THE RELATIONSHIP OF KOREAN STUDENTS' LEARNING STYLE WITH RESIDENCE, GENDER, AND ACHIEVEMENT

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CHAPTER I

INTRODUCTION

Learning style is a new concept that accommodates the cognitive, affective, and environmental proclivities of learning, areas which previously have been separately investigated. The major impetus for learning style research has come from groups concerned with improving and individualizing instruction and from those supporting the cause of the learning disabled (Keefe, 1979a). Learning style theory is based on the idea that students have strong or weak learning style skills, that is, students display characteristic emotional responses, or preferences for a particular learning environment, and that the optimal conditions for learning can be met through instructional arrangements that optimize those emotional responses or preferences, and also by fostering cognitive styles that augment inappropriate learning skills (Keefe, 1987a, 1987b; Dunn & Dunn, 1975, 1979a).

Learning style refers to the composite of characteristic cognitive, affective, and physiological factors which indicate how a student perceives, interacts with, and responds to the learning environment (Keefe, 1987a). The cognitive styles are information processing habits; affective styles are motivationally based emotional

responses; and physiological styles are biologically based responses, such as time of day rhythms or environmental preferences. The major task of the studies of learning style is identifying an individual's characteristic learning styles, including strengths and weakness in cognitive styles, characteristic emotional responses, and environmental preferences (Keefe, 1987a, 1987b; Dunn & Dunn, 1979a). Children bring to the classroom not only varying levels of intelligence and diversified cultural backgrounds, but also unique learning proclivities. Therefore, to be effective, instructional planning must first identify the learning styles of all the individual students, taking into account the major aspects of that individual's background which make him or her unique (Dunn & Dunn, 1975, 1978; Thomson, 1986).

Studies of learning style, characterized as identifying individual differences in learning styles, support the individualization of instruction and learning (Dunn & Dunn, 1975; Keefe, 1987a). Individualized education represents a systematic effort on the part of a school to take into account the individual student's characteristic and effective instructional practices when organizing the learning environment (Keefe, 1984).

Thus, the second step in individualized education is utilizing adaptive instructional strategies to build a learning environment which fits the learner's needs, especially learning style needs. Differences in the ways students learn translate into differences in the ways

students receive instruction. For example, students with strong visual responses are less likely to learn in settings that are strictly verbal; on the other hand, those with strong tactile or kinesthetic responses tend to ignore typical auditory or visual instruction. Thus, instruction will be more efficient and effective when instructional resources (environmental arrangement and teaching style) are matched with identified learning styles (Dunn & Dunn, 1979b; Keefe, 1987a; Lesser, 1971).

Researchers (Dunn & Dunn, 1978; Gregorc, 1979; Samples, 1978; Keefe, 1979a) have emphasized the importance of the identification of an individual's learning style and the application of this information to educational practices. A variety of benefits have been identified when students are taught through methods that complement their individual learning styles. Not only does academic achievement increase, but also students exhibit improved attitudes toward school and have fewer discipline problems (Carbo, 1980; Farr, 1971; Dunn & Dunn, 1979b). It is possible for teachers to help each child learn more effectively by diagnosing the individual's learning style, that is to consider how he or she is likely to learn most effectively, and then by providing appropriate learning environments and learning tasks for each individual.

Historically, there have been two lines of learning style research. One group is concerned with the cognitive dimension of learning styles, while the other group is concerned with the affective and physiological dimensions of

learning styles. In the former group, early researchers investigated one dimension of cognitive style, such as field dependence vs. independence (Witkin, Dyk, Faterson, Goodenough, & Karp, 1962; Witkin, Moor, Goodenough, & Cox, 1977); reflexivity vs. impulsivity (Kagan, 1965; Messer, 1970); leveling vs. sharpening (Holzman, 1954; Holzman & Gardner, 1960); and breadth of categorization (Pettigrew, 1958; Bruner & Tajfel, 1961). The other group investigated the affective and physiological dimensions of learning style, developing instruments such as the Learning Style Inventory (Dunn & Dunn, 1979a), or the cognitive and affective dimensions of learning style, creating the Myers-Briggs Type Indicator (Myers, 1962) and Cognitive Style Mapping (Hill, 1976).

However, there has not been any comprehensive instrument that assesses all three dimensions of learning style until the National Association of Secondary School Principals published the Learning Style Profile (Keefe, Monk, Letteri, Languis, & Dunn, 1986). As learning style refers to cognitive, affective, and physiological characteristics of a learner, researching only one dimension of cognitive style, or only part of the affective and physiological dimensions of learning styles can not provide a complete picture of a student's learning style. Thus, the Learning Style Profile satisfies the need to examine learning styles of individual students in a wholistic and comprehensive manner.

Learning style has been researched in the area of

cross-cultural studies, which have reported that learning style differences appear across ethnic groups and subcultural groups (Witkin, 1967; Witkin & Berry, 1975; Nedd & Gruenfeld, 1976; Gonzales & Roll, 1985). These learning style differences across cultural groups seem to originate from the different cultural values those societies maintain (Witkin & Goodenough, 1981; Witkin, et al., 1962). But there have not been enough studies focusing on the learning styles of Koreans, a cultural group which is an Oriental ethnic group and thus, is supposed to possesses traditional values. However, Korea is in the process of rapid change toward western values.

Recently, there has been clearly need for research about learning styles in Korea, arising from the bringing diverse students together in the same school because of the abolition of the traditional practice of selective middle school and high school entrance exams. With this newly diverse population, the struggle that U.S. schools have experienced as they move toward individualized educational models has been mirrored in Korea. In order to meet the individual student's different ability levels and needs, schools have had to adapt to individualized education.

The Korean school system and educational policy have begun a process of change toward equalization of education since the 1960s. The entrance exams for middle school were abolished in 1969, and the entrance exams for high school were abolished in 1974 (Kim, Choi, & Choi, 1985; Park & Han, 1970). The system of giving middle and high school entrance

exam was based on the traditional educational ideology of producing an elite class of scholar bureaucrats (Kim, Choi, & Choi, 1985). But this entrance exam produced side effects, such as too much out-of-school studies and emotional disorders as students tried to prepare themselves to pass the rigorous exams and thus to secure their futures. As the Korean educators were reflecting on these entrance exams' side effects, consequently the U.S. equal education movement was influencing the Korean educational system. Thus, in the 1970s, the movement toward equalization of education prevailed in Korea by abolishing middle and high school entrance exam.

This movement toward equalization of education brought together diverse students who have different abilities, home environments, educational experiences with parents, and experiences in different societies. The formerly homogeneous school system was faced with major challenges. A big issue raised by bringing diverse students in one school was how to deal with students with so many different qualities.

Korean schools can meet the needs of different learners by providing individualized education. Individualized education is based on the goal of matching of the instructional methods, learning tasks, and environment with the individual student's characteristics (Dunn & Dunn, 1979a). Achievement scores, IQ tests, personality instruments by themselves are no longer sufficient in dealing with complicated educational issues. Identifying

individual student's learning styles and matching appropriate instructional resources with different learning styles may serve as a vehicle to achieve individualized education.

Another issue that gives rise to the necessity of the study of learning style comes from the disparity in educational outcomes between Korean urban and rural students. This issue is based on the idea that differences in cultural values, lifestyles, and students' family background make differences in student's learning style (Witkin & Berry, 1975; Ramirez, 1982; Ramirez & Price-Williams, 1974) which, in turn, bring about differences in educational outcomes (Dunn & Dunn, 1975; Letteri, 1985; Keefe, 1985).

In Korea, there still exists disparity in educational environments between the place of residence, between schools, and between individual students even after the policy of equalization of education has been executed (Kim, 1981). According to Kim, Na, and Lee, (1983), and Lee, Kang, and Kong (1978), especially, a variety of differences exist between urban and rural education in the aspects of school environment, quality of teacher, and student's family background. More schools are located in urban areas, urban schools have better facilities, financial support, and higher quality teachers. The parents of urban students have high income jobs, spend more money for their children's extra-curricula work, have high aspirations for their children, and are more concerned about their children than

the parents of rural students.

The urban and rural students also are different in educational outcomes. According to Lee, Kang, and Kong (1978), urban elementary and middle school students achieved higher scores in Korean language, mathematics, and English than rural students, and this difference was especially marked in mathematics. The disparity in educational environment between urban and rural education produces differences in the educational outcomes, and further, different chances of higher education, specifically college entrance (Jeoung, 1981). Thus, differences in educational outcomes between urban and rural middle and high school students has been the focus of educational research in Korea because the college entrance is very difficult and the most significant issue among students and parents.

Educators in Korea can seek the possibility of reducing this disparity in educational outcome can be reduced by introducing a learning style model because student's achievement can be improved by matching student's learning styles with teaching styles (Dunn & Dunn, 1978) or by modifying inappropriate learning styles through training (Letteri, 1985; Keefe, 1987a). Learning style exerts influence on academic performance, acting as a controlling agent in information processing (Letteri, 1985). Past research revealed that some elements of learning styles, such as persistence, self-motivation, and no preference for tactile and kinesthetic senses, are related to high academic achievement (Dunn, Dunn, & Price, 1977; Carbo, 1980;

Calvano, 1985). On the other hand, another line of researchers have found significant relationships between cognitive styles and certain intellectual tasks, such as reading (Kagan, 1965), mathematics (Vaidya & Chansky, 1980), biology (Douglass, 1978), geography (Grieve & Davis, 1971), and general problem solving (Ehri & Muzio, 1974). These findings suggest that an individual's cognitive style is also a basic intellectual determinant in his/her level of achievement or success in educational environments (Letteri, 1977).

Further, they suggested that matching teaching styles and learning environment with student's learning styles, especially motivational and physiological styles, can improve academic achievement (Dunn & Dunn, 1979a). This method is based on the hypothesis that students learning styles and cognitive skills are relatively stable (Witkin, 1976) thus, providing wide variety in learning settings, resources, and instructional methodologies can maximize advantages of student's innate capacity (Kogan, 1971; Keefe, 1987a) The other way to improve student's academic achievement is by modifying student's learning styles, especially cognitive styles, through training so that individual student can have better profits from current educational methodology, resources, and environment (Letteri, 1985; Keefe, 1987a).

In summary, different learning styles exist in different cultures. Korean urban and rural societies, which are markedly different in socio-economic levels, school

environments, and the degree of westernization, have a high possibility for producing differences in their students' learning styles. In addition, it is questionable whether male and female students will have different learning styles in the Korean society, which has both traditional values and transitional values. On the other hand, selected learning style characteristics can be used as an intervening variable for different academic achievement between urban and rural students in various subjects areas because different learning styles are known to produce high or low academic achievement. In order to reduce differences in academic achievement between urban and rural students, educators can adapt a learning style model; diagnose a rural student's learning styles, and then modify inappropriate learning styles or prescribe instructions on the basis of those essentials.

Purpose of the Study

This study examined the relationship between the learning styles of Korean urban and rural students and male and female students. This study also investigated the relationship between learning styles of Korean students and academic achievement.

Translated versions of the National Association of Secondary School Principal's Learning Style Profile (Keefe, Monk, et al., 1986) and Group Embedded Figures Test (Oltman, Witkin, et al., 1971) were used to assess Korean students' learning styles. School achievement was measured by the

Kyohaksa Achievement Test in the five most important subject areas in Korea: Korean language, English, mathematics, social studies, and science.

The subjects were 9th grade middle school students in Korea, a group which are a more heterogeneous now than before 1970 as a result of the abolition of entrance exams. This heterogeneity brought the importance of diagnosing diverse differences in student's learning styles and investigating the influences of these learning style differences on school achievement. The subjects were selected in both urban areas and non-urban areas in order to find different learning styles as the sources of the wide range of school disparity between urban schools and non-urban schools.

Significance of the Study

School achievement disparities cut across broader contexts, from urban to non-urban school settings; from a small, to medium, to large school sizes; and across school types. In Korea, achievement disparity, especially between urban and non-urban students, has been remarkable and is a significant educational and social issue. To discover the sources of this disparity, it is not enough to examine only intelligence, teacher competencies and skills, school facilities, budgets, and so forth; research must focus on student learning styles. It is possible to conceptualize such disparities in performance in the light of the dissonance between learning styles and the school system;

that is, a mismatch, on the one hand, between school programs and requirements with student styles of cognition, on the other hand, a mismatch between school environment and affective and physical characteristics of learning styles. For example, school policy may demand a specific learning style while students might use different learning styles. Such a mismatch has been noticed by Cohen (1969), who highlighted the existence of cultural conflicts. His research stressed that if individual differences are recognized and teaching strategies can be adapted to meet individual students' needs, students' performances will increase. Recognition of the important place of learning styles in academic achievement and the need for integrating diverse learning styles into the curriculum is essential.

Definition of Terms

For the purpose of this investigation, the following terms are defined:

1. Learning style: Characteristic cognitive, affective, and physiological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment.
2. The place of residence: Living in either an urban area or a non-urban area, that is, Seoul or Kunwi.
3. Achievement : Performance in an academic achievement test, specifically performance measured by the Kyohaksa Achievement Test (1988, November version).

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

This chapter is divided into five major sections. The first section presents an overview of learning styles, including definitions of learning styles and comparison of learning style with a cognitive style. The second section reviews characteristics of available learning style instruments. The third section reviews a number of learning style studies, focusing especially on those treating learning styles as a dependent variable to reveal the sources which lead to differences in individual learning styles. To shed light on the extent to which learning styles contribute to variances of learning in school, the fourth section covers research studies treating learning styles as an independent variable. The final section deals with Korean characteristics particularily related to unique learning styles.

Learning Style: An overview

Historically, various theories have scientifically explained how learning occurs. Learning is an interactive process, the product of student and teacher activities

within a specific learning environment. These activities, which are central elements of the learning process, show wide variations in pattern, style, and quality (Keefe, 1987a). But general learning theories do not always account for individual characteristics in style that influence the learning process. In the educational setting, educators have tended to attribute lack of academic progress to IQ, socioeconomic status, environmental stimulation, emotional block, or personality conflict (Dunn & Dunn, 1978; Kogan, 1971). However, little attention has been given to different ways students learn.

Recently, research has turned to the individual learner to discover how and why he or she learns, by focusing on cognitive information processing theories and preferred affective and environmental characteristics. Students come to class with wide variety of entry characteristics, such as IQ, motivation, and family background. Individuals also differ in how they are likely to learn most effectively. These individual differences in cognitive, affective, and physiological characteristics with which an individual approaches the educational experience constitute that individual's learning style.

Researchers have provided numerous definitions for learning styles. Many of these definitions share certain common elements; however, crucial differences in emphasis on the importance of these various elements to overall learning provide fundamental theoretical differences.

Gregorc (1979) gave a phenomenological definition of

learning style. He said learning style can be identified through an analysis of overt behavior:

> Learning style consists 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)

According to Hunt (1979), learning style is more a determinant of process rather than of a content.

> Learning style describes a student in terms of those educational conditions under which he is most likely to learn. Learning style describes how a student learns, not what he has learned. To say that a student differ in learning style means that certain educational approaches are more effective than others for him. (p. 27)

Dunn and Dunn (1979a) have stated that everyone, regardless of age, sex, ability level, race, or socioeconomic level, tends to learn through their individual strength and to avoid their weaknesses. Dunn's conceptualization of learning style is based on the premise that at least eighteen different elements from four basic stimuli affect a student's ability to absorb and retain information. Learning style depends on 1) environment (sound, light, temperature, and the need for either a formal or informal design); 2) emotionality (motivation, persistence, responsibility, and the need for either structure or options); 3) sociological preference (self, peer, team, adult, or varied); and 4) physical traits (perceptual strength, need for food intake, time of day, and need for mobility preferences) (pp. 39-54). This research eventually touches the cognitive domain by adding a fifth dimension which includes analytic vs. global and impulsive

vs. reflective styles (Dunn, 1982).

The concepts of learning style presented above by Rita and Kenneth Dunn and David Hunt encompasses the most comprehensive models of learning styles developed to date. This line of models include numerous learning style characteristics, but a close examination reveals a common feature among all these definitions: they focus upon the learner's unique preferences in processing environmental information, such as preferences for perceptual modality, preferences for external environmental conditions, and preferences for learning pattern. This emphasis on individuality in processing environmental information holds the potential to modify the classroom environmental process in a significant and positive manner.

On the other hand, Keefe (1979a) defined learning styles in the larger context as characteristic behaviors on three dimensions.

> 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. (p. 4)

Keefe viewed learning style as consisting of three dimensions: 1) cognitive style--information processing habits representing the learner's typical mode of perceiving, thinking, problem solving, and remembering; 2) affective style--the offshoots of motivational processes viewed as the learner's typical mode of arousing, directing, and sustaining behavior, and 3) physiological style--biologically based modes of responses that are founded on

sex-related differences, personal nutrition and health, and accustomed reaction to the physical environment. According to Keefe, learning style includes individual differences not only in environmental factors but also in psychological factors, such as cognitive style. This is a significant addition to the definition of learning style, for the concepts of learning style offered by others focused on preferences for affective and environmental factors. Thus, Keefe's concept of learning style provides the broadest definition, including all the important elements of learning style.

"Learning style" and "cognitive style" are frequently confused and have often been used synonymously in the literature, although they decidedly are not the same; learning style is a broader term and cognitive style is a subcategory of learning style. Prior to the 1970s, researchers were primarily concerned with cognitive style. During the 1970s, however, "learning style" emerged as a more common term (Kirby, 1979), and learning style was viewed as parallel to cognitive style by the researchers who were concerned with the environmental factors of learning style. For example, Dunn (1981) states that:

> Although the two terms are often interchanged in the literature, they are different but complementary. Learning style is the way in which individuals respond to the environmental, emotional, sociological, and physical stimuli that surround them; whereas cognitive style - whether it refers to field dependence or independence, global or analytic approaches, the 'brain' concept of learning, or specific study skills -describes the ways in which the brain processes information. (p. 34)

The researchers who include all three cognitive, affective, and physiological dimensions in learning style considered cognitive style to be one of the dimensions of learning style. Keefe (1979a), however, distinguished clearly between learning style and cognitive style. He saw learning style as a broader term which included cognitive along with affective and physiological styles.

This study accepts Keefe's definition of learning style and views cognitive style as a component of learning style. This conceptualization of learning style is broad and encompasses all the important elements contributing to characteristic differences between learners. In order to provide appropriate education for students who learn in different ways, educators must identify all three aspects of their students' characteristic learning styles which each individual student brings to school. Presenting only one aspect of cognitive style coupled to one aspect of environmental preference does not give a complete picture of the individual's learning style. This study views learning style as having three dimensions: 1) cognitive, 2) affective, and 3) physiological.

Cognitive styles are information processing habits representing the learner's typical modes of perceiving, thinking, problem solving, and remembering (Keefe, 1987a). Each learner has preferred ways of organizing information that the learner sees and remembers and thinks about. These "consistent differences of the learners in the ways of organizing and processing information" (Messick, 1976,

pp. 4-5) are called cognitive styles. The cognitive style exerts control in the process of integration of new information into existing cognitive structure and in the process of reorganizing information already existing in the memory.

The affective dimension of learning style encompasses individual differences of personality that have to do with attention, emotion, and valuing. Keefe (1987a) defined affective styles as "the offshoots of motivational processes (attention, expectancy, incentive) viewed as the learner's typical modes of arousing, directing, and sustaining behavior" (p. 10). Affective style is relatively consistent for a given learner in a given environment, while individual motivational responses are unstable, and vary occasionally.

Physiological style describes the characteristic learning-related behaviors of the human body. Keefe (1987a) defined physiological style as "biologically based modes of response that are founded on sex-related differences, personal nutrition and health, and accustomed reaction to the physical environment" (p. 13). This physiological style includes preferences for certain aspects of the physical environment, such as different types of lighting and temperature, and modes of biologically based responses, such as needs for food intake, time-of-day rhythms.

Therefore, learning style may be thought of as a complex unit of cognitive, affective, and physiological operatives that control an individual's information processing system. In order to reveal how individual

students learn and to cope with those students' different styles of learning, it is advisable for educators to identify all three dimensions of learning styles (cognitive, affective, physiological) that each student brings to school.

Learning Style Instrumentation

Numerous researchers in the field of learning styles have developed inventories that are designed to measure learning styles. One group of instruments that has received dominant interest is the cognitive dimension of style. Other instruments are concerned with environmental, emotional, and physical dimensions of style. Learning style as used in this research includes cognitive, affective, and physiological characteristics. Accordingly, this section will review learning style instruments under cognitive, affective, and physiological dimensions.

Cognitive dimension

The following instruments assess the cognitive domain of learning style. The Edmonds Learning Style Identification Exercise (ELSIE) is a device for detecting perceptual modality preferences which describes a learner's tendency to use the different sensory modes to understand experience. The ELSIE detects four modes of perceptual responses to common English : (1) visualization--a mental picture of some object or activity, (2) written word--

a mental picture of the word spelled out, (3) listening--the sound of the word, (4) activity--physical or emotional feeling about the word.

The Embedded Figures Test (EFT) and the Group Embedded Figures Test (GEFT) assess field dependent vs. independent cognitive functioning, an area of study which has received the most research attention over the years (Kogan, 1971; Satterly, 1976). The EFT, developed by Herman Witkin, is an instrument which is to be administered individually, while the GEFT is group version of the EFT, which is short and easy to administer. In both the EFT and the GEFT, subjects are shown a simple figure and then required to find it in a complex design that is patterned so that each component of the simple figure is made part of a clear-cut subwhole of the pattern. To locate the simple figure, it is necessary to break up the organized pattern. Independents see elements apart from the background, but dependents are influenced by the overall organization of the background field and see the pattern as a whole. The field independent learner will tend to be highly analytic and systematic; the field dependent learner more wholiest.

The Cognitive Profile, developed by Charles Letteri, is a multidimensional instrument, which is derived from several existing single bipolar-style tests, designed to test the information-processing domain. This profile assesses seven dimensions: Field dependence vs. Field independence, Scanning, Breadth of Categorization, Cognitive Complexity vs. Simplicity, Reflectiveness vs. Impulsivity, Leveling

vs. Sharpening, and Tolerance for incongruence or unrealistic experiences. The Cognitive Profile can chart the student's position across seven cognitive style continuums. The total score of this profile leads to one of three types which predict the level of achievement in academic performance: the Type I profile--indicating analytic, focuser, narrow, complex, reflective, sharpener, and tolerant styles--is associated with high achievement; the Type II profile--reflecting intermediate range on the style continuum--is associated with average performance; and the Type III profile--indicating nonanalytic, nonfocuser, broad, simple, impulsive, leveler, and intolerant styles--is associated with low academic achievement.

Cognitive dimension instruments assess various aspects of information processing habits, such as the mode of perceptual responses, the mode of categorizing, and the mode of discrimination. Typical items are identifying figures or discrimination stimuli from the complex context. Most of the instruments measure one aspect of those cognitive styles respectively. However, the Cognitive Profile integrate those single dimension of cognitive style measures and assess the comprehensive cognitive style.

Affective Dimension

The second dimension of learning style encompasses personality traits that have to do with attention, emotion, and valuing--with the processes of motivation (Keefe, 1987a). The following instruments assess the affective

domain of learning styles.

The Paragraph Completion Method (PCM) is a semi-projective method to assess the Conceptual Level which was developed by David Hunt. The Conceptual Level describes the degree of structure a person needs to learn effectively. Students complete six incomplete statements involving conflict or uncertainty : 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..... Scoring this scale demands a cultivated clinical judgment based on training and practice. High conceptual level means a need for less structure, while low conceptual level indicates a need for high structure.

The I/E Scale by Jullian Rotter is one of several instruments available for the assessment of locus of control. Locus of control is a construct that describes the inclination of an individual's perceptions of causality: internal or external. The Rotter questionnaire presents a series of 29 paired alternatives that describe the ways certain important events in society affect different people. Tests subjects are directed to select the one statement of each pair that they actually believe to be true. Internal individuals think of themselves as responsible for their own behavior. Externals see outer forces beyond their control as responsible for what happens.

These instruments assess the individual's motivational and personality traits that direct or stimulate action

related with learning. Typically, those instruments do measure subjects' perception of their inclination through questionnaire. This dimension of instruments also measures some parts of affective style and does not provide a whole picture of learning styles.

Physiological Dimension

The third domain of learning style includes those learning-related behaviors associated with the functions and habits of the body. Physiological styles are biologically-based modes of response that are founded on sex-related differences, personal nutrition and health, and reaction to the physical environment (Keefe, 1987a).

This domain of learning style is concerned with the environmental elements and time rhythms. The environmental elements that influence learning are light, sound, and temperature. Time rhythms are personal variations in learning readiness related to the time of day: early morning, late morning, afternoon, or evening. The Learning Style Inventory (Dunn, Dunn, and Price, 1979) and the NASSP Learning Style Profile (Keefe, Monk, Letteri, Languis, & Dunn, 1986) incorporate environmental elements and assess time-of-day preferences.

The instruments which measure the physiological styles are quite comprehensive. The LSI measures several aspects of physiological styles including time rhythms, preferences for study environment, and nutrition-related behaviors. These instruments also measure the subjects' perception of

their preferences, rather than directly observing behaviors.

Comprehensive Instruments

The following instruments measure several dimensions of learning-related behaviors; some of them measure cognitive and affective styles, while some of them measure affective and physiological styles. The only instruments that measures all three dimensions of cognitive, affective, and physiological styles is the Learning Style Profile (LSP). The Myers-Briggs Type Indicator (MBTI) and the Cognitive Style Mapping are the instruments that comprehensively measure the styles of the cognitive and affective domains.

The Myers-Briggs Type Indicator is a measure of personality dispositions and preferences based on Carl Jung's theory of Psychological types. The MBTI consists of four bipolar dimensions: (1) sensing vs. intuition perception--sensing is a process of perceiving meaning through human's five senses, while intuition is an indirect perception of knowing; (2) thinking vs. feeling judgment--judgment by thinking is a logical process, while judgment by feeling is bestowing a personal, subjective value; (3) extraversion vs. introversion--the introvert focuses more on the world of concepts and ideas, while the extravert focuses more on the outside environment; (4) judgment vs. perception--judgment is a preference for using a thinking or feeling process in dealing with the outer world, while perception is a preference for using a sensing or intuitive process in interacting with outer world. The MBTI

categorizes individuals into 16 types, which are combinations of four bi-polar dimensions.

Cognitive Style Mapping introduced by Hill (1976) covers the perception, motivation, and mode of inference. The first dimension deals with how the student takes in and processes stimuli and information. The factors of this dimension are the impact of spoken and written words and numbers, the response to sensory stimuli, and the impact of setting. The second dimension examines to what degree the student is either influenced by peers and by authority, or motivated by himself. The third dimension deals with how the student reasons to conclusions; components of this dimension include how often he reasons through use of rules, through logical proofs, or by comparing. This instrument gives an easy-to-read, visual display of the student's cognitive style map by portraying each component as a bar on a graph.

The Learning Style Inventory (LSI), developed by Dunn, Dunn, and Price (1979), is an instrument that is widely utilized by in elementary and secondary schools. The LSI is a self-reporting instrument which is based on a rank-ordering of choices for 104 items. The LSI identifies learning preferences about immediate environmental conditions and emotional, sociological, and physical needs. This inventory incorporates many useful affective and physical elements of learning styles but only touches the perceptual modalities in the cognitive style area.

The NASSP Learning Style Profile (LSP) developed by

National Association of Secondary School Principals Task Force includes the cognitive, affective, and physiological elements of learning styles. The LSP is a single learning style instrument that assesses a broad spectrum of research-based style elements (Keefe & Monk, 1986). The LSP contains 23 scales, representing four higher order factors: cognitive styles, perceptual responses, study and instructional preferences (the affective and physiological elements). Descriptions of the 23 subscales are presented in chapter 3.

The LSP will be used in this because it is the only comprehensive instrument which encompasses the cognitive, affective, and physiological dimensions of learning style. In addition, the GEFT will be used to assess the field dependence-independence dimension of learning style which has been received the most attention. The GEFT is not only the instrument which received the most attention but also the one that has the most well established theoretical basis. On the other hand, the LSP is a new instrument which is in the experimental stage and should be studied more. Thus, in this present study, both the LSP and the GEFT were used in order to measure the comprehensive learning styles and to investigate further the validity and reliability of these instruments.

Sources of Individual Differences in Learning Style

A number of research findings document the existence of individual differences in learning styles (Keefe, 1987a; Dunn & Dunn, 1975; Messick, 1976; Witkin, 1967). Considering those studies dealing with cognitive, affective, and/or physiological styles, learning style differences appear in personal, social, cultural, and ethnic dimensions (Berry, 1966; Witkin & Berry, 1975; Ramirez & Price-Williams, 1974; Dunn, Dunn, & Price, 1985). Characteristic learning styles are not only different from person to person, but also vary according to ethnic groups or cultural groups within the same ethnic groups. As the cross-cultural studies manifest the differences in the learning style among cultural or ethnic groups, one may posit a question as to how these differences come out. The sources of learning style differences can be broadly categorized by two factors: biological or environmental factors.

The research about biological factors as sources of learning style differences originated mainly in male and female differences and sex-typical behaviors--such as aggressiveness, hyperactivity, verbal-spatialization--and cognitive restructuring and disembedding abilities. Hormonal and genetic factors are considered as biological sources of individual differences in the previous studies (Witkin & Goodenough, 1981). Hormonal levels may influence the development of hemispheric specialization of function,

which in turn affects the development of different cognitive restructuring skills relating high gonadal hormones with low restructuring ability (Broverman, Broverman, Vogel, Palmer, & Klaiber, 1964; Dawson, 1972). At the same time, Stafford (1961) proposed that spatial ability is influenced by an X-linked recessive gene predicting low spatial ability in the female who has two recessive X chromosomes. In some subsequent studies, the idea of biological determinant in the stylistic differences has not been repeated (Petersen, 1976; Lawson, 1977).

Although it seems possible that some portions of the variance in learning style among people are attributable to an X-linked genetic determinant, brain lateralization, or perhaps are mediated by hormonal factors, a definitive statement about the potential origins of learning styles in the biological development of the individual is clearly not yet possible (Witkin & Goodenough, 1981). According to Holtzman, Hernandez et al. (1979):

> The evidence presented thus far supports the conclusion that neither constitutional nor experiential factors by themselves can be responsible for the development of a particular cognitive style, rather a combination of both--nature and nurture--influences its development (p. 19).

It seems clear, from the literature, that environmental variables play a very important role in the development of learning styles. A variety of environmental variables, such as training, cultural factors, and socialization have been found to influence learning styles (Witkin & Goodenough, 1981; Shipman & Shipman, 1985; Letteri, 1985; Maccoby &

Jacklin, 1974).

For example, some elements of learning styles, such as spatial visualization, disembedding, and conceptual tempo, can be changed through training (Dolecki, 1976). Witkin (1948) and Goldstein and Chance (1965) found that performance on field dependence-independence and spatial tasks was improved by training, but their improvement did not generalize to other tasks (Witkin, et al., 1962). However, Dolecki (1976) found significant perceptual, analytic training effects on the Piagetian conservation tasks and Embedded Figures Test performance, both of which were considered as different training material. Thus, it may be possible to modify learning styles through training and finally improve academic performance. But, only a few studies are available about the effects of training and the results are not consistent, especially in the area of generalizability to other tasks.

Cultural factors have also been considered as the sources of learning style differences in the cross-cultural literature. Berry (1966) and Dawson (1967a, 1967b) found that the transitional groups, who adopted the more modern life style, were more field-independent than traditional (nonacculturated) groups of the same genetic background. Thus, it seems possible that differences in cognitive style are related to the degree of acculturation (Kagan & Kogan, 1970).

One of the operative variables which explains the relationship between the level of acculturation and

differences in cognitive style is social conformity (Witkin & Berry, 1975). In a traditional society, there exists a high level of pressure to conform to social norms or authoritative figures, such as parents, while in modernized society, there are fewer such pressures, and self-control and independence are allowed.

Witkin, Price-Williams, Bertini, Christiansen, Oltman, Ramirez, and Van Meel (1974) compared children from pairs of villages in each of three countries (Holland, Italy, and Mexico) on a battery of tests of differentiation (Portable Rod and Frame Test, Children's Embedded Figures Test or Embedded Figures Test, Block Design, and Human Figure Drawing Test). Approximately 100 children--boys and girls of about 10 years and 13 years of age from three pairs of villages representing a contrast with regard to emphasis on social conformity (more conformist vs. less conformist)--were examined. In the more conformist villages, there was more extended family structure and more pressure to conform to the prescriptions of authorities (social, religious, and political) and discouragement of any questioning of these prescriptions than in less conforming villages. The result showed that people from less-conformist villages exhibited greater differentiation than those from more conformist villages. The impact of family and social arrangements seemed to discourage individuality to a greater extent among children growing up in the more conforming villages and those values kept in the more conforming villages seemed to bring field-dependent cognitive style.

The different values kept in those societies may exert effects on the individual through socialization practices in childhood (Witkin & Berry, 1975; Ramirez, & Price-Williams, 1974) and finally bring diverse individual learning styles. Many researchers have found parental socialization practices as determinants of field dependence-independence (Dyk, 1969; Dyk & Witkin, 1965; Witkin, et al., 1962; Witkin & Berry, 1975; Ramirez, Price-Williams, 1974) and as determinants of sex typical behavior, such as male aggressiveness and hyperactivity and female dependency and anxiety (Maccoby & Jacklin, 1974).

The most influential determinant of cognitive style differences is the type of relationship that the child has with his or her parents and, in particular, the degree to which autonomous functioning in the child is either fostered or inhibited within the context of this relationship (Witkin & Berry, 1975; Witkin & Goodenough, 1981). According to Witkin and Goodenough (1981), "child-rearing practices that encourage separate autonomous functioning foster the development of differentiation, in general, and more particularly, of a field-independent cognitive style. In contrast, child-rearing practices that encourage continued reliance on parental authority are likely to make for less differentiation and a more field-dependent cognitive style" (pp. 81-82).

Dyk and Witkin (1965) supported the idea that the development of field dependence-independence is largely contingent upon parental socialization practices; whether it

fosters or interferes with autonomy. Based on interviews with mothers, it was revealed that the mother of a field-dependent boy, compared to the mother of a field-independent boy, was likely to encourage continued connections with her by limiting the child's activities in the community; emphasizing conformity; discouraging assertive and aggressive behavior; and not stimulating the child to assume responsibilities. The parental socialization practices seem to be an important operative variable which delivers social values to the children's learning styles

In conclusion, environmental factors, such as cultural values and training, exert an important role in the development of the individual's learning styles. Cultural values, such as the degree of social conformity, bring different learning styles through parental socialization practices because the parental socialization practices reflect the values that a family and the society hold. Thus, differences in the cultural values, environmental circumstances, and familial backgrounds among social groups may form different styles in the children's behaviors through their early experiences (Ramirez & Price-Williams, 1974).

Residence (Urban/Non-urban)

Urban and non-urban areas differ in several respects, including the size of the population, the job diversification, the access to centers of various life affairs, the economic level, the degree of acculturation,

the degree of social conformity, and child rearing practices. These differences might create conditions that generate different patterns of dealing with environmental stimulation from childhood, which would, in turn, be followed by the presence of learning style differences.

Urban society is more acculturated and modernized than rural society, in the sense that the urban environment emphasizes independence, autonomy, and achievement, while rural society emphasizes conformance to traditional norms (Nedd & Gruenfeld, 1976). According to the social conformity model (Witkin & Berry, 1975), the urban and rural societies which keep different levels of conformity to social values seem to produce different learning styles.

Ramirez and Price-Williams (1974) found the relationship between the degree of individual identity encouraged by the cultural groups and the development of field independence. Members of groups which placed emphasis on the group's identity and on respect for adult and authority (Mexican-American and Black-American) were more field-dependent, while members of groups which encouraged separated identity from the family and questioning of convention, were more field-independent. The degree of autonomy and separate identity seem to be related with the development of psychological differentiation.

Baran (1971), as cited by Witkin and Berry (1975, p. 55), found that rural people had less of their own identities and this value was related to field-dependence. Bantu rural adults were characterized as group-oriented and

as having less of a sense of their own identity than the urban counterparts and, thus, the rural subjects were more field-dependent than urban subjects. Thus, the degree of autonomy encouraged in urban and rural groups may be related with some elements of learning style.

The different values in subcultural groups might be reflected in the socialization practices, which, in turn, affect development of learning styles in children (Witkin, 1967). Okonji (1969) investigated the consequences of the differences in child-rearing practices usually observed among parents in rural and urban environments on the development of cognitive styles in their children. He found that Nigerian undergraduates brought up in an illiterate rural home were identified as more field-dependent on the RFT than those brought up in a literate urban home, yet both of these groups did not differ significantly on the EFT. In spite of the inconsistent findings between the RFT and EFT, the author concluded that urban students were more field-independent than rural students because the RFT is a more pure and stable measure of field dependence-independence than the EFT. In comparing this Nigerian data with the New York city data of Witkin, Okonji also found that Nigerian rural male subjects were more field-dependent than male subjects from New York City on the RFT and on the EFT. Also, Nigerian urban males were more similar to the New York males than were the Nigerian rural males, although neither Nigerian nor New York female subjects showed any differences on the RFT and on the EFT.

As shown in these research findings, different cultural values encouraged in urban and rural societies seem to produce different cognitive styles through socialization practices, identifying social conformity as being related to field-dependence cognitive style, and autonomy with field independence. As a whole, the degree of urbanization is related to the degree of social conformity/autonomy, which, in turn, is related to psychological differentiation. In short, the more urbanized the society is, the more field independent the members of that society are.

An urban area is more modernized and technologically developed than a rural area, a fact which means that members of an urban society have a more westernized life style and accept western values (transitional group). In contrast, a rural society is less westernized and keeps more traditional values (traditional group). As mentioned in the previous section, members of traditional society are exposed to and adhere to norms of social traditionalism, such as extended patriarchal structures, strict obedience to parental authority, emphasis on conformity, and restriction of emotional autonomy, while members of urban society are allowed emotional autonomy and self-control. These differences in values and life styles between urban and rural societies will exert an effect on the children of these societies through socialization practices, a factor which finally will bring about different learning styles.

In most studies, the urban and rural residents showed different cognitive styles. However, in a few studies, the

differences were insignificant or weak. As previously mentioned, in the Okonji's (1969) study, the urban children did not differ in the Embedded Figures Test from rural children, although there was significant difference on the Rod and Frame Test. Nedd and Gruenfeld (1976) examined differences in the field dependence-independence among six subcultures of Trinidad, using the group Embedded Figures Test developed by the Educational Testing Service. They found the degree of urbanism was weakly associated with field dependence ($p < .08$).

Thus, more extensive research about characteristic differences in learning styles between urban and rural residents, using a variety of subjects, is required in order to set a stable theory. In addition, the study of characteristic learning styles of urban and rural residents should not be limited to the range of field dependence-independence, rather it is recommended that this research include not only an examination of cognitive styles but also of the affective and physiological dimensions of learning styles.

Gender

A number of investigations deal with male and female performance, including intellectual characteristics, social behaviors, and motivation (Maccoby & Jacklin, 1974; Kogan, 1976; Witkin & Goodenough, 1981). However, the findings of research about gender differences are inconsistent so it is premature to bring a single comprehensive conceptual scheme

to bear on the issue (Kogan, 1976). Consequently, comparisons and conclusions must be drawn cautiously.

One line of study which focused on the psychological differentiation did substantiate some gender differences. Witkin, Dyk, Faterson, Goodenough, Karp (1962) found that male adults tended to be more field-independent than females on the Rod and Frame Test. Kagan, Moss, and Sigel (1963) reported that male children scored above the median on analytic conceptualization, while the females scored below the median. A study using New Zealand subjects (Harker, 1981), further supported gender differences: boys scored higher than girls in analytic responses. Considering these studies, the findings are in the same direction: male predominance over female. Although some studies using Western samples suggested gender differences in the cognitive style dimension, these differences were small in comparison with the range of differences within each sex (Witkin, Moore, Goodenough, & Cox, 1977).

Kogan (1976) asserted that the gender difference is not significant enough to make any practical difference educationally. Especially using diverse cultural subjects, gender differences in the cognitive style have not been consistent across scored tests within given studies nor across studies. Further, in studies in which some relationships did emerge between gender and cognitive styles, those results were not statistically significant. For example, Okonji (1969), using a field dependence-independence approach to visual perception, found gender

differences in the cognitive style on some tests, but these differences were not significant on all tests. Among Ibusa (rural) samples, male subjects scored higher on the Children's Embedded Figures Test (CEFT) than female subjects, indicating that the male adapted a more analytic, active, and field independent approach to the perceptual task, but there were no significant gender differences on the RFT. Among the university (urban) samples, the males showed a more field-independent performance than the females on the RFT, but there was no significant gender difference on the EFT. Okonji (1969) asserted that whether or not the sex differences do appear may depend on the type of tests used. Berry (1966) also reported no significant gender differences for an Eskimo community sample of mixed ages either on the EFT or the Block Design.

The possible reason for these inconsistent findings is that gender interacts with other demographic variables, such as age, socioeconomic class, the level of education, and cultural background (Kogan, 1976). For example, the pronounced gender differences in spatial-visualization ability emerge only during adolescence, with boy's superiority increasing through the high school years (Maccoby & Jacklin, 1974). Marked gender differences resulted in the studies using adults and adolescence, while the gender differences in similar studies using preadolescents were very small (Clark & Halford, 1983; Witkin & Goodenough, 1981). Gender differences observed in one cultural society are lacking in another society (Ramirez

& Price-Williams, 1974; Berry, 1966). Witkin and Berry (1975) have theorized that the possible reason for the interaction of gender and cultural background may be a different sexual socialization practice: for example, in agricultural and western cultures, females have been expected to conform in their behaviors more than males. While, in migratory hunting societies like the Eskimos, both the males and the females are brought up to be independent, a practice which, in turn, creates no gender difference.

The inconsistent findings about gender differences and the possible complicated interaction of gender with other demographic variables in learning styles require further research, study which should include not only cognitive styles but also emotive and motivational responses, environmental preferences. It is also necessary to include a variety of cultural variables, such as the urban/rural division, in any gender difference study in order to reveal the interaction effect of gender with these cultural variables.

Learning Style and Achievement

Attention to the manner in which learning style affects academic achievement, according to Dunn (1984), is a phenomenon which has emerged only in the last decade and a half. Extensive research regarding identifying the relationships between learning style and academic achievement has repeatedly supported the observation that students do learn differently from each other and that

student performance in diverse subject areas is related to each individual's learning style (Dunn, Dunn, & Price, 1977).

The relationship of learning style to academic performance can be explained by the model of information processing. Learning style is a composite of cognitive, affective, and physiological operatives that control an individual's information processing system (Letteri, 1985). Cognitive variables are perceptual controls or frames; affective variables are motivational biases or preferences; and physiological variables are bodily states or predispositions. If, for example, a student has good analytic skills (cognitive variable), information will probably be categorized correctly; if a student does not like mathematics (affective variable), learning will be impeded similarly; and if a student feels ill or tired (physiological variable), little learning will occur. Thus, learning style should be attended to as an important determinant of success in school.

If students have their own learning styles and these styles are related to performance, one may question which styles contribute the most to the academic achievement in certain subject areas. In fact, several dimensions of cognitive styles have been found to correlate with performance in diverse subject areas, such as general problem solving, reading, mathematics, physical science, and geography. One of the cognitive style dimensions, field dependence-independence, can lead to successful or

unsuccessful predictions in academic achievement. Since field dependence-independence style denotes a tendency to articulate figures as discrete from their backgrounds and a facility in differentiating objects from embedding contexts, an individual who can not keep an item separate from the surrounding visual field, i.e., field-dependent, is also likely to have difficulties with the kind of problem that requires taking some critical element out of the context in which it is presented and restructuring the problem so that the element must be used in a different manner (Witkin et al., 1962; Witkin et al., 1977). This difference in performance occurs often in problems of mathematical and logical reasoning.

Ehri and Muzio (1974) gave university students a verbally-stated problem concerning a merry-go-round with two concentric circles of horses. The subjects were asked to determine if a rider of a horse from the inner circle was travelling faster than, slower than, or at the same speed as a rider of a horse from the outer circle. Field-independent students performed better on this problem than field-dependent students. It was inferred from students's explanations about the answer that most field-dependent students tended to be dominated by the perceived physical properties of the situation and were most resistant at another line of reasoning, while most field-independent students tended to reason correctly from the beginning of the problem in that they were able to analyze the problem of the context, to extract the relevant variables, and to

coordinate them properly.

Contrary to the Witkin's claims that analytic functioning is independent of verbal and mathematical skills (Witkin et al., 1962), there are some studies reporting significant relationship between more analytic, or field-independent, cognitive style and mathematics achievement. Vaidya and Chansky (1980) studied the influence of field dependence-independence on mathematical achievement, using elementary school students. A significant main effect of cognitive style was found in this study, i.e., field-independent students who scored at or above their grade-level median on the CEFT, showed greater ability in conservation tasks and obtained higher raw mathematics scores on the Stanford Achievement Test. Satterly (1976) found that field independent boys (average age of 10.8) performed better in mathematics, in vocabulary, and in spatial judgment. But the differences were not found in vocabulary and in spatial judgment when IQ was controlled. In mathematics, the differences were found in favor of field-independent boys with IQ controlled. Results of these studies indicate that cognitive style characteristics do affect school performance (Cohen, 1969; Satterly, 1976), and there seem to be some relationship between field dependence-independence style and intelligence.

Black (1977) studied field dependence-independence, its relationship to school achievement and I.Q., and the stability of that relationship over time. An analysis of covariance, with I.Q. as the covariate, between the EFT

score and school subject grades (mathematics, science, social studies, and English) at both sixth and eleventh grades as nonsignificant. A t-test and Pearson product-moment correlation between field-independent subjects' IQ scores and field-dependent subjects' IQ scores revealed as both significant ($p < .001$). That is, there was a significant positive relationship between cognitive style and IQ. Since field-independent subjects tend to have a higher IQ, Black (1977), therefore, strongly recommended that IQ be measured and controlled whenever relationships are sought between cognitive style and other variables.

Charles Letteri (1977) contended that a multi-dimensional cognitive profile consisting of seven cognitive style elements would predict achievement on standardized tests: Type I profile--high achievement, Type III profile--low academic performance, Type II--average performance. Letteri (1980) tested whether a cognitive profile is capable of differentiating between high and low academic performers using seventh and eighth graders. The results showed that for each grade level, the cognitive profile was capable of differentiating between high and low achievers in the direction of Type I with high achiever and Type III with low achiever on each of the five achievement areas (mathematics, language, reading comprehension, work skills, and composite). The study revealed that cognitive profiles were significantly correlated to and, therefore, predictive of individuals' academic performances on standardized tests, employing a regression analysis on the subscores of the

individual dimensions of the subjects' cognitive profiles (Type I, II, or III).

When each of the seven cognitive styles was tested to determine if that style could significantly differentiate high and low academic achievers, the results indicated that none of the styles by themselves was able to significantly make such a differentiation (Letteri, 1980). In contrast to studies of cognitive styles using a unidimensional approach, Letteri's (1980) study clearly demonstrated that the cognitive profile was able to predict high and low achievers more accurately and to account for the levels of individual's academic achievement by using a multidimensional approach which employs a variety of learning styles. Therefore, through the use of comprehensive instruments, educators can accurately identify those specific dimensions of individuals' thinking and learning patterns which contribute to their levels of academic performance and can also specify academic weaknesses and strengths which could be ameliorated through focused and efficient training.

Several studies examined the relationship between the emotional and physical elements of learning style and achievement and found some elements of learning styles were significantly related to high or low levels of academic achievement (Price, Dunn, & Sanders, 1981; Carbo, 1980; Clyne, 1984; Calvano, 1985). Further, these study suggest that individuals learn most rapidly and effectively via their preferred learning style, so that identification and

utilization of these individual strengths can and should produce improved scholastic performance. Extrapolating from these studies, those students, who fit to the current school learning environments and teaching styles, seem to achieve high scores in academic performance.

Most of the research, concerned the affective and physiological styles, comparing the learning style preferences of high versus low achievers in the subject areas of reading and mathematics. In each study, significant differences in learning style preferences, as measured by the LSI, were found to exist between achievement groups. Carbo (1980) in comparing reading styles of good, average, and poor readers in second, fourth, sixth, eighth grades discovered the elements of perception, food intake, and mobility appear to be of importance to the students in reading. The reading preference of the good readers reflects visual and auditory strength with little need for mobility or food intake. The poor readers have a tactual, kinesthetic preference with a desire for mobility and availability of food intake.

Price, Dunn, and Sanders (1981) examined which of the LSI variables differentiated among students having high or low reading achievement. The LSI and New York State's Pupil Evaluation Program (PEP) in Reading and Math were administered to a total of eight five subjects in third and sixth grades. Eleven LSI variables significantly discriminated between subjects in the high and low reading achievement groups as measured by the PEP. Students with

high reading achievement preferred low light, formal design, were self-motivated, and not adult-motivated, were persistent, responsible, did not prefer to use the tactile and kinesthetic senses, did not prefer food intake, did not function best in late morning, and needed mobility. Students with low reading achievement preferred bright light, informal design, were not self-motivated, were adult-motivated, generally unmotivated, not persistent, not responsible, preferred to learn using tactile and kinesthetic senses, preferred food intake, functioned best in late morning, and did not need mobility. Price, Dunn & Sanders (1981) concluded that "selected learning style characteristics can be used as predictors to identify early those students who are likely to become good readers, namely, those who are persistent, responsible, self-motivated, and who do not prefer to learn tactually or kinesthetically" (p. 224).

Dunn, Dunn, and Price (1977) also identified learning style characteristics of high and low mathematics achievers in third and sixth grades. The results revealed that eight LSI variables significantly discriminated between high and low mathematics achievement groups. High math achievers preferred a formal design when studying, were not adult-motivated, were persistent, were responsible, were not peer-oriented learners, did not require food when studying, did not function best in the late morning, and needed mobility. In contrast, individuals with low mathematics achievement preferred an informal design when studying, were adult-

motivated, were not persistent, were not responsible, preferred studying with peers, required food when studying, functioned best in the late morning, and did not need mobility.

From the research presented above, the common characteristic styles of high achievers and low achievers can be generalized found: the learning styles of high achievers included persistence, preference for formal design, self-motivated, no preference for tactile and kinesthetic senses, and no preference for food intake, while the low achievers characteristic styles were inpersistence, adult-motivated, preference for informal design, and preference for food intake. These studies identified the learning style variables which discriminated high or low achievers, but these studies did not necessarily prove that these characteristic learning styles could predict the variance of achievement. Thus, it is desirable that educators identify the characteristic learning styles of students and identify which styles predict the most variance of their achievement. Once the characteristic learning styles, which predict achievement, are identified, the performance of the students can be improved by matching teaching styles with learning styles.

Cross-Cultural Studies of Learning Styles

An impressive body of cross-cultural research has largely supported learning style differences among ethnic groups or subcultures. For example, children from more

acculturated, transitional society (westernized) were more field independent than those from a traditional culture (Witkin, et al., 1962; Ramirez & Price-Williams, 1974; Gonzales & Roll, 1985). Cross-cultural studies proposed that social and cultural characteristics are associated with socialization which, in turn, influence stylistic differences (Ramirez, 1982; Oltman, 1986; Witkin & Berry, 1975). Traditional societies, characterized as less acculturated, adhere to the social traditional norms, and thus, emphasize conformity and obedience to parental authority, and restrict emotional autonomy for children in the socialization practice. On the other hand, transitional societies, characterized as westernized societies, exert less pressure to conform and thus, allow children greater opportunity for self-control and independence (Witkin & Berry, 1975). These different socialization practices in each transitional and traditional societies seem to foster different learning styles.

From a large body of cross-cultural research, there comes evidence of the contribution of cultural value to the development of characteristic learning styles. Some of the earliest studies examining interrelationship between cultural values and learning styles compared radically different groups within a single Israeli society (Preale, Amir, & Sharan, 1970; Weller and Sharan, 1971). All these studies compared groups of Middle-Easterners with those of Western ethnic-origin living in Israel. Preale Amir, and Sharan (1970), for example, stated that the emphasis on

subordination to authority was greater in the former group, whereas the latter was characterized by greater emphasis on the acquisition of individual autonomy. In contrast with the families of Western origin, the Middle-Eastern families were described as more tradition-oriented and as having an authoritative patriarchal structure, which tended to foster subordination to authority and reduction of autonomy. On the measures of EFT, Rod and Frame Test, Block Design, Human Figure-Drawing Test, or figure drawings, children of Western origin were more field-independent, reflecting a more differentiated body concept, and they produced more articulated figure drawings than children of the Middle-Eastern origin.

Studies along this line using Mexican-American participants also indicated that cognitive orientation differed between members of a more acculturated society and members of nonacculturated societies which emphasize social conformity (Ramirez & Castaneda, 1974; Ramirez & Price-Williams, 1974). Studies of Ramirez and Castaneda (1974) and Ramirez and Price-Williams (1974), employing various measures of field dependence-independence, have found that Mexican-American children were significantly more field-dependent than Anglo-American children. Mexican-Americans in these studies were, for the most part, drawn from communities identified as traditional and semirural, where it was assumed, the traditional cultural values and family practices are maintained, while the Anglo-Americans emphasized encouraging children to develop identities

separate from those of family group. The researchers suggested that stylistic differences among these societies, with a less conforming group tending to be more field-dependent than a more conforming group, can be attributed to related differences in cultural values between the two groups, which are, in turn, viewed as reflecting socialization differences (Ramirez & Castaneda, 1974).

One culture of particular interest to this study is the Korean culture. Korea, like other Asian countries, is a traditional society compared to western countries in terms of conformity to social norms, obedience to authorities, and the development of individualism (Nakamura, 1964). In Korea, historically Shamanism and Confucianism have had a marked influence; this influence extended to a self-devaluating authoritarian tendency, a face-saving formalism, and the patriarchal extended family system, all of which have been important agents in the formation of the Korean people's personality (Yoon, 1969). Consequently, free thought along the line of individualism did not develop as it did in the West (Nakamura, 1964). Furthermore, it goes without saying that Korean people are much more involved in familial lineage and family matters than Westerners. Considering these cultural differences between Korean society and the Western countries, one may hypothesize that Korean people may have particular learning style, which is different from that of more westernized societies.

Drawing from the cross-cultural study data, it is assumed that members of more westernized societies will have

different learning styles compared to those of traditional societies, including psychological differentiation, emotional and environmental preferences. The culture of Korea, previously characterized as a traditional society, is being changed by the influence of the western culture, specifically by developing technologically and accepting western values and life-styles. However, the degree of westernization varies according to urbanization (Gamble & Ginsberg, 1981). Thus, urban residents of Korea may be more westernized than the rural residents because urban residents have had more chance for a western education, and because the speed of change toward westernization is slower in the rural area. Thus, social traditionalism syndrome also can be used to explain differences in learning style between these urban and rural residents (Nedd & Gruenfeld, 1976).

Park (1972) found different cognitive styles between urban and rural Koreans and Americans who can be represented on the continuum of acculturation. A total of 525 subjects, sampled from fourth to eighth grade boys and girls in urban and rural areas, were administered the Witkin's Graphic Embedded Figures Test (GEFT) and the Sigel's Test of Conceptual Styles (TCS). The results of the TCS showed that the American children were more analytic in their conceptual approaches than the Korean children but the GEFT did not show any difference in the cognitive styles between American and Korean children. The urban group was more field-independent and analytic both on the TCS and on the GEFT. In addition, the Korean rural group was more field-dependent

than Korean urban group on the GEFT and the TCS. This study, using Korean and American subjects, also supported the idea that the degree of westernization is related to psychological differentiation: the more westernized the societies are, the higher the scores are on the cognitive style measures. Thus, one may conclude that urban and rural division can be seen on the dimension of a transition-traditional society in terms of the cultural values they maintain and, further, that cultural factors exert influence on the development of learning styles through socialization practices.

The values that Korean society adhere to are in transition through the influence of western culture's marked technological development. Thus, the socio-environmental situations and the patterns of socialization practice in Korean urban areas, especially in large metropolitan areas, are a combination of traditional and Western patterns. But, in the rural areas, the cultural value change may be slower than in urban society; the rural residents may have less westernized values and lifestyles and may conform to traditional values more than urban residents. Urban families observe the extended family system to a lesser degree and tend to imitate more Westernized ways of living and child-rearing ideologies. In addition, most urban parents press their children to do well in school and spend considerable money for extra-curricular study programs after formal school hours. Thus, urban and rural residents not only have different cultural values but also have a

different diversity of life affaires, different experiences in early childhood, and different socialization. It appears that the urban Koreans, compared to rural Koreans, live in situations that are more similar to those conditions presumed to foster characteristic western perceptual skills. Therefore, it is necessary to investigate the learning style differences between Korean urban and rural residents using a comprehensive instrument which measures diverse learning styles such as cognitive, affective, and physiological styles.

Summary

This chapter presented literature examining definitions of learning styles and instruments as related to concepts of learning styles. The relationship between the learning styles and achievement was discussed. This chapter also reviewed the possible sources explaining individual differences in learning styles and considered the different learning styles between Korean urban and rural groups and between Korean males and females.

A variety of definitions of learning style, from narrow to broad dimensions, were presented. The definition of learning style by Keefe (1987a) was accepted by this study because this definition includes all three dimensions of learning style: cognitive, affective, and physiological. Students differ not only in cognitive styles but also motivational and personality traits and in preferences for study environment. Further, these differences in learning

style seem to be related to high and low academic achievement. Thus, the study about learning style will have benefits when it admits broad definition of learning style because this concept encompasses all kinds of learning styles. Similarly, instruments, which measure various elements of learning style respectively, were present but NASSP Learning Style Profile was preferred as it is the only one which measures all three dimensions of styles. Employing the LSP gives benefits to the researcher because this instrument can provide a comprehensive picture of the students' characteristics related to learning.

Among the several genetic and environmental sources of learning style differences, the cultural factor has been the most thoroughly investigated and seems to be an influential source of individual's learning styles. Cross-cultural studies suggested that different cultural values, such as the degree of conformity to social norms, lead to different learning styles through parental socialization practices. According to social conformity model, the more westernized the societies are, the greater the pressure to conform to social norms is, and thus, the less autonomy and independence are allowed. Less conformity, high level of independence, and emotional autonomy may produce different learning styles, such as field independence, less strict study habits, and preference for informal study environment.

Focusing specifically on Korea, the Korean urban society is more westernized and less conforming than the Korean rural society. Considering this cultural difference,

the learning style differences between Korean urban and rural groups are expected. Since in previous studies, gender differences in learning styles were inconsistent or the differences were small because of interaction with other variables, further study is needed before gender can be hypothesized as important to learning style. Thus, studies about the differences in learning styles among Korean urban and rural groups with gender variable is necessary.

In addition, learning style differences are identified as related to high or low academic achievement. Some cognitive styles are more productive of school achievement than others and some affective and physiological styles fit better in the current study environment than others (Keefe, 1987a). Thus, educators can help students by identifying which learning styles are related to higher achievement in certain subject areas and by providing the appropriate instructions.

In summary, the cultural differences may produce students' different learning styles and these learning styles are related to high or low academic achievement. Thus, a learning style model can be an intervening variable which explains the relationship between cultural differences and differences in academic performance. When the students' learning styles, which may be caused by cultural factors, are identified and appropriate instructions are given based on the diagnosed learning styles, educators can reduce the differences in academic achievement between urban and rural students.

CHAPTER III

METHODOLOGY

Introduction

This chapter, consisting of five sections, describes the methodology of this study. Section one is a presentation of the research design; section two is a description of the population and sampling procedure; section three is a description of instruments employed and the reliabilities and validities of those instruments; section four is an outline of the procedures used in this study; the fifth section is a brief explanation of the scoring and data analyses; in the final section, the null hypotheses are addressed.

Research Design

This study consists of two parts: (1) the first part describes the relations between learning style and the place of residence (urban/non-urban) and gender; (2) the second part describes the relationship between learning style and school achievement as measured by the Kyohaksa Achievement Test (November, 1988 version) in the subject areas of Korean language, mathematics, English, social studies, and science.

In the first part of the study, a 2 X 2 Multivariate

Analysis of Variance was performed on the data. The independent variables were the place of residence (urban/nonurban) and gender. The dependent variables were scores from the Learning Style Profile (LSP) and scores from the Group Embedded Figures Test (GEFT). The 23 subscales of the LSP were subjected to a principal component analysis with varimax rotation and the resulting factor scores from the principal component analysis were used as dependent variables.

In the second part of the study, five Stepwise Multiple Regression Analyses were performed to test for a relationship between learning style and achievement scores. The independent variables were the factor scores from the LSP and score from the GEFT. The dependent variables in the stepwise multiple regression analysis were the school achievement scores of the Kyohaksa achievement test in the subject areas of Korean language, mathematics, English, social studies, and science.

Sample

In order to compare the characteristic learning styles of students in urban and non-urban areas, the subjects were drawn from Seoul, representing an urban area, and from Kunwi, representing a non-urban area. Seoul is the Korean capital city; it has a population of 11 million. Kunwi is a small town which has a population of 10,831 (November, 1988) and is located in a relatively remote mountain area. Except for a few people who live in the central area of the town

and earn a living by running small shops or providing public services, most people in this area own small farms. Kunwi has an elementary school, a boys' middle and high school, and a girls' middle and high school.

A coed middle school in Seoul was used for the urban sample. Among the 860 9th grade students in the school located in Seoul, 218 boys and girls were randomly selected and administered the Learning Style Profile. Eighteen students were deleted from the data analysis because they failed to provide the necessary information, such as their identification number, or because they did not completed the profile. In Kunwi, all the 206 9th grade students in the Kunwi girls middle school and in the Kunwi boys middle school were used as subjects for the non-urban sample. Among these subjects, 16 students were deleted from the data analysis because of lack of necessary information or incompleteness of the profile. Thus, a total of 390 students were used in the data analysis, including 200 urban students and 190 non-urban students. Among the 390 students, the number of male students was 189 and the number of female students was 201.

Instruments

The Learning Style Profile

The Learning Style Profile (LSP) published by National Association of Secondary School Principals (NASSP) was used to measure the characteristics of individual learning

styles. The LSP was developed by the NASSP research department in conjunction with a national task force of learning style experts (Keefe, Monk, Letteri, Languis, Dunn, 1986) in order to encompasses most of the important current unidimensional instruments. Thus, the LSP was modeled on the unidimensional instruments published so far and became a comprehensive instrument containing 23 subscales.

The 23 independent subscales of LSP represents four higher order factors: cognitive styles, perceptual responses, study, and instructional preferences (the affective, and physiological elements). The items on the five cognitive style scales (analytic, spatial, discrimination, sequential processing, and memory skills) generally involve identifying or differentiating figures. On the other hand, the items of categorization skill scale involve choosing verbal sentences which represent upper and lower criteria for a category, given verbally stated problems. The perceptual response scales require the subject to choose an initial response among visual, auditory, and emotive responses, given familiar words. The verbal-spatial preference scale presents words and shapes and requires the subjects to choose words or shapes. Items of the other scales, mostly of the affective and physiological style, are Likert-type verbally-stated problems.

Although there is no mandatory time limit for this test, the manual suggests an administration time of 45 minutes. In this research, the factor scores from the

principal component analysis of 23 subscales were used as variables. These 23 subscales are described as follows:

1. Analytic Skill - The analytic scale is modeled on the Embedded Figures Test (EFT) developed by Witkin and the Group Embedded Figures Test (GEFT) which is group version of the EFT. Analytic skill measures a student's capacity for identification of simple figures hidden in a complex field.

2. Spatial Skill - This scale includes pattern recognition items and spatial rotation items. Pattern recognition items assess the capacity for identification of identical but different sized geometric shapes within larger identical figures. The spatial rotation items assess the capacity of mental rotation and visualization of two-dimensional patterns as three-dimensional shapes in the imagination.

3. Discrimination Skill - This skill is modeled on focusing control (so-called scanning) developed by Schlesinger (1954) and Holzman (1966). Subjects view a series of randomly ordered discs which include several distracting cues and must choose a disc of the same size as the standard disc. Discrimination skill assesses the capability for focusing attention on important elements and avoiding distractions.

4. Categorizing Skill - This scale is patterned on a category width test developed by Pettigrew (1958). Given a statement of the average for some category, the subjects are asked to identify the upper and lower limits of the category. Categorization skill measures students'

consistency in making judgments based on either narrow or broad parameters for category inclusion. Narrow categorizers tend to be better equipped for demanding academic tasks requiring a complete, accurate, and organized category of easily accessible information. Broad categorizers lack the organization and accuracy for these kinds of tasks.

5. Sequential Processing Skill - This scale measures the capacity of processing of information sequentially to readily derive meaning from information presented sequentially. The subjects are asked to determine whether a series of geometric shapes is present or missing in a set of simple puzzles.

6. Memory Skill - This scale measures the ability of retaining distinct vs. vague images in repeated tasks, detection and remembering subtle changes in information. Given a series of familiar figures presented in sequence, the subjects are to detect whether or not each succeeding figure is identical to the preceding ones. Differences are created by omitting or adding to each new version of the preceding figures.

7. Perceptual Response - The perceptual response subscales - visual, auditory, emotive - are based on the Edmonds Learning Style Identification Exercise developed by Harry Reinert (1976). This scale measures the tendency of an individual to react to a series of words (representing various concepts and objects) in terms of visual, auditory, or emotive modalities. These include: Visual - Initial

reaction to information as visual response; auditory - Initial reaction to information as auditory response; emotive -Initial reaction to information as emotional and/or physiological response.

8. Persistence Orientation - This scale is composed of Likert-type items written to assess willingness to work at a difficult task until completion.

9. Verbal Risk Orientation - This scale consists of Likert-type items assessing willingness to express opinions, speak out, and defend thoughts and ideas before a group.

10. Verbal-Spatial Preference - This scale assesses the subject's preference for verbal vs. nonverbal activities. Items of this scale contain a set of three shapes and a set of three words. Two of the words and two of the shapes in each set are related, while the remaining word and shape are distractors. The subjects is to asked to choose the preferred pair, verbal or spatial, in each item.

11. Manipulative Preference - This scale, consisting of Likert-type items, identifies learner preference for "hands-on" learning activities. Manipulative learners like to build, fix, make, or put things together.

12 Study time preference: The study time preference subscales employ Likert-type items modeled on similar statements from the Dunn, Dunn, and Price (1985) Learning Style Inventory. These statements ask learners to identify their optimum time preference for individual study and learning: early morning, late morning, afternoon, evening.

13. Grouping Preference - This scale is composed of

Likert-type items that identify individual learner preferences for whole class vs. small group learning arrangements.

14. Posture Preference - This subscale, consisting of Likert-type items, assesses learner choice for formal vs. informal study arrangements and related body posture. A student with formal preference prefers to work in an upright posture at a desk or table, using a straight chair. A student with informal preferences prefers to work in a more relaxed posture, sitting or sprawling on a carpeted floor, a sofa, or an upholstered chair.

15. Mobility Preference - This Likert-type scale assesses learner tendency to move about and take breaks while studying in contrast to working in place until finished.

16. Sound Preference - This scale, employing Likert-type items, measures individual preference for quiet study areas vs. background sound (radio, TV).

17. Lighting Preference - This subscale, employing Likert-type items, assesses individual preference for bright vs. low lighted study areas.

18. Temperature Preference - This subscale uses Likert-type statements to assess learner preference for studying in a cold vs. a warm environment.

Reliability of the LSP

Keefe & Monk (1986) evaluated the reliability of the LSP in two ways. First, they calculated internal

consistency coefficients using Cronbach's alpha for each of the twenty-three subscales from the entire normative sample. Second, they calculated test-retest reliabilities for each subscale (except the Categorization skill subscale) from a smaller separate sample for 10-day and 30-day periods of time. An alternate Categorization Skill subscale was adopted as a result of the reliability studies, and, therefore, no test-retest reliability data is available for this subscale at this time. Results of the reliability studies are presented in Table 1. As shown in Table 1, the internal consistency reliability for the subscales ranges from .82 to .21 and the average is .60. Even though Keefe and Monk interpreted these reliabilities as acceptable for short tests (typically five items for each subscales), the reliabilities of LSP subscales seem to be low.

Validity of the LSP

Keefe & Monk (1986) also reported four types of validity: face, content, construct, and concurrent validity.

Face validity was examined carefully by the Learning Style Task Force (David P. Cavanaugh, John K. DiTiberio, Rita Dunn, Barbara Ferrell, Marlin Languis, Charles A. Letteri, Penelope Peterson, Royce Ronning, John S. Monk, James W. Keefe). They screened scales and items on the LSP and chose scale names and scale items for their ability to measure exactly what they appear to measure (Keefe & Monk, 1986).

Content validity was investigated by the Learning Style

TABLE 1

TEST RETEST RELIABILITY OF LSP

Subscale	Cronbach's Alpha	10-Day Test-Retest r_n	30-Day Test-Retest r_n	No. of Items
Analytic Skill	0.56	0.54	0.37	5
Spatial Skill	0.60	0.77	0.50	5
Discrimination Skill	0.51	0.53	0.48	5
Categorization Skill*	0.74	NA	NA	8
Sequential Processing Skill	0.72	0.54	0.42	6
Memory Skill	0.62	0.58	0.44	12
Perceptual Response:				
Visual	0.51	0.74	0.45	20
Auditory	0.49	0.66	0.49	20
Emotive	0.48	0.70	0.44	20
Persistence Orientation	0.67	0.65	0.59	4
Verbal Risk Orientation	0.55	0.77	0.54	4
Verbal-Spatial Preference	0.76	0.58	0.43	6
Manipulative Orientation	0.69	0.82	0.76	4
Study Time Preference:				
Early Morning	0.47	0.46	0.33	2
Late Morning	0.67	0.36	0.24	2
Afternoon	0.60	0.47	0.21	3
Evening	0.58	0.51	0.39	3
Grouping Preference	0.64	0.74	0.54	5
Posture Preference	0.52	0.72	0.56	4
Mobility Preference	0.64	0.58	0.56	4
Sound Preference	0.69	0.78	0.64	4
Lighting Preference	0.73	0.63	0.55	5
Temperature Preference	0.72	0.59	0.44	4

*The categorization subscale was normed on a separate sample. Test-Retest data are not available for this subscale.

Task Force acting as a panel of experts. They reviewed the literature in the field, compiled an initial developmental list, prepared operational definitions, and approved the final content of each scale.

In order to determine whether the underlying dimensions of a test are those predicted by the theory, construct validity was evaluated using factor analysis of data from extensive research. Results from the factor analyses of the LSP identified and helped to purify 23 relatively independent scales that assess elements of learning style (Keefe & Monk, 1986).

Concurrent validity of the LSP was examined through several separate studies. The LSP Examiner's Manual (Keefe & Monk, 1986) provided concurrent validity of the LSP's subscale scores with similar measures from the GEFT, the Edmonds Learning Style Identification Exercise, and from the Learning Style Inventory. Correlations between the subscales of the LSP and comparable scales of the LSI, ELSIE, and GEFT are presented in Table 2.

A correlation study (Keefe & Monk, 1986) between the LSP and the GEFT revealed that the only subscale on the LSP which correlated significantly with the GEFT alpha at .002 was the analytic scale. The correlation was .39. Thus, the analytic subscale of LSP seems to represent the analytic cognitive skill.

A correlation study between the LSP and the Edmonds Learning Style Identification Exercise (ELSIE) indicated that the visual, auditory, and emotive perceptual response

TABLE 2

CORRELATIONS OF LEARNING STYLE PROFILE SUBSCALES WITH OTHER INSTRUMENTS

Learning Style Profile Subscales	Learning Style Inventory Subscales	r	p
Sound Preference	Noise Level	0.15	0.143
Lighting Preference	Light	0.70	0.000*
Cool Temperature	Temperature	0.65	0.000*
Warm Temperature	Temperature	0.58	0.000*
Informal Posture	Design	0.51	0.000*
Formal Posture	Design	0.50	0.000*
Grouping Preference	Learning Alone/ Peer Oriented	0.38	0.000*
Persistence Orientation	Persistence	0.23	0.048
Manipulative Preference	Tactile	0.71	0.000*
Manipulative Preference	Kinesthetic	0.41	0.000*
Evening Study Time Preference	Evening/Morning	0.44	0.000*
Early Morning ST Preference	Evening/Morning	0.66	0.000*
Late Morning ST Preference	Evening/Morning	0.40	0.000*
Late Morning ST Preference	Late Morning	0.49	0.000*
Afternoon ST Preference	Afternoon	0.54	0.000*
Mobility Preference	Needs Mobility	0.66	0.000*
	Edmonds Learning Style Identification Exercise		
Visual Perception	Picture	0.64	0.000*
Auditory Perception	Sound	0.51	0.000*
Emotive Perception	Feeling	0.60	0.000*
Analytic Skill	Group Embedded Figures Test	0.39	0.000*

*p < 0.002 level

subscales were significantly correlated with the corresponding subscale of ELSIE alpha at .002. The correlation between the visual perceptual response subscales of the LSP and the visualization scale of ELSIE was .64, and the correlation between auditory response of LSP and listening scale of ELSIE was .51. Thus, visual, auditory, and emotive perception subscales seem to have concurrent validity.

A correlation study between the selected LSP subscales and comparable scales of the Learning Style Inventory was calculated. Significant correlations were found in all but two instances; the correlation between noise level of the LSI and sound preference of the LSP and the correlation between persistence of LSI and persistence orientation of the LSP were nonsignificant alpha at .002. Keefe and Monk (1986, 1988) contended that those two scales of the LSI contained items with no face or content validity, and thus the lack of the correlation is not unduly disturbing.

Correlations between the study time preferences of the LSP and comparable scales of the LSI ranged from .70 to .41. The early morning scale of the LSP was moderately correlated with the evening/morning scale of the LSI ($r = .66$) and moderately correlated with the late morning scale ($r = .25$). The late morning scale of the LSP was significantly correlated with the late morning scale of the LSI ($r = .49$) and with the evening/morning scale of LSI ($r = .40$) alpha at .002. The afternoon scale of the LSP was moderately correlated with the afternoon scale of the LSI ($r = .54$) and

the evening scale of LSP was significantly correlated with the evening/morning scale of LSI (r = .44).

These extensive checks of content validity, the concurrent validity studies, and the construct validity examined through factor analyses of this instrument supports valid results for the use of the LSP with students in the sixth to twelfth grades.

Group Embedded Figures Teset (GEFT)

The second instrument used in the present study was the Group Embedded Figures Test developed by Oltman, Raskin, and Witkin (1971). The GEFT is a group version of Embedded Figures Test (EFT) developed by Witkin (1950). The subject's task in both of the EFT and the GEFT is to locate a previously seen, simple figure embedded in a larger, complex figure. The major purpose of the GEFT is to provide a substitute for the EFT in research situations requiring group testing. The GEFT was selected over the EFT for the present study because of convenience of large group administration (Cantwell, 1986; Goodstein, 1978).

The GEFT contains three sections; the first section, which has seven items, is for practice, the second and the third sections, each of which has nine items, comprise the scored parts of the test. The time limits for each section are 2, 5, and 5 minutes, respectively. On the GEFT, students are supposed to locate a simple geometric figure, previously seen, within a more complex figure. The number of simple figures correctly traced on the second and third

sections constitutes the raw score on the GEFT. A high score on this test indicates field independence, while a low score indicates field dependence.

Reliability reflected by the correlation between the scores on the second and third sections of the test. Corrected by the Spearman-Brown formula, a reliability estimate of .82 was obtained. The correlation between the scores on the GEFT and the original form of the EFT was .82 for males and .63 for females. The GEFT is a well-conceptualized and extensively-researched instrument for the field dependence-independence dimension of cognitive style, as shown in Goodstein's (1978) evaluation, this instrument provides "a different and potentially powerful approach" (p. 572).

Achievement Scores

In order to obtain the achievement scores in several subject areas, including the Korean language, English, social studies, and science, a Kyohaksa achievement test (November 1988 version) was administered. This test was developed by Kyohaksa, which is the most popular testing and publishing company in Korea. This test was developed to measure the level of achievement of 9th grade students on a national scale. Kyohaksa and some other companies have been developing this kind of test, making a different version every month, then selling it to schools, and providing nation-wide norms. The means of the November 1988 version of this test in the population of Korean students are

TABLE 3

MEANS OF NOVEMBER 1988 VERSION OF KYOHAKSA ACHIEVEMENT TEST IN POPULATION

Subject	Total Score	Mean
Korean Language	24	17.6
Mathematics	20	10.9
English	20	11.4
Social Studies	14	8.6
Science:		
Physics	16	8.9
Biology	8	4.3

N = 38,737

presented in Table 3. The achievement scores in Korean, English, social studies, and science were analyzed in this study because these are perceived to be the most important subjects in middle school by the students, parents, and educators because of the high proportion of those subjects in the high school entrance exam.

Procedures

The researcher translated the LSP and GEFT into Korean after obtaining the permission for translation from NASSP. Two bilingual experts in the fields of linguistics and psychology, one Korean language expert, and two middle school teachers reviewed the translation. The primary principle guiding the translation was that the contents and examples of the LSP would be translated to fit the culture of Korea without changing their original meanings and purpose. Due to the visual nature of the GEFT, the only part of the GEFT which needed to be translated was the instruction. The rest of this instrument remained intact.

A teacher in Kyung-Il middle school in Korea administered the translated version of LSP to 30 9th grade students during November, 1988 in a pilot study in order to ascertain the time needed to take the test and to pinpoint any problems in the translated version of the LSP and GEFT. Some difficulties in understanding the translated version of the LSP were found but the translated version of GEFT did not present any difficulties. Most of the difficulties in understanding the translated version of the LSP were found

in the instructions of cognitive styles scales, and with the instructions for the verbal-spatial preference scale being the one that students had the hardest time understanding. These problems with translation were rectified, and the translation was revised again in order to reduce the difficulties originating from cultural differences. The methods and skills in administering the instrument were also refined through the pilot study.

In the actual study, the two instruments were administered to the two student samples during their regular school day by either the researcher or classroom teachers in the selected schools. The LSP, which has no preset time limit, took approximately one hour to administer and was given to a whole group at each school during December 1988. The GEFT, with its preset time limit, was administered one week after the administration of the LSP. The standardized achievement test (November 1988 version) by Kyohaksa was administered on November 16, 1988 in both of the selected urban and rural schools as regular school procedure.

A problem was found in administering the LSP which was not found during the pilot study. Controlling the administration time was very difficult because the LSP includes several diverse types of tests and questions, and the speed of taking this instrument was so varied among students. This problem was not found during pilot study because it was administered in small groups (5 -10 students) during the pilot study.

Scoring and Data Analyses

There are several types of scoring methods for the LSP. All scoring directions from the LSP manual were followed. The criteria used for scoring of Sequential Processing Skill, Discrimination Skill, Analytic Skill, Spatial Skill, and Memory Skill was derived from whether the student was able to respond correctly or not. A "1" was assigned to correct responses, and a "0" was assigned to incorrect responses. Raw scores of each subscale were generated by adding together the scores of individual items on each subscales.

The criteria used for scoring Categorization Skill was a 4-point scale, with a "3" designating the broadest response and a "0" the narrowest response.

The criteria used for scoring Perceptual Response was how many Visual, Auditory, or Emotive responses the student made. The score was the total number of responses made to each perceptual mode.

The criteria used for scoring Persistence Orientation, Verbal Risk Orientation, Manipulative Preference, Study Time Preference, Grouping Preference, Posture Preference, Mobility Preference, Sound Preference, Lighting Preference, and Temperature Preference was a 5-point scale, with a score of "5" designating Always and a "1" indicating Never; some of the items were reversed.*

The criteria used for scoring the responses to the GEFT was whether or not the student was able to trace all of the

lines of the simple figure, previously seen, within a more complex figure. A score of "1" was assigned to each correct response, and a "0" to each incorrect response. The possible score that each student might obtain was the total number of his or her correct responses to all eight items in section two and three, ranging from 0 to 18.

Null Hypotheses

Null Hypothesis 1: There will be no significant interaction effect between residence and gender on the set of learning style variables.

Null Hypothesis 2: There will be no significant differences between the urban and non-urban students on the set of learning style variables.

Null Hypothesis 3: There will be no significant differences between male and female students on the set of learning style variables.

Null Hypothesis 4: There will be no significant relationship between the achievement scores of Korean language and a set of learning style variables.

Null Hypothesis 5: There will be no significant relationship between the achievement scores of mathematics and a set of learning style variables.

Null Hypothesis 6: There will be no significant relationship between the achievement scores of English and a

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* Some of reversed items are 62, 64, 65, 66, 72, 73, 74, 75, 77, 78, 80, 82, 84, 85, 86, 87, 88, 89, 92, 93, 95, 97, 99, 101, 102, 106, 107, 108.

set of learning style variables.

Null Hypothesis 7: There will be no significant relationship between the achievement scores of social studies and a set of learning style variables.

Null Hypothesis 8: There will be no significant relationship between the achievement scores of science and a set of learning style variables.

CHAPTER IV

RESULTS

Introduction

This chapter, consisting of three sections, presents the results of the statistical analyses utilized to test the hypotheses. The first section contains descriptive statistics of 23 subscales of the Learning Style Profile, the Group Embedded Figures Test, and achievement scores in the five subjects areas of Kyohaksa Achievement Test: Korean language, math, English, social studies, and science. The second section deals with a principal component analysis of the 23 subscales of the Learning Style Profile. The third section deals with tests of hypotheses, including the results of 2x2 multivariate analysis of variance for residence and gender as independent variables and the factor scores of the LSP and the GEFT scores as dependent variables. In addition, the third section includes results from the multiple regression analyses utilizing the GEFT and factor scores of the LSP as independent variables and each separate achievement score as dependent variables.

Descriptive Statistics

The means and standard deviations for the 23 subscales

of the LSP, the scores on the GEFT, and the five achievement scores are reported in Appendix A. The means and standard deviation for subgroups divided by the place of residence and gender are also presented in Appendix A. The meanings of the high score and the low score of each subscale of LSP are presented in Table 4.

The Pearson correlation coefficients were calculated using SPSSx packages on the Oklahoma State University IBM 3081 MVS/XA system. Appendix B presents the intercorrelations among the 23 subscales of the LSP, the GEFT, and five achievement scores. Intercorrelations of these variables ranged from -.67 to .50. Analytic skill and spatial skill were moderately correlated ($r = .44$, $p < .01$); furthermore, the GEFT was moderately correlated with both analytic and spatial skills ($r = .47$, $p < .01$; $r = .50$, $p < .01$). Visual (7), auditory (8), and emotive (9) perceptual responses were negatively correlated to each other because they were mutually exclusive ($r78 = -.49$, $p < .01$; $r79 = -.67$, $p < .01$; $r89 = -.32$, $p < .01$).

Achievement scores of Korean language, math, English, social studies, and science were moderately correlated with analytic skill ($r = .49$, $p < .01$; $r = .42$, $p < .01$; $r = .36$, $p < .01$; $r = .36$, $p < .01$; $r = .43$, $p < .01$), with spatial skill ($r = .49$, $p < .01$; $r = .45$, $p < .01$; $r = .34$, $p < .01$; $r = .36$, $p < .01$; $r = .45$, $p < .01$), and with GEFT ($r = .48$, $p <. 01$; $r = .43$, $p < .01$; $r = .36$, $p <. 01$; $r = 39$, $p < .01$; $r = .49$, $p < .01$). Intercorrelations among the five achievement scores were high, ranging from .64 to .78.

TABLE 4

MEANINGS OF HIGHER AND LOWER SCORES IN
LEARNING STYLE PROFILE SUBSCALES

Subscales	Higher Score	Lower Score
Analytic Skill	Greater skill	Poorer skill
Spatial Skill	Greater skill	Poorer skill
Discrimination Skill	Greater Attention skill	Poorer attention skill
Categorization Skill	Broader perception	Narrow perception
Sequential Processing Skill	Greater skill	Poorer skill
Memory Skill	Greater skill	Poorer skill
Visual Perception	Greater preference	Lower preference
Auditory Perception	Greater preference	Lower preference
Emotive Perception	Greater preference	Lower preference
Persistence Orientation	Higher persistence	Lower persistence
Verbal Risk Orientation	Higher preference	Lower preference
Manipulative Preference	Higher preference	Lower preference
Early Morning Time Preference	Higher preference	Lower preference
Late Morning Time Preference	Higher preference	Lower preference
Afternoon Time Preference	Higher preference	Lower preference
Evening Time Preference	Higher preference	Lower preference
Verbal-Spatial Preference	Preference for verbal tasks	Preference for spatial tasks
Grouping Preference	Preference for larger groups	Preference for smaller groups
Posture Preference	Preference for formal settings	Preference for informal settings
Mobility Preference	Higher mobility while studying	Lower mobility while studying
Sound Preference	Preference for sound while studying	Preference for quite environment
Lighting Preference	Higher lighting conditions	Lower lighting conditions
Temperature Preference	Preference for warm temperature	Preference for cold temperature

In summarizing intercorrelations among the subscales, the analytic, spatial, and GEFT scores were not only intercorrelated but also moderately correlated with five achievement scores.

The Principal Component Analysis

The 23 subscale scores of the LSP were subjected to a principal component analysis, followed by a Varimax rotation using SPSSx. The purpose of the principal component analysis was to obtain a few underlying and nonredundant factors of the LSP. The factors with eigenvalues larger than one were rotated and interpreted according to the Kaiser's (1960) rule because the number of subjects was larger than 250 and the mean communality of the variables was moderate, about .70 (Stevens, 1986). Ten factors were retained and rotated to a final solution. The variance of the LSP explained by the ten factors was 64%. Factor loadings from the Varimax rotation that were larger than .40 were used for the interpretation of the factors in order to have at least 15% shared variance between the variable and the factor which Stevens (1986) recommended. The summary of principal component analysis with varimax rotation are presented in Table 5 and the tentative thoughts and factor labels are presented in Table 6.

Among the six subscales which were defined as cognitive styles in the LSP, four subscales -- analytic, spatial, sequential processing, and memory skills -- were loaded positively on Factor 1, and two subscales -- categorization

TABLE 5

PRINCIPAL COMPONENTS ANALYSIS WITH VARIMAX ROTATION

Subscales	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9	Factor 10	Communality
Analytic Skill	0.643	0.019	0.047	-0.235	-0.130	-0.042	0.194	0.132	-0.075	-0.125	0.566
Spatial Skill	0.653	0.056	0.010	-0.161	-0.239	-0.020	0.035	0.205	-0.101	-0.122	0.582
Discrimination Skill	0.363	0.105	0.034	0.086	0.120	-0.167	-0.283	0.354	0.509	0.314	0.757
Categorization Skill	-0.113	0.053	0.018	0.027	-0.015	0.044	0.071	-0.131	0.762	-0.161	0.647
Sequential Processing Skill	0.504	-0.078	-0.021	-0.056	0.273	0.177	0.005	-0.091	0.164	-0.212	0.450
Memory Skill	0.588	0.125	-0.003	0.089	0.055	0.054	0.058	-0.193	-0.018	0.266	0.487
Visual Perception	0.052	0.009	0.862	0.017	-0.454	0.036	-0.088	0.049	0.022	-0.001	0.965
Auditory Perception	-0.080	-0.090	0.011	-0.010	0.946	-0.072	0.071	0.001	-0.009	0.012	0.920
Emotive Perception	0.013	0.064	-0.940	-0.014	-0.305	0.017	0.038	-0.051	-0.018	-0.008	0.986
Persistence Orientation	0.200	0.636	0.010	-0.018	-0.004	0.300	0.024	-0.104	-0.207	0.091	0.597
Verbal Risk Orientation	-0.040	0.093	-0.010	0.018	-0.029	0.773	-0.066	0.179	0.048	-0.051	0.650
Manipulative Preference	0.383	0.143	-0.029	0.119	0.004	0.519	0.007	0.108	-0.293	-0.130	0.566
Early Morning Time Preference	0.211	0.501	0.101	-0.060	0.037	0.239	-0.452	0.063	-0.062	-0.103	0.591
Late Morning Time Preference	-0.027	0.053	0.034	-0.040	-0.081	-0.013	-0.704	0.065	-0.079	0.092	0.528
Afternoon Time Preference	0.165	0.294	-0.064	0.075	0.012	-0.083	0.582	0.096	-0.131	0.183	0.530
Evening Time Preference	0.060	0.083	0.084	-0.096	-0.114	0.192	0.383	0.608	0.006	0.071	0.598
Verbal-Spatial Preference	-0.119	-0.011	0.003	-0.035	0.001	-0.041	0.032	-0.034	-0.092	0.812	0.687
Grouping Preference	-0.055	0.330	-0.129	0.323	0.141	-0.482	-0.026	0.098	-0.263	-0.261	0.632
Posture Preference	0.125	0.508	-0.020	-0.432	-0.138	-0.053	0.175	-0.015	0.054	-0.123	0.532
Mobility Preference	-0.006	-0.740	0.069	0.067	0.078	0.084	-0.043	-0.030	-0.221	-0.023	0.623
Sound Preference	-0.098	-0.136	-0.053	0.801	-0.026	0.115	0.014	0.029	-0.020	0.104	0.698
Lighting Preference	-0.011	0.066	-0.023	0.027	-0.042	-0.088	0.154	-0.735	0.096	0.080	0.595
Temperature Preference	-0.067	0.001	0.093	0.635	-0.028	-0.141	0.152	-0.147	0.084	-0.193	0.527

TABLE 5 (Continued)

Subscales	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9	Factor 10	Communality
Eigenvalues	2.675	1.923	1.650	1.444	1.360	1.278	1.184	1.091	1.058	1.050	
Percentage of Variance	11.6	8.4	7.2	6.3	5.9	5.6	5.1	4.7	4.6	4.6	

TABLE 6

INTERPRETATION OF FACTORS

Factor #	Subscales Loading on Factors	Direction of Loading	Characteristics of High Scores of Factors	Tentative Factor Label
Factor 1	Analytic Skill	+	1. Identify embedded figures.	Cognitive Differentiation
	Spatial Skill	+	2. Identify and compare figures.	
	Sequential Processing Skill	+	3. Identify shapes within puzzles.	
	Memory Skill	+	4. Compare figures.	
Factor 2	Persistence Orientation	+	1. Willingness to work at difficult tasks.	Personal Rigidity
	Early Morning Time Preference	+	2. Prefers early morning study.	
	Posture Preference	+	3. Prefers formal study arrangements.	
	Mobility Preference	-	4. Prefers to study in one location.	
Factor 3	Visual Perception	+	1. Tendency to react visually.	Visual-Emotive Perception
	Emotive Perception	-	2. Tendency not to react emotively.	
Factor 4	Posture Preference	-	1. Prefers informal study arrangements.	External Environment
	Sound Preference	+	2. Prefers moderate sound while studying.	
	Temperature Preference	+	3. Prefers warm study setting.	

TABLE 6 (CONTINUED)

Factor #	Subscales Loading on Factors	Direction of Loading	Characteristics of High Scores of Factors	Tentative Factor Label
Factor 5	Visual Perception	-	1. Lower preference for visual presentation.	Auditory-Visual Perception
	Auditory Perception	+	2. Higher preference for auditory presentation.	
Factor 6	Verbal Risk Orientation	+	1. Prefers to present verbally.	External Expressiveness
	Manipulative Preference	+	2. Prefers manipulative activities.	
	Grouping Preference	-	3. Prefers smaller learning groups.	
Factor 7	Early Morning Time Preference	-		Afternoon-Morning Preference
	Late Morning Time Preference	-		
	Afternoon Time Preference	+	Prefers afternoon to morning study times.	
Factor 8	Evening Time Preference	+		Lighting Preference
	Lighting Preference	-	Prefers lower lighting conditions.	
Factor 9	Discrimination Skill	+	1. Focus on relevant detail - avoids distractions.	Organizational Skill
	Categorization Skill	+	2. Use of appropriate criteria in organizing data.	
Factor 10	Verbal-Spatial Preference	+	1. Prefers verbal tasks to spatial tasks.	Verbal-Spatial Preference

and discrimination skills -- were loaded positively on Factor 9. Examination of the items in Factor 1 and Factor 9 led to the conclusion that the items of Factor 1 represent cognitive differentiation skill, which indicates a cognitive skill to identify and/or to compare geometric shapes or figures. The significant correlation ($r = .52$, $p < .05$) between Factor 1 and GEFT provide some validity for this interpretation. Factor 9 was tentatively labeled as organizational skill, which represents styles of organizing data through focusing on relevant details while avoiding distractions and using of appropriate criteria. In comparing the items in Factor 1 and Factor 9, items in Factor 1 require thinking processes, while items in Factor 9 require immediate perception. A high score on the cognitive differentiation skill indicates proficiency in that skill. At the same time, a high score on the organizational skill indicates proficiency in data organization by using appropriate criteria while a low score indicates inappropriate data organizing skill.

Factor 2 was labeled as personal rigidity which represents strict rigidity in study habits. A high score on personal rigidity indicates a preference for immobility, persistence, and formal and strict posture during studying. Factor 3 was labeled as visual-emotive perception, which indicates a preference for visual vs. emotive modality in perception on bipolar continuum. A high score on the visual-emotive perception indicates preference for visual modality, while a low score indicates a preference for an

emotive modality in perception. Factor 4 appeared to represent an external environment variable which indicates a sensitivity to external environment, such as background sound, temperature, and posture. A high score on the external environment indicates high sensitivity for the external environment, such as a preference for background sound, warm temperature, and informal posture.

Factor 5 was labeled as auditory-visual perception, which indicates a modality preference for auditory vs. visual perception on the bipolar continuum. However, the emphasis of the factor is clearly on the auditory preference variable as evidenced by a loading of .946. A high score on the auditory-visual perception indicates a preference for auditory modality, while a low score indicates a preference for visual modality. Factor 6 was labeled as external expressiveness, which indicates the degree of willingness to express thinking to an audience or to express an idea with one's hands. A high score on external expressiveness indicates high willingness to express oneself publicly. Factor 7 seemed to discriminate afternoon-morning time preference. A high score on the morning-afternoon time preference indicates a preference for studying in the afternoon, while a low score indicates preference for studying before noon.

Factor 8 appears to consist of a lighting preference, which indicates a preference for the degree of brightness during studying. A high score on the lighting preference scale indicates a preference for dark light and evening

time, while a low score indicates a preference for bright light. Factor 10 was labeled as verbal-spatial preference, which indicates a preference for verbal vs. spatial tasks. A high score on the verbal-spatial preference scale indicates a preference for verbal tasks, and a low score indicates a preference for spatial tasks.

Tests of Hypotheses

The following data analyses were conducted on the ten factor scores of the LSP, the raw scores of the GEFT, and the five achievement scores to test the hypotheses, using SPSSx. In order to test hypotheses 1, 2, and 3, a 2x2 (Residence by Gender) Multivariate Analysis of Variance was conducted with the GEFT and the ten factor scores resulting from the principal component analysis serving as dependent variables. Stepwise regression analyses were computed to test hypotheses 4, 5, 6, 7, and 8, with the GEFT and ten factor scores serving as independent variables and achievement scores serving as dependent variables. Alpha was set at .05 for all analyses.

Null Hypothesis One

This null hypothesis stated that there will be no significant interaction effect between residence and gender on the set of learning style variables (the ten factor scores of the LSP and the score of the GEFT). The MANOVA revealed that the interaction effect between residence and gender was not statistically significant ($F = 1.163$,

df = 11/378, p = .311). Consequently, this hypothesis was not rejected.

Null Hypothesis Two

This null hypothesis stated that there will be no significant difference between the urban and rural students on the set of learning style variables (the ten factor scores of the LSP and the score of the GEFT). The multivariate main effect for residence was statistically significant ($F = 23.349$, df = 11/378, $p < .05$). The means and standard deviations for the eleven learning style variables by residence is presented in Table 7. This result indicated that the urban and rural groups were different on the set of learning style variables. Therefore, null hypothesis two was rejected.

Because the multivariate residence effect was significant, univariate tests of residential status effect on the eleven learning style variables (the ten factor scores of LSP and the scores of the GEFT) were conducted. In the univariate tests, the alpha was set at .0045 in order to maintain the overall type I error at .05 (Stevens, 1986). See Table 8. Statistically significant differences between the urban and rural groups were found on the GEFT ($F = 86.417$, df = 1/388, $p < .0045$), on cognitive differentiation ($F = 79.842$, df = 1/388, $p < .0045$), on external environment ($F = 25.785$, df = 1/388, $p < .0045$), and on afternoon-morning time preference ($F = 40.293$, df = 1/388, $p < .0045$). As shown in Table 7, the urban

TABLE 7

MEANS AND STANDARD DEVIATIONS OF LEARNING STYLE VARIABLES BY RESIDENCE

Variable	Urban		Rural	
	Mean	SD	Mean	SD
Group Embedded Figures Test	16.090	2.392	12.863	4.224
Cognitive differentiation	0.403	0.856	- 0.424	0.967
Personal rigidity	0.104	1.030	- 0.110	0.958
Visual-emotive perception	0.051	0.997	- 0.054	1.003
External environment	- 0.244	1.029	0.257	0.902
Auditory-visual perception	- 0.099	0.987	0.104	1.005
External expressiveness	- 0.010	1.000	0.010	1.002
Afternoon-morning preference	0.297	1.048	- 0.313	0.843
Lighting preference	0.095	1.042	- 0.101	0.946
Organizational skill	- 0.132	1.038	0.139	0.942
Verbal-spatial preference	- 0.102	1.013	0.108	0.977

N = 390

TABLE 8

UNIVARIATE F TESTS OF MAIN EFFECT - RESIDENCE

Variable	SS	df	MS	F	p
Group Embedded Figures Test	1007.042	1	1007.042	86.417	0.000*
Cognitive differentiation	66.620	1	66.621	79.842	0.000*
Personal rigidity	4.519	1	4.519	4.704	0.031
Visual-emotive perception	1.142	1	1.142	1.146	0.285
External environment	24.354	1	24.354	25.786	0.000*
Auditory-visual perception	4.061	1	4.061	4.098	0.044
External expressiveness	0.064	1	0.064	0.066	0.798
Afternoon-morning preference	36.231	1	36.231	40.293	0.000*
Lighting preference	3.962	1	3.962	4.031	0.045
Organizational skill	7.370	1	7.370	7.508	0.006
Verbal-spatial preference	4.211	1	4.211	4.247	0.040

*$p < 0.0045$

group (Mean = 16.090) was higher than the rural group (Mean = 12.863) on the GEFT. This result indicated that urban students were more field-independent than rural students. The urban group (Mean = .403) was higher than the rural group (Mean = -.424) on cognitive differentiation. This result indicated that urban students were more proficient in the cognitive differentiation skill. The urban group (Mean = .297) was higher than the rural group (Mean = -.313) on afternoon-morning time preference. This result indicated that urban students preferred afternoon time more than rural students and that rural students liked morning time more than urban students. Regarding external environment, the urban group (Mean = -.244) was lower than the rural group (Mean = .257), which indicated that rural students preferred background sound and warm temperature more than urban students.

These results indicated that the four learning style variables of the GEFT, cognitive differentiation, external environment, and afternoon-morning preference were contributing to the overall multivariate significance of the residence effect. Personal rigidity, visual-emotive perception, auditory-visual perception, external expressiveness, lighting preference, organizational skill, and verbal-spatial preference were not significantly different between urban and rural groups.

Null Hypothesis Three

This null hypothesis stated that there will be no

significant differences between male and female students on the set of learning style variables (the ten factor scores of the LSP and the score of the GEFT). The multivariate main effect for gender was statistically significant ($F = 3.793$, $df = 11/378$, $p < .05$). The means and standard deviations for the eleven learning style variables by gender is presented in Table 9. This result indicated that male and female groups were different on the set of learning style variables. Therefore, null hypothesis three was rejected.

Because the multivariate gender effect was significant, univariate tests of gender effect on the eleven learning style variables (the ten factor scores of the LSP and the score of the GEFT) were performed. In the univariate test, the alpha was set at .0045 in order to maintain the overall type I error at .05 (Stevens, 1986). Refer to Table 10, statistically significant differences between male and female groups were found in personal rigidity ($F = 14.087$, $df = 1/388$, $p < .0045$) and in external expressiveness ($F = 8.710$, $df = 1/388$, $p < .0045$). As shown in Table 9, the male group (Mean = -.191) was lower than female group (Mean = .180) in personal rigidity. This result indicated that female students were more persistent in their work, kept strict posture, and did not want to move until they finished their work compared to male students. The male group (Mean = .150) was higher than female group (Mean = -.141) on external expressiveness. This result indicated that male students tended to express their

TABLE 9

MEANS AND STANDARD DEVIATIONS BY GENDER

Variable	Male		Female	
	Mean	SD	Mean	SD
Group Embedded Figures Test	14.587	3.804	14.453	3.744
Cognitive differentiation	0.028	1.040	- 0.027	0.962
Personal rigidity	- 0.191	0.946	0.180	1.019
Visual-emotive perception	- 0.071	1.095	0.067	0.900
External environment	0.001	1.054	- 0.001	0.949
Auditory-visual perception	- 0.077	0.994	0.072	1.003
External expressiveness	0.150	1.013	- 0.141	0.970
Afternoon-morning preference	- 0.123	0.981	0.116	1.006
Lighting preference	- 0.084	0.949	0.079	1.042
Organizational skill	- 0.063	1.015	0.060	0.984
Verbal-spatial preference	- 0.066	1.030	0.062	0.969

N = 390

TABLE 10

UNIVARIATE F TESTS OF MAIN EFFECT - GENDER

Variable	SS	df	MS	F	p
Group Embedded Figures Test	1.925	1	1.925	0.165	0.685
Cognitive differentiation	0.279	1	0.279	0.334	0.563
Personal rigidity	13.534	1	13.534	14.087	0.000*
Visual-emotive perception	1.949	1	1.949	1.955	0.163
External environment	0.000	1	0.000	0.000	0.987
Auditory-visual perception	2.116	1	2.116	2.135	0.145
External expressiveness	8.522	1	8.522	8.710	0.003*
Afternoon-morning preference	5.570	1	5.570	6.195	0.013
Lighting preference	2.758	1	2.758	2.806	0.095
Organizational skill	1.396	1	1.396	1.422	0.234
Verbal-spatial preference	1.638	1	1.638	1.652	0.199

*$p < 0.0045$

thinking verbally or physically more often than female students.

These results indicated that the two learning style variables of personal rigidity and external expressiveness were contributing to the overall multivariate significance of the gender effect. The GEFT, cognitive differentiation, visual-emotive perception, external environment, auditory-visual perception, afternoon-morning time preference, lighting preference, organizational skill, and verbal-spatial preference were not significantly different for males and females.

Null Hypothesis Four

This null hypothesis stated that there will be no significant relationship between the achievement scores of Korean language and the eleven learning style variables (the ten factor scores of the LSP and the score of the GEFT). The results of multiple regression analysis are presented in Table 11. A multiple regression analysis using the eleven learning style variables to predict Korean language scores resulted in a multiple R of .65, which is statistically significant ($F = 24.49$, $df = 11/378$, $p < .05$). This finding indicates that 42% of the variance in the Korean language achievement score can be accounted for by the set of learning style variables. Therefore, null hypothesis four was rejected.

The GEFT, cognitive differentiation, afternoon-morning time preference, auditory-visual perception, personal

TABLE 11

SUMMARY TABLE OF STEPWISE REGRESSION ANALYSIS
OF KOREAN LANGUAGE

Step #	Variable Entered	R	F-Ratio for Equation	Significance of Equation	R^2 Change	F-Ratio for Increment	Significance of Increment	Zero-Order Correlation
1	Group Embedded Figures Test	0.480	116.304	0.000	0.231	116.304	0.000*	0.480
2	Cognitive differentiation	0.532	76.232	0.000	0.052	28.051	0.000*	0.443
3	Afternoon-morning preference	0.567	61.043	0.000	0.039	22.282	0.000*	0.239
4	Auditory-visual perception	0.597	53.376	0.000	0.035	20.923	0.000*	-0.214
5	Personal rigidity	0.620	47.912	0.000	0.028	17.118	0.000*	0.179
6	External environment	0.631	42.155	0.000	0.014	8.616	0.004*	-0.152
7	Organizational skill	0.637	37.254	0.000	0.080	5.126	0.024*	-0.121
8	Visual-emotive perception	0.641	33.269	0.000	0.006	3.597	0.059	0.081
9	Lighting preference	0.645	30.051	0.000	0.005	2.947	0.087	0.096
10	External expressiveness	0.645	27.003	0.000	0.000	0.169	0.681	0.006
11	Verbal-spatial preference	0.645	24.486	0.000	0.000	0.013	0.908	-0.021

rigidity, external environment, and organizational skill entered the equation and predicted significantly the Korean language scores. After these seven variables were entered into the equation, the visual-emotive perception, lighting preference, external expressiveness, and verbal-spatial preference fail to add significantly to the prediction of the Korean language scores.

The zero order correlations between eleven learning style variables and Korean language achievement scores support this result. The GEFT ($r = .48$, $p < .01$) and cognitive differentiation ($r = .44$, $p < .01$) were moderately correlated with Korean language scores, explaining most of the variance in Korean language achievement scores. The more field independent the student was, the higher score he or she achieved in Korean language. The more proficient in cognitive differentiation skill the student was, the higher the student's score in Korean language was. The afternoon-morning time preference ($r = .24$, $p < .01$) and the auditory-visual perception ($r = -.21$, $p < .01$) were significantly correlated with Korean language achievement scores. The more the student liked the afternoon time, the higher the student's score in Korean language was. The more the student had auditory modality, the lower score in Korean language the student achieved. Personal rigidity($r = .18$, $p < .01$), external environment ($r = .15$, $p < .01$), and organizational skill ($r = -.12$) were slightly but significantly correlated with Korean language achievement scores. The more rigid the student's study habits were, the

higher the student's score in Korean language was. The more sensitive to the external environment the student was, the lower the student's score in Korean language was. The lower in data organizing skills the student was, the higher the student's score in the lower the student's score in Korean language. The correlation between the four remaining variables, visual-emotive perception, external expressiveness, and verbal-spatial preference, and Korean language achievement scores were insignificant, ranging from .08 to 01. The insignificant relationships between the four remaining variables and Korean language scores, explained why the four remaining variables did not add significantly to the prediction of Korean language achievement.

The direction of prediction of each learning style variable in achievement was the same in all of the five subjects areas. Thus, the explanation of the direction of prediction in achievement will be omitted in the following subjects areas.

Null Hypothesis Five

This null hypothesis stated that there will be no significant relationship between the achievement score of mathematics and the eleven learning style variables (the ten factor scores of the LSP and the GEFT). The results of multiple regression analysis are presented in Table 12. A multiple regression analysis using the eleven learning style variables to predict mathematics scores resulted in a multiple R of .59 which is statistically significant

TABLE 12

SUMMARY TABLE OF STEPWISE REGRESSION ANALYSIS
OF MATHEMATICS

Step #	Variable Entered	R	F-Ratio for Equation	Significance of Equation	R^2 Change	F-Ratio for Increment	Significance of Increment	Zero-Order Correlation
1	Group Embedded Figures Test	0.431	88.632	0.000	0.186	88.632	0.000*	0.431
2	Cognitive differentiation	0.494	62.513	0.000	0.058	29.812	0.000*	0.429
3	Auditory-visual perception	0.530	50.187	0.000	0.036	19.545	0.000*	-0.216
4	Personal rigidity	0.555	42.770	0.000	0.027	15.041	0.000*	0.177
5	External environment	0.567	36.425	0.000	0.014	7.953	0.005*	-0.151
6	Afternoon-morning preference	0.573	31.212	0.000	0.007	3.813	0.052	0.110
7	Visual-emotive perception	0.578	27.337	0.000	0.005	3.075	0.080	0.079
8	Organizational skill	0.582	24.433	0.000	0.005	3.067	0.081	-0.099
9	Verbal-spatial preference	0.584	21.892	0.000	0.002	1.374	0.242	-0.064
10	Lighting preference	0.585	19.711	0.000	0.001	0.396	0.529	0.050
11	External expressiveness	0.585	17.919	0.000	0.001	0.343	0.558	0.043

($F = 17.92$, $df = 11/378$, $p < .05$). This result indicates that 34% of the variance in the mathematics achievement score can be accounted for by the set of learning style variables. Therefore, null hypothesis five was rejected.

The GEFT, cognitive differentiation, auditory-visual perception, personal rigidity, external environment entered the equation and predicted significantly the mathematics achievement scores. After these variables entered the equation, afternoon-morning time preference, visual-emotive perception, organizational skill, verbal-spatial preference, lighting preference, and external expressiveness did not add significantly to the prediction of the mathematics achievement.

Zero order correlations between eleven learning style variables and mathematics achievement scores support this result. The GEFT ($r = .43$, $p < .01$) and cognitive differentiation ($r = .43$, $p < .01$) were moderately correlated with mathematics achievement scores, explaining most of the variance in mathematics achievement scores. Auditory-visual perception ($r = -.23$, $p < .01$), personal rigidity ($r = .18$, $p < .01$), and external environment ($r = -.15$, $p < .01$) were significantly related to mathematics achievement scores. The correlations between mathematics achievement and the remaining variables, afternoon-morning preference, visual-emotive perception, organizational skill, verbal-spatial preference, lighting preference, and external expressiveness, were insignificant, ranging from .11 to .04. These insignificant zero order

correlations explained why these six remaining variables did not add to predict mathematics achievement.

Null hypothesis six

This null hypothesis stated that there will be no significant relationship between the achievement score of English and the eleven learning style variables (the ten factor scores of the LSP and the score of the GEFT). The results of multiple regression analysis are presented in Table 13. In predicting English achievement, the multiple regression coefficient was .50 which was statistically significant ($F = 11.47$, $df = 11/378$, $p < .05$). Twenty five percent of the variance in the English achievement scores can be accounted for by the set of learning style variables. Therefore, null hypothesis six was rejected.

GEFT, auditory-visual perception, cognitive differentiation, external environment, personal rigidity, and afternoon-morning time preference entered the equation and predicted significantly the English achievement. After these variables entered the equation, visual-emotive perception, organizational skill, verbal-spatial preference, lighting preference, and external expressiveness did not add significantly to predict the English achievement.

The zero order correlations between eleven learning style variables and English achievement scores support this result. GEFT ($r = .36$, $p < .01$), auditory-visual perception ($r = -.22$, $p < .01$), and cognitive differentiation ($r = .32$, $p < .01$) were significantly related to English achievement

TABLE 13

SUMMARY TABLE OF STEPWISE REGRESSION ANALYSIS
OF ENGLISH

Step #	Variable Entered	R	F-Ratio for Equation	Significance of Equation	R^2 Change	F-Ratio for Increment	Significance of Increment	Zero-Order Correlation
1	Group Embedded Figures Test	0.362	58.468	0.000	0.131	58.468	0.000*	0.362
2	Auditory-visual perception	0.410	38.983	0.000	0.037	17.075	0.000*	-0.224
3	Cognitive differentiation	0.444	31.500	0.000	0.029	13.929	0.000*	0.323
4	External environment	0.459	25.689	0.000	0.014	6.828	0.009*	-0.149
5	Personal rigidity	0.473	22.072	0.000	0.013	6.215	0.013*	0.122
6	Afternoon-morning preference	0.485	19.598	0.000	0.012	5.836	0.016*	0.133
7	Visual-emotive perception	0.491	17.327	0.000	0.006	3.068	0.081	0.083
8	Organizational skill	0.497	15.594	0.000	0.006	2.868	0.091	-0.099
9	Verbal-spatial preference	0.500	14.042	0.000	0.003	1.474	0.225	-0.067
10	Lighting preference	0.500	12.646	0.000	0.001	0.313	0.576	0.046
11	External expressiveness	0.500	11.467	0.000	0.000	0.004	0.948	0.019

scores, explaining most of the variance in English achievement scores. External environment ($r = -.15$, $p < .01$), personal rigidity ($r = .12$, $p < .01$), and afternoon-morning time preference ($r = .13$, $p < .05$) were also significantly related to English achievement scores. The remaining five variables; visual-emotive perception, organizational skill, verbal-spatial preference, lighting preference, and external expressiveness, were not significantly correlated to English achievement scores, with correlation coefficients ranging from .08 to .19. The insignificant correlations between the remaining five variables and English achievement scores explained why these remaining variables did not add significantly to predict English achievement.

Null Hypothesis Seven

This null hypothesis stated that there will be no significant relationship between the achievement score of social studies and eleven learning style variables (the ten factor scores of the LSP and the score of the GEFT). The results of multiple regression analysis are presented in Table 14. The multiple regression analysis using the eleven learning style variables to predict social studies achievement resulted in a multiple R of .53, which was statistically significant ($F = 13.48$, $df = 11/378$, $p = < .05$). Twenty-eight percent of variance in social studies achievement scores can be accounted for by the set of learning style variables. Therefore, null hypothesis

TABLE 14

SUMMARY TABLE OF STEPWISE REGRESSION ANALYSIS
OF SOCIAL STUDIES

Step #	Variable Entered	R	F-Ratio for Equation	Significance of Equation	R^2 Change	F-Ratio for Increment	Significance of Increment	Zero-Order Correlation
1	Group Embedded Figures Test	0.387	68.234	0.000	0.150	68.234	0.000*	0.387
2	Auditory-visual perception	0.443	47.221	0.000	0.047	22.438	0.000*	-0.250
3	Afternoon-morning preference	0.468	36.106	0.000	0.023	11.349	0.001*	0.196
4	Cognitive differentiation	0.491	30.638	0.000	0.022	11.335	0.001*	0.307
5	External environment	0.508	26.688	0.000	0.016	8.501	0.004*	-0.161
6	Personal rigidity	0.515	23.086	0.000	0.008	4.026	0.046*	0.099
7	Lighting preference	0.520	20.239	0.000	0.005	2.584	0.109	0.098
8	Visual-emotive perception	0.524	18.044	0.000	0.004	2.223	0.137	0.071
9	Organizational skill	0.528	16.336	0.000	0.004	2.212	0.138	-0.091
10	External expressiveness	0.530	14.830	0.000	0.002	1.200	0.274	0.067
11	Verbal-spatial preference	0.531	13.482	0.000	0.001	0.280	0.597	0.009

seven was rejected.

GEFT, auditory-visual perception, afternoon-morning time preference, cognitive differentiation, external environment, and personal rigidity entered the equation and predicted significantly social studies. After these six variables entered the equation, lighting preference, visual-emotive perception, organizational skill, external expressiveness, and verbal-spatial preference did not add significantly to predict social studies achievement.

Zero order correlations between the eleven learning style variables and social studies support this result. GEFT ($r = .39$, $p < .01$), auditory-visual perception ($r = -.25$, $p < .01$), afternoon-morning time preference ($r = .20$, $p < .01$), and cognitive differentiation ($r = .31$, $p < .01$) were significantly correlated with social studies achievement scores, explaining most of the variance in social studies scores. External environment ($r = -.16$, $p < .01$) and personal rigidity ($r = .10$, $p < .05$) were also correlated significantly to social studies achievement. The remaining five variables; lighting preference, visual-emotive perception, organizational skill, external expressiveness, and verbal-spatial preference were not significantly correlated with social studies achievement scores, with correlation coefficient ranging from .10 to .01. The insignificant correlations between the remaining five variables and social studies achievement scores explained why these remaining variables did not add significantly to predict social studies achievement scores.

Null Hypothesis Eight

This null hypothesis stated that there will be no significant relationship between the achievement score of science and eleven learning style variables (the ten factor scores of the LSP and the score of the GEFT). The results of multiple regression analysis are presented in Table 15. In predicting science achievement, the multiple regression coefficient was .63 which was statistically significant ($F = 22.76$, $df = 11/ 378$, $p = < .05$). Forty percent of the variance of science achievement was accounted for by the set of learning style variables. Therefore, null hypothesis eight was rejected.

GEFT, cognitive differentiation, personal rigidity, auditory-visual perception, external environment, afternoon-morning time preference, and organizational skill entered the equation and predicted significantly science achievement. After these seven variables entered into the equation, visual-emotive perception, lighting preference, external expressiveness, and verbal-spatial preference did not add significantly to predict science achievement scores.

Zero order correlations between the eleven learning style variables and science achievement scores supported this result. GEFT ($r = .49$, $p < .01$) and cognitive differentiation ($r = .44$, $p < .01$) were moderately correlated to science achievement scores explaining most of the variance in science achievement scores. Personal rigidity ($r = .22$, $p < .01$) and auditory-visual perception

TABLE 15

SUMMARY TABLE OF STEPWISE REGRESSION ANALYSIS
OF SCIENCE

Step #	Variable Entered	R	F-Ratio for Equation	Significance of Equation	R^2 Change	F-Ratio for Increment	Significance of Increment	Zero-Order Correlation
1	Group Embedded Figures Test	0.486	119.770	0.000	0.236	119.770	0.000*	0.486
2	Cognitive differentiation	0.533	76.633	0.000	0.048	25.831	0.000*	0.438
3	Personal rigidity	0.568	61.365	0.000	0.039	22.366	0.000*	0.215
4	Auditory-visual perception	0.594	52.357	0.000	0.029	17.476	0.000*	-0.201
5	External environment	0.612	45.992	0.000	0.022	13.652	0.000*	-0.190
6	Afternoon-morning preference	0.630	40.480	0.000	0.014	8.453	0.004*	0.152
7	Organizational skill	0.629	35.727	0.000	0.008	4.800	0.029*	-0.121
8	Visual-emotive perception	0.630	31.416	0.000	0.002	1.143	0.286	0.049
9	Lighting preference	0.631	27.923	0.000	0.001	0.385	0.535	0.056
10	External expressiveness	0.631	25.090	0.000	0.000	0.154	0.695	0.009
11	Verbal-spatial preference	0.631	22.757	0.000	0.000	0.057	0.811	-0.028

($r = -.20$, $p < .01$) were also significantly related to science achievement scores. External environment ($r = -.19$, $p < .01$), afternoon-morning time preference ($r = .15$, $p < .01$), and organizational skill ($r = -.12$, $p < .01$) were significantly but slightly correlated to science achievement scores. The remaining four variables, visual-emotive perception, lighting perception, external expressiveness, and verbal-spatial preference were not significantly correlated to science achievement scores, with correlation coefficients ranging from .05 to .01. The insignificant correlations between the four remaining variables and science achievement scores explained why these variables did not add significantly to predict science achievement scores.

Related Findings

This study also examined the differences in achievement scores between urban and non-urban students, and between male and female students. The multivariate effect was tested at .05 alpha level and the univariate effect was tested at alpha .0045 level.

The multivariate main effect for residence was statistically significant ($F = 63.487$, $df = 5/384$, $p < .05$). This result indicated that the urban and rural students differed in the set of achievement scores. The univariate test of the place of residence on the set of achievement scores revealed that urban and rural students differed in all five achievement scores: Korean language ($F = 263.416$, $df = 1/388$, $p < .0045$), in mathematics

($F = 188.488$, $df = 1/388$, $p < .0045$), in English ($F = 165.963$, $df = 1/388$, $p < .0045$), social studies ($F = 138.130$, $df = 1/388$, $p < .0045$), and in science ($F = 198.837$, $df = 1/388$, $p < .0045$).

Urban students demonstrated higher achievement than rural students in all five subjects areas. Means and standard deviations of urban and rural students achievement in five subjects areas are presented in Appendix A.

The multivariate main effect for gender was also significant ($F = 7.406$, $df = 5/384$, $p < .05$). The univariate test of gender effect on the set of achievement scores showed that male and female students differed only in mathematics achievement ($F = 12.348$, $df = 1/388$, $p < .0045$). Male students (Mean = 12.439) were higher on mathematics achievement than female students (Mean = 10.975). Male and female students did not differed in any other achievement scores.

Summary

Ten factor scores were obtained from a principal component analysis of the 23 subscales of the LSP, explaining 64% of the variance of the original scale. These ten factor scores and the score of the GEFT were used as the set of learning style variables in the subsequent MANOVA and multiple regression analyses.

The results of 2x2 MANOVA (residence x gender) revealed significant learning styles differences for both main effects but not the interaction. Urban students were more

field independent as measured by the GEFT and more proficient in the cognitive differentiation tasks of the LSP. Additionally, urban students were less sensitive to external environment and preferred afternoon time as study time more often than did rural students.

Gender differences were notable on only two learning style variables: personal rigidity and external expressiveness. Female students were more strict and rigid in their study habits and more passive in the expression of their thoughts. Male and female students were different neither in cognitive styles as measured by the GEFT nor cognitive differentiation of the LSP.

The set of learning style variables was a good predictor of school achievement, accounting for a variance of Korean language, mathematics, English, social studies, and science ranging from 25% to 42%. Among the eleven learning style variables (the ten factor scores of LSP and the score of the GEFT), the GEFT and cognitive differentiation skill were the most significant learning styles, accounting for the greatest amount of achievement differences. Other learning style variables were statistically significant in the prediction of school achievement, but they were not practically significant because they accounted for a small amount of the variance in achievement.

CHAPTER V

DISCUSSION

Introduction

This chapter presents a discussion of the findings of this study reported in chapter 4, indicating the meanings and implications of those findings. This chapter contains four subdivisions: a summary and discussion of the results, practical implications, limitations and recommendations, and conclusions.

Summary and Discussion of the Results

The summary and discussion of the results section provides the summary of the results, the discussion of the possible reasons for these results, as well as the theoretical implications of the results. This section is presented in two areas: the differences between the urban and rural students in learning style is discussed first and then the relationship between learning style and achievement is discussed.

Learning Style Differences

Urban and rural students scored differently on the set of learning style variables. In fact, 40% of the variance

of place of residence was accounted for by the set of learning style variables.

The GEFT and cognitive differentiation explained the largest variance of learning style differences among urban and rural students. The urban students were more field independent than the rural students as measured by the GEFT; yet the urban students were more proficient compared to their rural counterparts in cognitive differentiation tasks which, as a result of principal component analysis, are a combination of four cognitive styles (analytic, spatial, sequential processing, and memory) of the LSP. On the other hand, urban and rural students did not show any difference on the dimension of organizational skill which, as a result of principal component analysis, is a combination of the other two cognitive style (categorization and discrimination) of the LSP.

The urban and rural differences in field dependence-independence style were proved by Baran (1971, cited by Witkin & Berry, 1975), partly by Okonji (1969) and Nedd and Gruenfeld (1976), all of whom suggested that urban people were more field-independent than their rural counterparts. The urban and rural people generally presented different cognitive styles; however, in a few studies, they did not show significantly different cognitive styles. In Okonji's (1969) study, urban children did not differ in the EFT from rural children although they differed in the RFT. In contrast, using Korean subjects, Park (1975) found that Korean urban children were markedly more field independent

than their rural counterparts on the Adopted Embedded Figures Test.

The results of this present study support these previous findings that urban people are more field independent than rural people. These studies asserted that the urban society, which is more acculturated and modernized, emphasized autonomy and independence from authorities, such as parents or political and/or religious leaders, while rural society emphasized conformity to traditional norms (Witkin & Berry, 1975; Ramirez & Price-Williams, 1974; Witkin & Goodenough, 1981). The researchers assume that different cultural values among the urban and rural groups, which affected child rearing practices, produced different cognitive styles. In conclusion, the degree of urbanization was related to cognitive differentiation and to the field dependence-independence style. The more urbanized the society is, the more field independent and proficient in the cognitive differentiation skill the members of that society are.

Another possible reason, especially for difference in cognitive differentiation skill between Korean urban and rural students, comes from the differences in opportunities for diverse life affairs and the extent of extracurricular work experienced by urban and rural students. Urban students in Korea tend to have more chances for diverse life affairs, hobbies, and extra activities, while rural students tend to have a simpler life. Students in urban areas participate in extracurricular work, such as reading, math,

English, and computer lessons, in private institutes. Schools in urban areas provide more materials, such as books, computers, experimental equipment, and extracurricular classrooms, because they have more financial support (Kim, 1983). Urban and rural children also have different experiences from early childhood due to their markedly different socio-economic status (Kim, 1983); urban children enjoy more toys, diverse equipment at home, while rural children have simpler experiences from childhood. The hypothesis that the extensive differences in the diversity of life affairs and extracurricular activities between urban and rural students might produce the differences in cognitive differentiation and field dependence-independence is in accordance with research about training effect (Goldstein and Chance, 1965; Dolecki, 1976). If training makes a difference on the tests of spatial visualization, disembedding, and perception of upright (field dependence-independence), the different experiences in real life among urban and rural students may produce different cognitive styles, such as cognitive differentiation and field dependence-independence. As a whole, the findings of this study support Witkin and Goodenough's argument (1981) that environmental variables play a very important role in the development of cognitive differentiation skill.

Afternoon-morning time preference and external environment contributed to the variance of residence difference on the set of learning styles. Urban students preferred afternoon time more often than rural students did,

and rural students preferred morning time more often than urban students did. Rural students were more sensitive to the external environment; that is, rural students preferred background sound and warm temperature more than urban students did. Urban students might want a quiet environment for study because houses and schools in urban areas are noisier than those in rural areas. Rural students might be more sensitive to warm temperature because the houses and schools do not typically have adequate heating systems.

Male and female students were significantly different on the set of learning style variables. Overall, 10% of the variance of gender difference was accounted for by the set of learning style variables. The two learning style variables of personal rigidity and external expressiveness were contributing to the gender differences in the learning style sets.

Female students had more strict and rigid habits while studying; that is, female students were more willing to finish their work and kept strict posture, while male students wanted to move during work and wanted informal posture. This gender difference reflects the characteristic gender difference in activity level; boys are likely to be more active and more mobile from the age of peer interaction (Maccoby & Jacklin, 1974).

Male students were more externally expressive; that is, they tended to take more risks to express their thinking verbally to an audience, and they liked manipulating objects by hands. These style differences are traditional gender

differences in Korea. Girls are brought up to be passive and to yield to others. Boys are encouraged to express their thinking to other people, to be more active and dynamic, and to be more expressive. These differences in child rearing might result in the style differences between male and female.

Male and female students were not different on the GEFT nor on the cognitive differentiation scale in this study. In most previous studies about gender differences in the cognitive style dimension, the findings revealed the male's proficiency in field dependence-independence tasks (Witkin & Goodenough, 1981). Witkin, Dyk, Faterson, Goodenough, & Karp (1962) asserted that male adults tended to be more field independent than females on the RFT. Kagan, Moss, and Sigel (1963) also reported that boys scored above the median on analytic conceptualization, while girls scored below the median. The result of this present study contradicted those findings. However, the results of this present study agree with Park (1972), supporting that there is no difference between male and female in cognitive differentiation skill as a whole nor in the field dependence-independence dimension using Korean subjects.

The research findings about gender differences were inconsistent (Kogan, 1976) or the gender differences, which were found in a few studies, were small in comparison with the range of differences within each sex (Witkin, Moore, Goodenough, & Cox, 1977). Thus, Kogan (1976) asserted that gender differences in cognitive styles are not significant

enough to make any practical differences educationally.

This result implies that Korean society and parents, in the present era, might provide the same opportunities for children to participate in cognitive activities so that they were not different in the cognitive differentiation tasks. Male and female students were different only in the traditional characteristic gender differences, such as external expressiveness and personal rigidity, which implies that girls were brought up to be passive and persistent.

Learning Style and Achievement

The five multiple regression analyses of the Kyohaksa achievement test scores of Korean language, mathematics, English, social studies, and science on the set of eleven learning style variables were statistically significant. A multiple regression analysis of the achievement of Korean language on the set of learning style variables indicated that 42% of the variance of Korean language achievement was accounted for by the set of learning style variables. In a multiple regression analysis of mathematics achievement on a set of learning style variables, 34% of the variance of mathematics achievement was explained by the set of learning style variables. In predicting English achievement, 25% of the variance of English achievement was accounted for by the set of eleven learning style variables. In predicting social studies, 28% of the variance of social studies was explained by the set of learning style variables. Finally, 40% of the variance of science achievement was explained by

the set of learning style variables. In summary, the achievement scores of Korean language, mathematics, social studies, and science can be predicted by the set of learning style variables measured by the Learning Style Profile and the Group Embedded Figures Test. Each learning style variable will be discussed in this section in order to show how they predicted the achievement scores.

First, the GEFT, cognitive differentiation, and organizational skill will be discussed together because they have been defined as cognitive styles by previous researchers (Keefe, 1987a; Kogan, 1971). The GEFT was the variable which predicted most of the variance in all the five achievement scores. The GEFT was positively correlated with Korean language, mathematics, English, social studies, science achievement. The more field independent the student was, the higher score he or she achieved in all five subject areas.

Cognitive differentiation (Factor 1) also predicted significantly the variance in all five achievement scores. Cognitive differentiation was positively correlated with all five achievement scores. The more proficient in cognitive differentiation skills the student was, the higher score he or she achieved in the five subject areas. The GEFT and cognitive differentiation seem like good predictors of academic achievement in all five subject areas.

Organizational skill significantly predicted only Korean language and science. This variable was not highly correlated with both Korean language and science achievement

scores, explaining very small amounts of the variance of achievement scores. Besides, it was not significantly correlated with other achievement scores. Thus, the GEFT and cognitive differentiation were important predictors of achievement, but organizational skill was not.

The result about field dependence-independence, as measured by GEFT, supports previous findings of studies (Witkin et al., 1977) which proved that relatively field-independent college students performed significantly better in the mathematics, sciences, and engineering. The results concerning cognitive differentiation, as measured by the LSP, confirm the previous findings of Letteri (1980) which suggested that the composite cognitive profile of field dependence-independence, scanning, breadth of categorization, cognitive complexity-simplicity, reflectiveness-impulsiveness, leveling-sharpening, and tolerance for incongruous experience, predicted academic performance in all areas, including language, reading comprehension, composite, and math.

There is one important research consideration here. Two styles of Letteri's cognitive profile, scanning and breadth of categorization, were separated from the cognitive differentiation style and loaded on a different factor, organizational skill, in this study. Further, this organizational skill was not an important predictor of achievement in this study, while cognitive differentiation style was a very important predictor. Thus, organizational skill, which can be considered as immediate perception not

as a thinking process in chapter 4, is a different style from cognitive differentiation and further is not a predictor of academic achievement.

Conversely, some studies proved that cognitive style was not related to achievement scores when intelligence was controlled. Black (1977) reported that field independent students achieved higher scores than field dependent students on only two (paragraph meaning and language) of four subscales of English competency, but not on the math, social studies, and science when IQ was controlled. Satterly (1976) found no significant differences between field independent and field dependent subjects in English performance when IQ was controlled, but high performance in mathematics was related to field independence even after differences in the IQ scores were controlled. Thus, it is questionable whether the level of cognitive differentiation will predict the achievement scores when intelligence is controlled.

Auditory-visual perception significantly predicted achievement scores in all five subject areas. This variable was negatively correlated with all five achievement scores. Those who had a high preference for auditory perception achieved lower scores in these five subject areas. This result is different from the previous findings of Carbo (1980) and Price, Dunn and Sanders (1981), which proved low achievers in reading as related to kinesthetic modality, and thus auditory and/or visual modalities were related to high achievement in reading. Carbo (1980), and Price, Dunn,

Sanders (1981) used elementary school students and tested reading, which requires the auditory sense, while this study used middle school students (9th grade) and tested general achievement, which requires much more use of the visual sense. It is advantageous to learn and be tested in the same modality as individual's preferred modality (Farr, 1971). Learning and testing of five subjects in Korean middle schools might require more use of the visual sense, so those students who have an auditory modality are disadvantaged in learning in Korean middle schools. Thus, those students who have an auditory modality might not fit in the learning and testing of Korean language, mathematics, English, social studies, and science in Korea and tend to achieve lower scores. The linear correlation matrix in Appendix B showed the same results: visual modality is positively correlated with the five achievement scores; auditory modality is negatively correlated with the five achievement scores; and, finally, emotive perception is not correlated significantly with any achievement scores.

Personal rigidity was a significant predictor of achievement scores in all five subjects areas and positively correlated with all five achievement scores. Those students who were persistent in their work, who kept formal posture while studying, and who did not move about nor take a break until finished, had higher scores in all five achievement areas than those who were not rigid in their studying. The reason why this learning style is an important predictor in achievement might be that personal rigidity fits into the

current school studying environment; the large class size of these schools necessiates that students sit still until finished and keep a formal posture while studying.

The external environment significantly predicted Korean language, mathematics, social studies, and science, explaining a small amount of the variance in the five achievement scores and negatively correlated with those academic performance but it did not significantly predict the English achievement score. Those students who were sensitive to external environment had lower scores in academic achievement. The sensitivity to external environment was a barrier to school learning because the schools can not provide the appropriate heating nor the appropriate level of background sound for the each individual student's different learning styles.

Afternoon-morning time preference was a significant but practically weak predictor which was weakly related with achievement scores in Korean language, English, social studies, and science, and was not a significant predictor in mathematics. The more a student preferred to study in the afternoon time, the higher score he or she achieved.

Other variables were not important predictors of achievement. Even though some of them were statistically significant in some subject areas, they were not practically significant, explaining only a small amount of variance. Interpretation of affective and physical dimensions of learning style is very difficult because those styles have not been consistently significant variables across studies.

For example, personal rigidity which encompasses persistence, formal posture, and immobility was a significant predictor in this study. In previous studies, persistence and preference for formal design were consistently related with high math and reading achievers, but needs for mobility were not consistently related to either high or low achievers (Dunn, Dunn, & Price, 1977; Price, Dunn, & Sanders, 1981; Staplin, 1984; Calvano, 1985). The learning and testing environment of the schools used in each of these studies might have been different requiring different learning styles from the students.

Factor analysis

Cognitive differentiation and organizational skill came from those styles which were defined as cognitive styles in the LSP: analytic, spatial, discrimination, categorization, sequential processing, and memory skill. But in this study, those styles loaded on the different factors: analytic, spatial, sequential, and memory skill on Factor 1 and categorization and discrimination skill on Factor 9. And these two factors are considered as different styles: one as cognitive differentiation and the other as organizational skill.

Further, research findings about those variables of cognitive differentiation and organizational skill were different. Cognitive differentiation skill was found to differ between urban and rural students, while the organizational skill did not. In predicting academic

achievement, cognitive differentiation skill accounted for an average of about 14% of the variance of academic achievement in all five subjects, while either organizational skill did not significantly predict academic achievement, or the prediction was very small.

In examining the items of those cognitive styles of LSP, it was found that the cognitive differentiation task items require thinking while the organizational skill task items require immediate perception. In addition, cognitive differentiation was highly correlated with the GEFT, which has been defined as a cognitive style, while organizational skill was not correlated with the GEFT. Thus, cognitive differentiation measures different styles than the organizational skill and has different effects on school learning.

Practical Implication

The findings of this study indicate that learning style differences exist between urban and rural students as well as between male and female students. This study also provides evidence that the set of learning styles predicts achievement in Korean language, mathematics, English, social studies, and science. In summary, learning style differences exist which, in turn, lead to differences in achievement performance.

Two practical implications arise from these findings related to providing equal education for individuals who have different learning styles. One is modifying cognitive

styles which do not fit to current school learning through training and the other one is adopting teaching styles and environments appropriate for different learning styles.

It is possible to enhance cognitive differentiation skills through training; this effect has been proved with material that differed from the training material (Dolecki, 1976; Goldstein & Chance, 1965). It is suggested that cognitive differentiation skills may be developed by a variety of educational programs. These cognitive differentiation skills have an effect on learning, acting as a cognitive control in the process of information processing (Messick, 1976). Thus, once the individual has developed the skill at an appropriate level, academic achievement will be enhanced (Letteri, 1985). Therefore, those students who are experiencing difficulties in learning will be remediated by training and practice in cognitive differentiation skills. By providing training programs in cognitive differentiation skills for those students who have cognitive styles which do not fit to the current school setting, educators can maximize educational effects.

Another way to maximize educational effects for those students who have different learning styles is to match teaching style (instructional and environmental) with identified student characteristics. According to the present study's findings, urban and rural as well as male and female students have different learning styles. Furthermore, a characteristic learning style is related to academic achievement. Those students, who have learning

styles appropriate for the specific learning situation, achieve higher academic performance. Students function best in the condition of matched instructional arrangement with individual's learning styles (Farr, 1971; Dunn & Dunn, 1975). For example, the inquiry approach is most appropriate for those students who are analytic, while the traditional approach is better suited to the non-analytic type (Keefe, 1987a). Thus, non-analytic students function best if educators provide them with traditional lecture-type instruction. It is recommended that educators provide instructional and environmental resources which complement the students' unique learning styles. By modifying inappropriate cognitive skills through training programs and by arranging educational resources adequate to individual learning styles, we can ensure equal access to learning in addition to equal opportunity for learning.

Limitations and Recommendations

The main limitation of this study is the inability to control for the effects of intelligence on the learning style differences between urban and rural students and on the prediction of achievement. There has been an argument that the cognitive differentiation skill correlates with IQ scores (Black, 1977) although there is evidence that it is related with only some components of intelligence (Cohen, 1969, Goodenough & Karp, 1961). Further investigation is recommended to discover whether there are learning style differences between urban and rural students after IQ is

controlled and to ascertain the degree how much variance in academic achievement that the learning styles predict after the IQ difference is adjusted.

There were a couple of limitations in terms of methodology. First, the range of sampling was restricted in this study. Only one area, Kunwi was selected as representing of non-urban area and only Seoul was selected as representing urban area. In addition, one school in Seoul was used as urban sample even though all of the schools in Kunwi were used as non-urban sample. Thus, the students of Seoul school, used in this study, might not represent the urban students and the students of Kunwi school might not represent nonurban students. Because of restricted range of sampling, the generalizability of the findings of this study to the entire population of urban students is uncertain. It is recommended that a variety of samples be used as subjects.

Another limitation of this study is the use of a translated version of LSP, for there is not enough information whether this translated instrument is appropriate for Korean students in terms of reliability and validity. Thus, it is suggested that reliability and validity of this translated version of LSP be investigated for further study.

Conclusion

Learning style has been noticed as a new intervening variable in the learning process, accounting for the great

degree of variance in student learning (Keefe, 1987a) because some styles are more productive in certain school achievement than others (Kogan, 1971) and some styles fit better to the existing school instructional environment than others (Dunn & Dunn, 1978). By diagnosing characteristic individual styles of learning and adapting instruction to these different learning styles, educators can optimize the individual student's learning performance.

In Korea, there exist better conditions for urban students than rural students in the quality of school staff, the socio-economic status of the student's family, the educational facilities and equipment, and the financial support; these differences in conditions lead to sharp differences in academic achievement (Kim, et al., 1983, Kim, 1981). A model of learning style can explain this different academic achievement acting as an intervening variable between learning environment and academic achievement; that is, the different conditions in learning environment may produce different learning styles and, then, these different learning styles cause differences in academic achievement. Actually, in this present study, urban students achieved markedly higher in academic performance than rural students did. The results of this study also indicated that there exists learning style differences between urban and rural 9th grade Korean students. Urban students were more field independent, more proficient in cognitive differentiation tasks, less sensitive to external environment, and preferred morning time more often than rural students. Furthermore,

the results of this study show that learning styles are heavily related to academic achievement. Learning style was a quite good predictor of academic achievement, accounting for a variance of Korean language, mathematics, English, social studies, and science ranging from 25% to 42%. Thus, it is possible that educators can reduce the differences in achievement between urban and rural students by modifying the rural students' inappropriate learning styles or providing different teaching and instructional environments for these rural students.

Male and female students were different only on the personal rigidity and external expressiveness subscales. Female students were more rigid in their study habits and were more passive in the expression of their thinking. Contrary to the previous findings, they were not different on the field independence nor on the cognitive differentiation skill factors, which accounted for the biggest variance of achievement. In addition, male and female students were different only on mathematics achievement, not on other subjects, such as Korean language, English, social studies, and science, according to the related finding of this study and the studies reviewed by Maccoby and Jacklin (1974). Thus, one may conclude that male and female students do not have different cognitive styles, but rather they have different affective styles and do achieve differently only in the mathematics and not any other subject areas. Equality between male and female might have been accomplished in the cognitive area, but male and

female are still unequal in certain affective areas such as personal rigidity and external expressiveness.

As a whole, urban and rural students, and male and female students have different learning styles, and further these different learning styles are related to high or low academic achievement. The differences in academic achievement between urban and rural students are especially large in Korea. In order to reduce these differences in academic achievement and optimize individual student's learning performance, educators are recommended to identify students' learning styles and to provide appropriate instructions or to modify those inappropriate learning styles. With recognition of and attention to providing a learning environment where all students have an opportunity to achieve, Korea will make an important step toward providing truly equal education for all.

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APPENDICES

APPENDIX A

DESCRIPTIVE STATISTICS OF 23 SUBSCALES OF LEARNING STYLE PROFILE, GROUP EMBEDDED FIGURES TEST, AND ACHIEVEMENT SCORES

Variable	Mean	SD	Range
Analytic Skill	3.669	1.389	0 - 5
Spatial Skill	3.649	1.290	0 - 5
Discrimination Skill	4.018	1.107	0 - 5
Categorization Skill	12.705	4.354	0 - 24
Sequential Processing Skill	5.585	0.849	0 - 6
Memory Skill	7.154	2.539	0 - 12
Visual Perception	7.033	2.725	1 - 16
Auditory Perception	4.772	2.131	0 - 10
Emotive Perception	8.190	2.522	1 - 16
Persistence Orientation	13.405	3.132	4 - 20
Verbal Risk Orientation	11.628	2.814	4 - 19
Manipulative Preference	12.690	3.318	4 - 20
Early Morning Time Preference	6.841	1.830	2 - 10
Late Morning Time Preference	5.064	2.135	2 - 10
Afternoon Time Preference	10.377	2.223	4 - 15
Evening Time Preference	9.636	2.639	3 - 15
Verbal-Spatial Preference	3.556	1.275	0 - 6
Grouping Preference	14.736	2.881	7 - 23
Posture Preference	14.262	3.678	4 - 20
Mobility Preference	12.997	3.032	4 - 20
Sound Preference	11.649	2.825	4 - 20
Lighting Preference	15.615	3.550	5 - 25
Temperature Preference	12.203	3.119	4 - 20
Group Embedded Figures Test	14.518	3.769	2 - 18
Korean Language	17.036	4.018	1 - 24
Mathematics	11.685	4.992	1 - 20
English	12.136	4.547	2 - 20
Social Studies	8.664	2.862	1 - 14
Science	14.133	5.654	3 - 24

N = 390

Variables	Urban		Rural	
	Mean	SD	Mean	SD
Analytic Skill	4.520	0.795	2.774	1.316
Spatial Skill	4.110	1.011	3.163	1.372
Discrimination Skill	3.950	1.172	4.089	1.032
Categorization Skill	12.120	4.288	13.321	4.349
Sequential Processing Skill	5.740	0.667	5.421	0.982
Memory Skill	7.560	2.409	6.726	2.606
Visual Perception	7.215	2.599	6.842	2.846
Auditory Perception	4.590	2.169	4.963	2.079
Emotive Perception	8.190	2.551	8.189	2.498
Persistence Orientation	13.820	3.230	12.968	2.972
Verbal Risk Orientation	11.825	2.833	11.421	2.787
Manipulative Preference	13.060	3.324	12.300	3.274
Early Morning Time Preference	6.630	1.876	7.063	1.757
Late Morning Time Preference	4.745	2.084	5.400	2.143
Afternoon Time Preference	10.825	2.181	9.905	2.173
Evening Time Preference	10.325	2.652	8.911	2.427
Verbal-Spatial Preference	3.495	1.341	3.621	1.201
Grouping Preference	14.785	2.997	14.684	2.761
Posture Preference	15.315	3.311	13.153	3.728
Mobility Preference	12.620	3.165	13.395	2.839
Sound Preference	11.105	2.811	12.221	2.732
Lighting Preference	15.640	3.707	15.589	3.387
Temperature Preference	11.845	3.270	12.579	2.913
Group Embedded Figures Test	16.090	2.392	12.863	4.224
Korean Language	19.500	2.445	14.442	3.707
Mathematics	14.430	4.135	8.795	4.112
English	14.560	3.734	9.584	3.887
Social Studies	10.095	2.386	7.158	2.534
Science	17.310	4.837	10.789	4.387

N = 390

Variables	Male		Female	
	Mean	SD	Mean	SD
Analytic Skill	3.661	1.441	3.677	1.342
Spatial Skill	3.725	1.279	3.577	1.298
Discrimination Skill	3.937	1.142	4.095	1.071
Categorization Skill	12.545	4.460	12.856	4.258
Sequential Processing Skill	5.587	0.869	5.582	0.833
Memory Skill	6.952	2.298	7.343	2.738
Visual Perception	6.989	2.879	7.075	2.579
Auditory Perception	4.630	2.129	4.905	2.130
Emotive Perception	8.381	2.776	8.010	2.249
Persistence Orientation	13.355	3.163	13.453	3.110
Verbal Risk Orientation	11.799	2.825	11.468	2.802
Manipulative Preference	13.180	3.247	12.229	3.325
Early Morning Time Preference	6.746	1.986	6.930	1.669
Late Morning Time Preference	5.042	2.108	5.085	2.165
Afternoon Time Preference	9.921	2.161	10.806	2.199
Evening Time Preference	9.212	2.597	10.035	2.622
Verbal-Spatial Preference	3.524	1.261	3.587	1.290
Grouping Preference	14.349	3.036	15.100	2.685
Posture Preference	13.804	3.589	14.692	3.718
Mobility Preference	13.355	2.740	12.662	3.253
Sound Preference	11.757	3.013	11.547	2.640
Lighting Preference	15.508	3.508	15.716	3.595
Temperature Preference	12.116	3.150	12.284	3.096
Group Embedded Figures Test	14.587	3.804	14.453	3.744
Korean Language	16.640	4.348	17.408	3.653
Mathematics	12.439	5.015	10.975	4.876
English	12.434	4.455	11.856	4.626
Social Studies	8.714	2.925	8.617	2.808
Science	14.545	5.629	13.746	5.665

N = 390

Variables	Urban Male		Urban Female		Rural Male		Rural Female	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Analytic Skill	4.577	0.748	4.466	0.838	2.696	1.365	2.847	1.271
Spatial Skill	4.227	0.919	4.000	1.085	3.196	1.393	3.133	1.359
Discrimination Skill	3.907	1.164	3.990	1.184	3.967	1.124	4.204	0.930
Categorization Skill	11.608	4.645	12.602	3.884	13.533	4.050	13.122	4.625
Sequential Processing Skill	5.711	0.676	5.767	0.660	5.457	1.021	5.388	0.948
Memory Skill	7.371	2.251	7.738	2.547	6.511	2.275	6.929	2.880
Visual Perception	7.330	2.783	7.107	2.421	6.630	2.949	7.041	2.747
Auditory Perception	4.402	2.144	4.767	2.188	4.870	2.098	5.051	2.068
Emotive Perception	8.268	2.801	8.117	2.302	8.500	2.760	7.898	2.199
Persistence Orientation	13.897	3.399	13.748	3.077	12.783	2.800	13.143	3.130
Verbal Risk Orientation	11.887	2.824	11.767	2.853	11.707	2.838	11.153	2.726
Manipulative Preference	13.330	3.496	12.806	3.150	13.022	2.972	11.622	3.412
Early Morning Time Preference	6.515	2.011	6.738	1.743	6.989	1.941	7.133	1.571
Late Morning Time Preference	4.763	2.110	4.728	2.068	5.337	2.077	5.459	2.211
Afternoon Time Preference	10.392	2.163	11.233	2.129	9.424	2.055	10.357	2.193
Evening Time Preference	10.052	2.481	10.583	2.792	8.326	2.427	9.459	2.307
Verbal-Spatial Preference	3.485	1.276	3.505	1.406	3.565	1.252	3.673	1.156
Grouping Preference	14.577	3.265	14.981	2.722	14.109	2.771	15.224	2.654
Posture Preference	14.845	3.170	15.757	3.394	12.707	3.693	13.571	3.731
Mobility Preference	12.928	3.107	12.330	3.207	13.804	2.220	13.010	3.282
Sound Preference	11.227	3.053	10.990	2.572	12.315	2.882	12.133	2.595
Lighting Preference	15.299	3.618	15.961	3.778	15.728	3.394	15.459	3.392
Temperature Preference	11.732	3.268	11.951	3.285	12.522	2.985	12.633	2.859
Group Embedded Figures Test	15.990	2.352	16.184	2.436	13.109	4.444	12.633	4.016
Korean Language	19.454	2.415	19.544	2.484	13.674	3.945	15.163	3.330
Mathematics	15.443	3.425	13.476	4.520	9.272	4.453	8.347	3.731
English	14.814	3.386	14.320	4.037	9.924	4.061	9.265	3.710
Social Studies	10.134	2.339	10.058	2.441	7.217	2.737	7.102	2.340
Science	18.268	4.063	16.408	5.331	10.620	4.206	10.949	4.567

N = 390

APPENDIX B

CORRELATIONS AMONG 23 SUBSCALES OF LEARNING STYLE PROFILE, GROUP EMBEDDED FIGURES TEST, AND ACHIEVEMENT SCORES

		1	2	3	4	5	6	7	8
Analytic Skill	(1)	1.00							
Spatial Skill	(2)	0.45**	1.00						
Discrimination Skill	(3)	0.10*	0.12**	1.00					
Categorization Skill	(4)	-0.07	-0.11*	0.07	1.00				
Sequential Processing Skill	(5)	0.20**	0.13**	0.09*	0.03	1.00			
Memory Skill	(6)	0.19**	0.21**	0.10*	-0.02	0.10*	1.00		
Visual Perception	(7)	0.07	0.10*	0.06	0.02	-0.04	-0.01	1.00	
Auditory Perception	(8)	-0.10*	-0.17**	0.04	-0.00	0.08	-0.01	-0.48**	1.00
Emotive Perception	(9)	0.01	0.05	-0.09*	-0.03	-0.02	0.02	-0.67**	-0.32**
Persistence Orientation	(10)	0.15**	0.16**	0.00	-0.08	0.07	0.13	0.02	-0.11*
Verbal Risk Orientation	(11)	-0.01	0.02	0.00	-0.04	0.06	0.03	0.06	-0.09*
Manipulative Preference	(12)	0.20**	0.24**	-0.03	-0.10*	0.14**	0.16**	0.03	-0.08
Early Morning Time Preference	(13)	-0.09*	-0.01	0.02	0.01	-0.11*	-0.08	0.08	-0.04
Late Morning Time Preference	(14)	-0.10*	-0.04	0.07	-0.04	-0.04	-0.06	0.10*	-0.07
Afternoon Time Preference	(15)	0.14**	0.12**	-0.01	-0.07	0.03	0.16**	-0.08	-0.01
Evening Time Preference	(16)	0.22**	0.19**	0.05	-0.05	0.02	0.03	0.09*	-0.07
Verbal-Spatial Preference	(17)	-0.09*	-0.12*	0.05	-0.07	-0.09*	0.02	-0.01	0.02
Grouping Preference	(18)	-0.05	-0.11*	-0.05	-0.02	-0.03	-0.01	-0.12**	0.06
Posture Preference	(19)	0.21**	0.15**	0.01	0.04	0.09*	0.10*	0.03	-0.16**
Mobility Preference	(20)	-0.04	-0.10*	-0.12**	-0.05	0.02	-0.06	0.02	0.10*
Sound Preference	(21)	-0.16**	-0.19**	-0.01	0.00	-0.06	-0.05	-0.03	0.01
Lighting Preference	(22)	-0.02	-0.11*	-0.09*	0.08	-0.03	0.02	-0.08	0.02
Temperature Preference	(23)	-0.13**	-0.07	-0.07	0.04	-0.04	-0.04	0.01	0.05
Group Embedded Figures Test	(24)	0.47**	0.50**	0.02	-0.12**	0.24**	0.25**	0.07	-0.10*
Korean Language	(25)	0.49**	0.49**	0.03	-0.15**	0.12**	0.19**	0.15**	-0.21**
Mathematics	(26)	0.42**	0.45**	0.04	-0.15**	0.19**	0.15**	0.17**	-0.23**
English	(27)	0.36**	0.34**	-0.00	-0.12**	0.13**	0.12*	0.17**	-0.24**
Social Studies	(28)	0.36**	0.36**	-0.01	-0.14**	0.08	0.13**	0.17**	-0.24**
Science	(29)	0.43**	0.45**	0.03	-0.16**	0.17**	0.20**	0.14**	-0.22**

		9	10	11	12	13	14	15	16
Analytic Skill	(1)								
Spatial Skill	(2)								
Discrimination Skill	(3)								
Categorization Skill	(4)								
Sequential Processing Skill	(5)								
Memory Skill	(6)								
Visual Perception	(7)								
Auditory Perception	(8)								
Emotive Perception	(9)	1.00							
Persistence Orientation	(10)	0.06	1.00						
Verbal Risk Orientation	(11)	0.00	0.16**	1.00					
Manipulative Preference	(12)	0.04	0.24**	0.25**	1.00				
Early Morning Time Preference	(13)	-0.05	0.23**	0.16**	0.10*	1.00			
Late Morning Time Preference	(14)	-0.06	-0.00	0.08	-0.02	0.20**	1.00		
Afternoon Time Preference	(15)	0.09*	0.16**	-0.05	0.09*	-0.13**	-0.17**	1.00	
Evening Time Preference	(16)	-0.04	0.10*	0.16**	0.13**	-0.03	-0.03	0.16**	1.00
Verbal-Spatial Preference	(17)	-0.00	0.02	-0.09*	-0.07	-0.04	0.02	0.02	0.01
Grouping Preference	(18)	0.08	0.06	-0.17**	-0.03	-0.00	-0.00	0.08	-0.06
Posture Preference	(19)	0.10*	0.20**	0.03	0.10*	0.11*	-0.05	0.14**	0.11*
Mobility Preference	(20)	-0.11*	-0.30**	-0.04	0.00	-0.20**	0.00	-0.16**	-0.06
Sound Preference	(21)	0.01	-0.08	0.03	0.04	-0.05	-0.03	-0.01	-0.03
Lighting Preference	(22)	0.07	0.03	-0.14**	-0.15**	-0.09*	-0.04	0.04	-0.15**
Temperature Preference	(23)	-0.05	-0.11*	-0.10*	-0.07	-0.07	-0.09*	0.01	-0.10*
Group Embedded Figures Test	(24)	0.01	0.15**	0.06	0.28**	-0.05	-0.06	0.13**	0.23**
Korean Language	(25)	0.01	0.27**	0.04	0.13**	-0.06	-0.14**	0.24**	0.24**
Mathematics	(26)	0.01	0.28**	0.06	0.15**	-0.05	-0.04	0.16**	0.14**
English	(27)	0.01	0.23**	0.07	0.07	-0.07	-0.05	0.16**	0.13**
Social Studies	(28)	0.02	0.18**	0.08	0.11*	-0.09	-0.08	0.19**	0.21**
Science	(29)	0.04	0.29**	-0.01	0.17**	-0.05	-0.07	0.20**	0.19**

		17	18	19	20	21	22	23	24
Analytic Skill	(1)								
Spatial Skill	(2)								
Discrimination Skill	(3)								
Categorization Skill	(4)								
Sequential Processing Skill	(5)								
Memory Skill	(6)								
Visual Perception	(7)								
Auditory Perception	(8)								
Emotive Perception	(9)								
Persistence Orientation	(10)								
Verbal Risk Orientation	(11)								
Manipulative Preference	(12)								
Early Morning Time Preference	(13)								
Late Morning Time Preference	(14)								
Afternoon Time Preference	(15)								
Evening Time Preference	(16)								
Verbal-Spatial Preference	(17)	1.00							
Grouping Preference	(18)	-0.06	1.00						
Posture Preference	(19)	-0.01	0.06	1.00					
Mobility Preference	(20)	0.03	-0.08	-0.30	1.00				
Sound Preference	(21)	0.06	0.13**	-0.30	0.16**	1.00			
Lighting Preference	(22)	0.01	0.00	0.01	-0.05	0.04	1.00		
Temperature Preference	(23)	-0.05	0.08	-0.14	-0.01	0.27**	0.09*	1.00	
Group Embedded Figures Test	(24)	-0.07	-0.08	0.17	-0.06	-0.11*	-0.09*	-0.10*	1.00
Korean Language	(25)	-0.04	-0.06	0.24	-0.16**	-0.16**	-0.02	-0.05	0.48**
Mathematics	(26)	-0.10*	-0.08	0.23	-0.20**	-0.13**	-0.02	-0.10*	0.43**
English	(27)	-0.08	-0.04	0.22	-0.10*	-0.13**	-0.04	-0.07	0.36**
Social Studies	(28)	-0.03	-0.13**	0.22	-0.14**	-0.09*	-0.04	-0.11*	0.39**
Science	(29)	-0.08	-0.07	0.22	-0.26**	-0.18**	-0.01	-0.14**	0.49**

		25	26	27	28	29
Analytic Skill	(1)					
Spatial Skill	(2)					
Discrimination Skill	(3)					
Categorization Skill	(4)					
Sequential Processing Skill	(5)					
Memory Skill	(6)					
Visual Perception	(7)					
Auditory Perception	(8)					
Emotive Perception	(9)					
Persistence Orientation	(10)					
Verbal Risk Orientation	(11)					
Manipulative Preference	(12)					
Early Morning Time Preference	(13)					
Late Morning Time Preference	(14)					
Afternoon Time Preference	(15)					
Evening Time Preference	(16)					
Verbal-Spatial Preference	(17)					
Grouping Preference	(18)					
Posture Preference	(19)					
Mobility Preference	(20)					
Sound Preference	(21)					
Lighting Preference	(22)					
Temperature Preference	(23)					
Group Embedded Figures Test	(24)					
Korean Language	(25)	1.00				
Mathematics	(26)	0.66**	1.00			
English	(27)	0.66**	0.74**	1.00		
Social Studies	(28)	0.64**	0.64**	0.66**	1.00	
Science	(29)	0.71**	0.78**	0.72**	0.66**	1.00

*p < 0.05, **p < 0.01, N = 390

APPENDIX C

CORRELATIONS AMONG FACTOR SCORES OF LEARNING STYLE PROFILE AND GROUP EMBEDDED FIGURES SCORES

		1	2	3	4	5	6	7	8	9	10	11
Group Embedded Figures Test	(1)	1.00										
Cognitive differentiation	(2)	0.52**	1.00									
Personal rigidity	(3)	0.05	0.00	1.00								
Visual-emotive perception	(4)	0.03	0.00	0.00	1.00							
External environment	(5)	-0.14**	0.00	0.00	0.00	1.00						
Auditory-visual perception	(6)	-0.09*	0.00	0.00	0.00	0.00	1.00					
External expressiveness	(7)	0.10*	0.00	0.00	0.00	0.00	0.00	1.00				
Afternoon-morning preference	(8)	0.13**	0.00	0.00	0.00	0.00	0.00	0.00	1.00			
Lighting preference	(9)	0.13**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00		
Organizational skill	(10)	-0.13**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	
Verbal-spatial preference	(11)	-0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00

*$p < 0.05$
**$p < 0.01$
N = 390

APPENDIX D

PERMISSION OF TRANSLATION OF LEARNING STYLE PROFILE

OSU

Oklahoma State University

APPLIED BEHAVIORAL STUDIES IN EDUCATION
COLLEGE OF EDUCATION

STILLWATER, OKLAHOMA 74078-0254
NORTH MURRAY HALL 116
(405) 624-6040

September 22, 1988

NASSP
Director of Publications
and Editorial Services
1904 Association Drive
Reston, VA 22091

Dear Director:

I am writing to request permission to translate the Learning Style Profile into Korean. Currently, I am a doctoral student in educational psychology and I am requesting permission for use in my dissertation.

The translated version of the LSP will be administered in Korea during December. The research design includes the use of 11th grade high school students and will assess their respective learning styles. I will make all results available to you when completed and will be more than happy to share my norming results with you.

I appreciate your prompt attention to this request.

Sincerely,

Nah Kwi Ok

Kwi-Ok Nah
39-9 S. University Place
Stillwater, OK 74075

David S Lane

David S. Lane, Jr., Ph.D.
Major Professor

DSL:dsb

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PLEASE CREDIT MATERIAL APPROPRIATELY.

T. KOERNER, EDITOR
NASSP

Koerner
9/27/88

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Celebrating the Past . . . Preparing for the Future

VITA

Kwi-Ok Nah

Candidate for the Degree of

Doctor of Philosophy

Thesis: THE RELATIONSHIP OF KOREAN STUDENTS' LEARNING STYLE WITH RESIDENCE, GENDER, AND ACHIEVEMENT

Major Field: Applied Behavioral Studies

Minor Field: Family Relations and Child Development

Biographical:

Personal Data: Born in Taegu, Korea, December 17, 1957, daughter of Jae-Su Nah and Man-Sang Son.

Education: Graduated from Kyungpook Girls' High School, Taegu, Korea in January, 1976; received the Bachelor of Arts degree in Korean Language and Literature from Kyungpook National University in Taegu, Korea, in October, 1980; received Master of Education degree in Educational Psychology from Kyungpook National University in February, 1985. Completed requirements for Doctor of Philosophy degree at Oklahoma State University in December, 1989.

Professional Experience: Teacher, Kyungil Girls' Middle School, Taegu, Korea, March, 1983 to August, 1985; Research Assistant, Department of Applied Behavioral Studies in Education, August, 1989 to present.