasian, bubble 2 if you are Asian, and bubble 3 if you are not Caucasian nor Asian. Under "Special Codes", second column, darken bubble 1 if you are a freshman, 2 if you are a sophomore, 3 if you are a junior, and 4 if you are a senior.

(Now read the directions at the top of the instrument, emphasizing that they are to give their IMMEDIATE reactions rather than give a lot of thought to each statement.)

APPENDIX B

PRODUCTIVITY ENVIRONMENTAL PREFERENCE SCALE
(PEPS)

PLEASE NOTE:

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These consist of pages:

P. 106-107

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International**

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APPENDIX C
PROFILE SHEET

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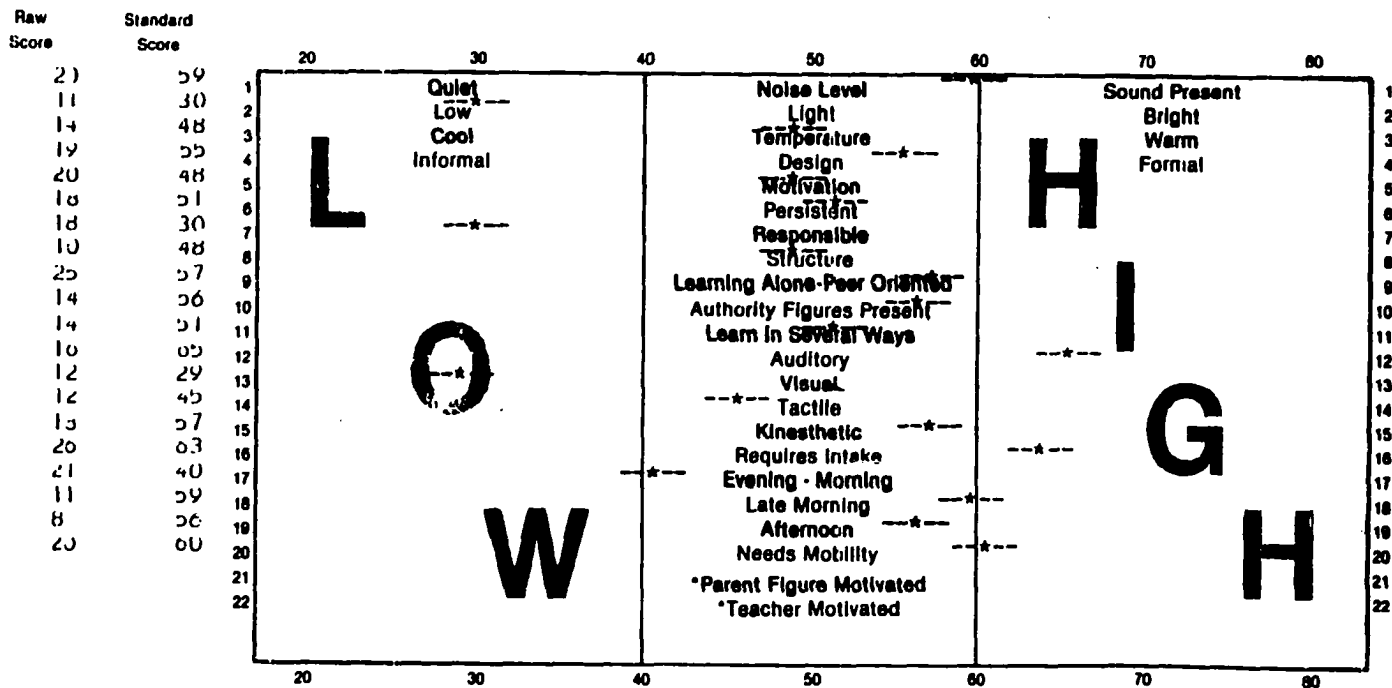


INDIVIDUAL PROFILE

PRODUCTIVITY ENVIRONMENTAL PREFERENCE SURVEY

Name: _____ Sex: ^M Year in School: _____ Date of Birth: 02 / 05 I.D. No.: _____
 Yr./Mo. _____
 Group Identification: _____ Special Code: 14 Date: 05-09-1986 Group No.: 474

PREFERENCE SUMMARY



APPENDIX D
DATA FILE

FORMAT FOR SAMPLE OF 309 SUBJECTS

Columns 1-3	=	the number of the subject
Column 4	=	sex of the subject (1-female, 2-male)
Column 5	=	ethnicity (1-Caucasian, 2-Asian)
Column 6	=	class level (1-freshman, 2-sophomore, 3-junior, 4-senior)
Columns 7-46	=	standard scores on the 20 <u>PEPS</u> subscales

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0022215458485238544653544840405645515246654760
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VITA

Name: Sally Lam-Phoon
Place of birth: Penang, Malaysia
Date of birth: September 12, 1950
Marital status: Married to Chek-Yat Phoon

Education:
1971 Southeast Asia Union College, Singapore
B.S.Ed. (magna cum laude)
1980 Philippine Union College, Philippines
M.A. in Education
1986 CPS (Certified Professional Secretary)
1987 Andrews University, Berrien Springs, Michigan
Doctor of Philosophy, Curriculum & Instruction

Experience:
1972-74 Teacher, Sunny Hill School
Kuching, Sarawak, East Malaysia
1977 Secretary to the Youth Director
West Malaysia-Singapore Mission
Shorthand instructor
Melaka Tutorial College
Melaka, Malaysia
1978 Secretary to the President
Southeast Asia Union College, Singapore
1980 Secretary to the President
Southeast Asia Union College, Singapore
1980-1982 Instructor (Education & Office Adm. Depts.)
Southeast Asia Union College, Singapore
1983-1984 Assistant professor & chairperson (Office Adm. Dept.)
Southeast Asia Union College, Singapore
1984-1985 Graduate assistant
School of Education
Andrews University, Michigan

1985-1986 Graduate assistant
Business Education Dept.
Andrews University, Michigan

Professional
Memberships:
1984-1985

Member, American Management Society

1985-1986

Member, Professional Secretaries International
Student member, National Business Education
Association

1986

Member, CPS Academy

1986

Member, Learning Styles Network

Appointment:
1986

Chairperson, Office Administration Department
Southeast Asia Union College, Singapore