AN ABSTRACT OF THE THESIS OF

Shirley A. Beaty for the degree of Doctor of Philosophy in Education presented on April 30, 1986.

Title: The Effect of Inservice Training on the Ability of Teachers to Observe Learning Styles of Students.

Redacted for privacy

Abstract approved:

Dr. Bonnie Jean Young

Research on the topic of learning styles has revealed the positive impact that implementation of a learning styles program can have on the education of America's youth. Yet for many districts in the state of Oregon, implementation is hindered by a lack of available funds and personnel trained to do so. A search of the literature raised the possibility of using inservice training to improve teacher observation skills as a means of implementing a learning styles program. Thus, the purpose of this study was to test whether inservice training could improve the ability of classroom teachers to observe the learning styles of students.

Sixty-nine teachers in two school districts participating in the quasi-experimental design were asked to observe and identify the learning styles of students according to the Dunns' learning style model. These observations were compared with information on the Learning Style Inventory (Dunn, Dunn & Price, 1985) student profiles using the following data analysis procedures: analysis of covariance, analysis of variance for improvement, and percentage of agreement tests for each of the twenty-two elements in the model.

Data analysis led to rejection of the null hypothesis at the .05 level of significance for only two elements, responsible and parent-figure motivated. The findings in this study support previous findings which led to the development of a standardized tool to identify learning styles. Teacher observation alone did not prove to be the best approach to identification of students' learning styles.

Recommendations include replication of the present study at the elementary level, use of volunteer teachers in a study, addition of the technique of interviewing to the observation process, and the use of paired observations to improve teacher observation skills.

THE EFFECT OF INSERVICE TRAINING ON THE ABILITY OF TEACHERS TO OBSERVE LEARNING STYLES OF STUDENTS

by

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A THESIS

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Doctor of Philosophy

Completed April 30, 1986

Commencement June 8, 1986

APPROVED:

Redacted for privacy

Professor of Education in charge of major

Redacted for privacy

Head of Department of Educational Foundations

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Date of exam: April 30, 1986

Date thesis is presented: April 30, 1986

Thesis prepared on computer by Shirley A. Beaty

ACKNOWLEDGEMENT

Sincere appreciation is extended to all those who helped me along the way:

To Dr. Bonnie Young, my major advisor, who spent hours advising, encouraging, and supporting me from my entry into the doctoral program to the completion of this writing.

To my committee members who helped me along the way: Dr. Frank Cross, Dr. Merle Kelley, Dr. Donald Duncan, Dr. Arthur McElroy, and Dr. David Phelps.

To Susie Maresh, statistician at the OSU Computer Center, for assistance with the data.

To the secretaries and friends who typed and input data into the computer, Pam Brown and Carolyn Oeder.

To Mary Langevin, a friend, who transported materials back and forth to the schools.

To all the teachers who completed the activities over and above their daily responsibilities.

To Dr. Glenn Dorn, Mr. Ellis Mason, Mr. Larry Armbrust, Mr. James Moskal, Ms. Penny Steward, Mr. Dick Reiling, and Mr. Maurice Paul, administrators, who worked closely with me in the project.

And, most of all, to my family who helped and supported me along the way:

To my parents who encouraged me to learn everything I could along my educational path.

To my boys who helped input data, kept the house quiet, and gave up time with Mom so she could study.

To my husband, Bill, who along with Parry Walborn, spent hours at the computer, helped with copying, and supported my efforts in completing the project.

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CHAPTER I

INTRODUCTION

Teachers teach to help students learn. If teachers were asked to define their job role, they would include information which would support this statement. When asked if students all learn in the same way, nearly all teachers would say "no". Perceptive teachers could name many ways that students differ (Lindelow, 1983). For example, they might mention differences in rate of acquisition of knowledge, ability to retain information, need for reinforcement of learning, ability to abstract or generalize, and many other qualities. Some teachers could describe much more; others, however, would have difficulty describing individual differences. When asked if they teach to the individual needs of learners, most teachers would say it is very difficult to do and that very few are able to adapt instruction to student needs. Those who say they teach to individual needs cannot show it when observed (Guild, 1980).

Teachers are a product of education, training and experience. Most have been taught theories of

learning, methods of instruction in several content areas, and the content skills and objectives that should be taught in each content area. Very few have received instruction about identifying the individual differences in students and adapting instruction to meet these differences. It is ironic that educators, in general, recognize the true purpose of education--to teach students to learn--and the fact that students do have individual differences in learning, and yet these same educators teach as if all students were the same (Lindelow, 1983).

The lack of emphasis in public schools today on meeting individual needs may be an end-product of an era when individualization was sought through the use of approaches such as programmed learning and independent study. Kiernan (1979) wrote that individualization did not work because there was a tendency to apply a single approach to all students. Students worked at an individual rate through a common approach. He suggested that the concept of individualization was solid, but the means of accomplishing it was incorrect. Gregorc (1982) suggested another reason that individualization did not work when he wrote that some educators are haphazard in their selection of instructional means, methods, and environmental conditions. A third reason often cited

for the failure of teachers to teach to individual needs is cost (Lindelow, 1983). Providing every student with individual materials and hiring enough staff to serve the students raises budgets above the bare bones level where many schools have to operate. While the problems of teachers using inappropriate teaching strategies and districts struggling to find funding sources will continue to face administrators, the approach to implementing individualization can be changed. The national focus on individualization has resulted the development of a very practical approach to implementation (Mercer, 1983).

Background of Present Problem

A new body of research has been collected in the past two decades. This new research on learning styles provides educators with more knowledge about the many ways that individuals learn. It reinforces the idea that all people possess ways to learn despite their variance in ability levels (Cornett, 1983). The research clearly indicates that individuals do differ significantly in the ways they perceive, process, remember, and organize information (Lindelow, 1983). The research on learning styles requires a rethinking of the process of independent study, programmed learning, modular scheduling, and many other

individualized approaches (Keefe, 1979). It is a revolutionary idea which requires that instructional planning be based upon the identification of student traits. It, furthermore, emphasizes that learning strategies are picked for students rather than students being picked for learning experiences (Warner, 1981). Keefe emphasized that understanding and utilizing the research on learning styles opens the door to educational improvement. Learning style is much more than just another innovation; it is a fundamental new tool with which to work, a new way of looking at learning and instruction, a more in-depth way of looking at the learner, and the key to educational improvement in the 80's (Keefe, 1979).

Research on learning styles has been the focus of many individuals during the past two decades. The work of Witkin (1977), Hill (1969), Kolb (1976), Gregorc (1979, 1982), Canfield and Lafferty (Bennett, 1979), Hunt (1979, 1981, 1982), Schmeck (1981, 1982), Ramirez and Castanada (1974), Renzuelli and Smith (1978), Dunn, Dunn, and Price (1977, 1981), McCarthy (1979), Letteri (1980, 1982), and many others have contributed to a body of literature from which practitioners can learn. The literature on learning styles is very closely tied to that of brain research. Teachers often have been unaware of this formal body of knowledge

because of the difficulty in obtaining it in summary form (Keefe, 1979). However, at least two dissertations have been written to accomplish this purpose (Guild, 1980, and Garger, 1982). The access to the literature may help to overcome the mismatch between the emerging science on individualized instruction via learning styles and the practice in today's schools.

Researchers have defined learning style in different ways. While educators have primarily called the differences in learning "learning styles", many psychologists have referred to these differences as "cognitive styles." Keefe (1979) has drafted a model which attempts to combine all of the learning style and cognitive style definitions into one overall design. The model groups the definitions into cognitive, affective, and physiological categories.

Though there are different approaches to defining the elements of learning style, there is the common thread of agreement that learning style describes how a student learns and not what the student has learned or why the student has learned that way. Furthermore, there is a commitment from all involved that this information be shared with the practitioners so that they will be able to better meet the instructional

needs of the learner and maximize achievement for all students.

Many researchers have developed approaches to assessing the learning styles of students. Some of these assessment tools are self-report inventories, some are multiple choice tests, some require the person being tested to select the words with which they feel most comfortable, some are non-verbal tests, and others require teacher observation and/or analysis. Many critics suggest that both formal and informal assessment must be completed. Guild (1980) typified a growing controversy in the assessment of learning styles when she suggested that since there was such a wide variability among testing tools, there should be more emphasis placed upon observation, analysis of student work, and general interaction.

There is a need to understand learning style prior to beginning the process of diagnosing students. Dunn, Dunn, and Price (1979) recommend that before a school staff begins to diagnose students for learning styles, there needs to be inservice training which provides the indepth understanding of the theory and the implications for instruction. During this inservice training, evidence that addressing learning styles does improve education for students can be presented. The literature provides many examples of improvement in

student performance on classwork and tests, reduction in truancy and vandalism, development of positive attitudes toward school, and use of information in guidance and counseling programs (Avise, 1982; Ballinger & Ballinger, 1982; Cavanaugh, 1981; Griggs, 1982; Hardy, 1979; Hodges, 1982; Letteri, 1982; Pizzo, 1981; Shea, 1983; Spires, 1983; Vigna, 1983; White, 1980; Anderson & Bruce, 1979; Tappenden, 1983; & Wolfe, 1983). Only when educators see how addressing student learning needs will improve education will the importance of using the knowledge of learning styles become a reality in public education.

The implications for incorporating the new approach to individualization through learning styles requires districts to do several things. First, they must select a test from the many tests that are available. Then they must find the funds to purchase these tests and provide for the necessary inservice training for appropriate implementation of the testing program. For many districts, the lack of funds would be enough reason to avoid implementing a learning styles program.

For some districts, the mobility of students in and out of the district creates an additional burden which must be addressed prior to implementing a learning styles program. Because of this movement, it

would be necessary for districts to have trained staff who could be available to test new students upon their arrival in the districts. This is both costly and time-consuming. If there was a way to accomplish this task without a test, it would be a valuable process for districts facing these problems. Can teachers use observation as a means of identifying student learning styles and thus be able to implement a learning styles program without the use of a standardized test? This question needs to be addressed.

Statement of the Problem

Does an inservice training program provided to teachers in grades 5-12 significantly improve the ability of teachers to identify student learning styles through observation? Which elements improve the most and which improve the least?

Purpose of the Study

The purpose of this project was to measure how well teachers can identify the learning styles of students in grades 5-12 before and after inservice training by comparing their observational ratings with the student profile on the Learning Style Inventory (Dunn, Dunn,& Price, 1985). This was measured by answering the following major research question:

Does the given inservice training cause a significant difference in the ability of teachers to identify student learning styles? In addition to the major research question, the following questions were addressed:

1. Which elements of learning style can teachers identify most accurately prior to inservice training?
2. Which elements of learning style can teachers identify least accurately prior to inservice training?
3. Which elements of learning style show the greatest gain in identification after the inservice training?
4. Which elements of learning style show the least gain after inservice training?

Definition of Terms

The following terms and abbreviations were used in the study:

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

LSI: Learning Style Inventory

developed by Dunn, Dunn, and Price. (1985 revision). This test is normed for students in grades 3 through 12. It assesses students on twenty-two different learning style areas.

PEPS: Productivity Environmental Preference Survey developed by Dunn, Dunn, and Price in 1979. This tool is for identification of individual adult preferences of conditions in a working and/or learning environment.

PS: Preference Summary scoresheet which matches the computer printout of the student's scores on the LSI. Teachers mark the scoresheets as they identify students' learning styles.

Limitations of the Study

The following should be considered limitations in using this data in other settings:

1. The subjects in this study observed students across several grade levels which prohibits any consideration of observational accuracy with any one particular grade or age level.

2. The study was limited to two similar semi-rural school districts which prevents generalization to large urban areas.

3. Limited minority populations are well-established in the area and do not represent the cultural diversity of many school districts.

4. Since the standardized instrument requested personal preferences for the answers, there is the chance that answers do not reflect the actions of the respondent.

5. Since there was no third party verification that observations were accurate, there is the chance of observation error.

Basic Assumptions of the Study

1. Students were able to identify their own learning style preferences.

2. Teachers did take the time to consider each student's learning style.

3. Each of the items being tested was observable or made available to the teacher in the given classroom setting.

CHAPTER II

REVIEW OF THE LITERATURE

Interest in the topic of learning styles has increased rapidly in the past two decades (Lindelow, 1983). One researcher found that in the early 1970's the literature on the topic of learning styles was quite limited with less than fifty citations in Educational Resources Information Center (ERIC), but by the end of the decade it had yielded more than 800 citations (Guild, 1980). Between January 1975 and January 1985, the accumulation of articles and dissertations amounted to 290 citations in ERIC, 250 citations in Psychological Abstracts, and 245 Dissertation Abstracts. The amount of information on the topic now stands as testimony to the overwhelming interest in discovering the true nature of learning styles and the application of learning styles to the fields of education and psychology.

In addition to the accumulation of articles in the literature, there has been an increase in attendance at national conferences. In 1979 at a conference held in Chicago, researchers began to share definitions and the results from research (Keefe, 1982). While only twenty researchers attended the first conference on learning styles, the first major conference on learning styles

and brain research sponsored by the National Association of Secondary School Principals and held in New Orleans in 1981 attracted the interest of more than 500 persons (Thomson, 1982). At this conference fifty models were shared and more than forty school districts stated that they were involved in research studies. As Fischer and Fischer (1979) stated, research on teaching and learning styles is still in the embryonic stage. There are still theories being united to form a new science, the science of learning styles (Thomson, 1982).

To provide the foundation for this study, this review of the literature will cover the following five topics:

1. A general description of the term "learning style."
2. A discussion of a comprehensive model which encompasses the definitions by most researchers.
3. A discussion of the definition of learning styles by some of the major researchers whose assessment tools have contributed to the formation of the comprehensive model.
4. A summary of the research which has been done to justify the definitions, the use of assessment tools, and the values of applying

the research to the field.

5. A discussion of one area of controversy evident in the literature which must be addressed by school districts interested in implementing the assessment of learning styles.

Definition of "Learning Style"

Early research was concerned with the difference between memory and verbal or visual teaching methods. Therefore, definitions of learning style were considered often synonymous with the definition of cognitive style (Keefe, 1979a). Kuchinskas (1979) supported this idea by stating that because cognitive style can be defined as the way that a person acts, reacts, and adjusts to the environment, it is often the same as learning style. Ferrell (1981) took exception to this idea by stating that learning style is broader than cognitive style. Most researchers today support the latter concept and separate the two terms.

A learning style appears to be the way one is programmed to learn effectively. It consists of distinctive behaviors which serve as indicators of how a person can learn from and adapt to the environment. Some people work best with concrete or abstract items, require either structure or non-structure, like varying temperatures, lighting levels, noise levels, and

function differently at different ages and in different stages of physical and emotional development. These patterns are probably genetic in their origin and are expressed by us within our environment and culture (Gregorc, 1979b). Gregorc (1982b) has a hypothesis that people organize in linear and non-linear ways, think about things differently, and use sensory apparatus in differing degrees. Their dependence on the feelings, their intuition, and the use of the intellect all control the way they identify, judge, substantiate, confirm, and validate truth. Thus, learning styles control the way people separate themselves from their environment. Cornett (1983) wrote that learning style is a consistent pattern of behavior within which there is much individuality. These natural differences in people can explain why some highly motivated students fail to perform (Gregorc & Butler, 1984).

Researchers have included different elements in their definitions of learning styles. A summary of some of these differences is available in an article written by Dunn, DeBello, Brennan, Krimsky, and McMurrain (1981). Some of the elements which are considered include structure, motivation, sociological needs, perceptual processes, and thought processing.

Some confusion does occur when intelligence is discussed in reference to learning styles. According to Fischer and Fischer (1979), intelligence has nothing to do with learning style. Mercer (1983) also emphasizes that learning style is different from intelligence. Learning style involves how a person processes information, whereas intelligence focuses on aptitude. Another characteristic which separates learning style from intelligence is that learning style does change with age (Price, 1980; Copenhaver, 1979; & Cornett, 1983).

Gregorc (1982) warned that there can be too superficial or too complex a definition of the term "learning style" if researchers are not careful. This need for a definition which is neither too complex or too superficial has been incorporated into the research completed by James Keefe at the national office of the National Association of Secondary School Principals. Keefe (1982) developed a definition of learning styles which included the elements mentioned in the foregoing discussion. He stated (p. 44) that "learning styles are cognitive, affective, and physiological traits that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment." He further explained that learning is an internal process and that we can only recognize

learning styles by observing learners' overt behaviors. He included genetic coding, personality development, and environmental adaptation as factors in the definition. The elements of a learning style are somewhere along a continuum with extremes at each end. It is this definition of learning styles that forms the basis for a comprehensive model that can unite researchers in their efforts to bind the knowledge into a science.

A Comprehensive Model of Learning Style

Developing a model requires the ability to synthesize all of the research. Several researchers have attempted to group definitions into categories. Guild (1980) in her attempt to summarize the literature for the use of teachers grouped the learning styles into the following categories: cognitive processes, learner behaviors, comprehensive, and other. Garger (1982) in his description of the state of the art divided the definitions of learning styles into four categories--information processing habits, behavioral styles, input and output styles, and eclectic styles. Other researchers referred to only two categories, processing styles and input/output styles. Keefe (1982), in his definition of learning styles, was able to cover all of the definitions recorded in the

literature by establishing the three categories of cognitive, affective, and physiological styles.

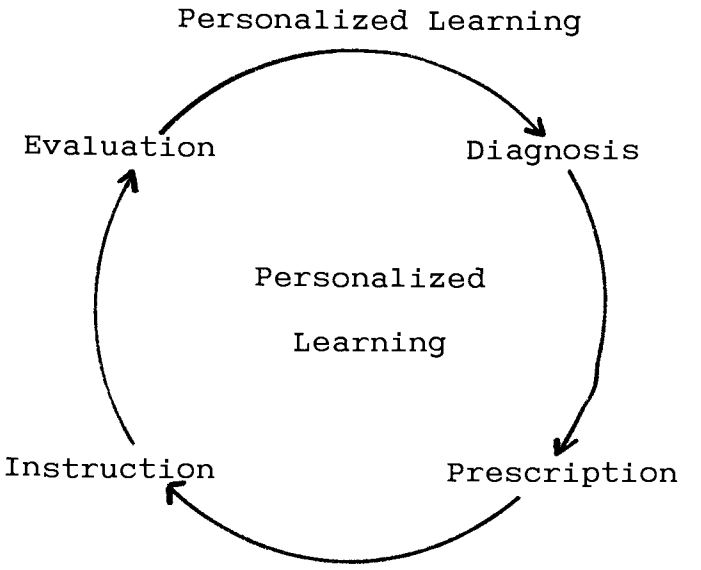
Keefe (1982, p. 44-45) used Messick's (1976) definition of cognitive styles. He wrote that "Cognitive styles are information processing habits representing the learner's typical mode of perceiving, thinking, problem solving, and remembering." This category includes perceptual modality preferences and strengths, field independence and dependence characteristics, scanning, leveling, and sharpening, reflectiveness and impulsivity, tolerance and intolerance, hemisphericity, bi-polar profiles which measure abstract/concrete and random/sequential dimensions of learning, and other cognitive profiles that can be used to predict achievement.

The second division of the comprehensive definition developed by Keefe (1982, p. 48) was called affective styles. "Affective styles are these same motivational processes viewed as the learner's typical mode of arousing, directing, and sustaining behavior". These are affected by culture, environment, parental and peer pressures, school practices, and personality factors. This category includes such factors as the amount of structure people require, their motivation for learning, their locus of control or internal/external perceptions of casuality.

The third category of the comprehensive model includes physiological styles. Keefe (1982, p. 49) defined this category as follows: "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." Physiological factors are among the most obvious influences on school learning. They involve the environmental elements of temperature, sound, and light. THey include time rhythms and the need for intake. These elements are more easily identified by observation.

The concept of learning styles fits into the diagnostic-prescriptive phase of personalized learning as proposed by Keefe in 1980. In this description, Keefe shows that personalized learning involves four steps as shown below:

Figure 1



Personalized learning requires one to fit the method to the individual rather than the individual to the method. This is the core of the learning style approach in education (Garger, 1982).

Researchers and Their Contributions

Cognitive Domain

One of the most prolific of the writers and researchers in the area of cognitive learning style is Herman Witkin (Guild, 1980). He defined cognitive styles as characteristic modes of functioning that we show consistently in perceptual and intellectual activities (Witkin, 1976). These styles involve the form rather than the content of cognitive activity. They refer to differences in how we perceive, think, solve problems, and relate to others (Witkin, Moore, Goodenough, & Cox, 1977). Based on his research, Witkin proposed the existence of two different perceptual tendencies in people depending on how they view and use these surroundings. These two styles are field independent and field dependent. Witkin, et. al, (1977) describe these two elements as follows:

Field independent: People who are field independent impose their own structure to the field. They organize verbal materials and concepts and are

interested in the abstract and theoretical. They are often very articulate and analytical. Often giving an impersonal orientation, they prefer physical distance from others and are unaware of their own social stimulus value. Personal needs, feelings, and attributes are usually more important. Individualism is a common trait.

Field dependent: People who are field dependent accept the world as it is. They prefer loose organization of verbal and content material. In general, they are more attentive to social frames of reference, look at faces of others, attend to verbal messages with social content, are drawn to people, like to be physically close to people, want to be known by people, and want to be perceived as socially outgoing and affectionate.

Witkin developed a test to measure these two elements of learning style. The Embedded Figures Test measures the ability of the observer to find simple, geometric forms hidden in a complex pattern (Oltman, 1982). Observers are shown an isolated geometric shape. Then the shape is removed and the observer is shown a configuration of shapes. The observer is to

find the shape. This test has been used in several research studies either as the sole testing tool or in conjuction with other assessment tools (Anderson & Bruce, 1979).

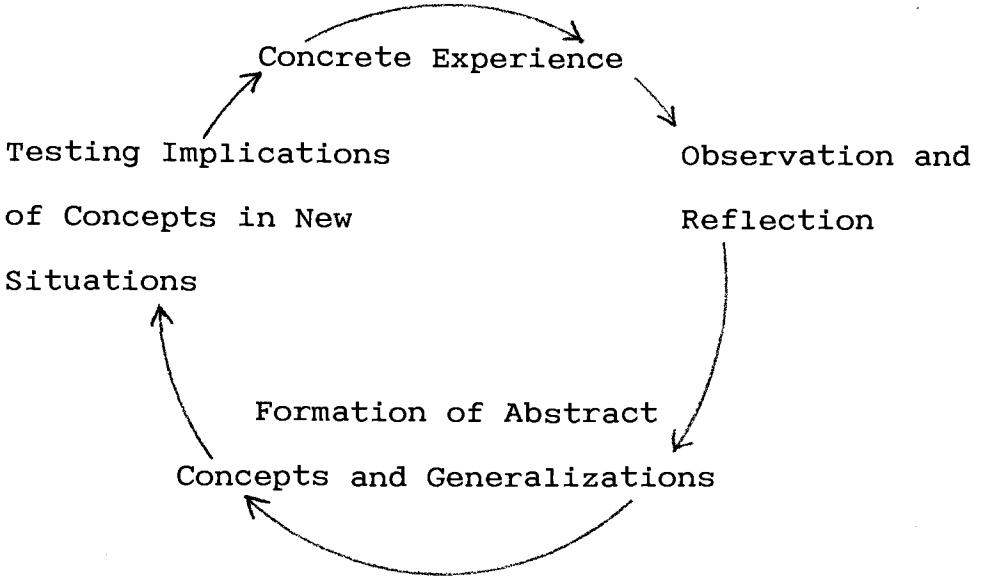
Two other researchers who have followed the research of Herman Witkin are Ramirez and Casteneda (1974). They have chosen to change the term field dependent to field sensitive. Their attention has been to apply the terms to different cultural groups with the major focus on the Chicano population. They believe that most Chicanos are field sensitive and thus are placed in conflict with the western society which stresses field-independence.

Based on their research, Ramirez and Castenada (1974) have developed a procedure to assess cognitive styles in children and teachers, to train teachers to teach bicognitively, to develop curriculum and class environments reflecting both cognitive styles, and to develop appropriate teaching and testing environments which match the cognitive styles of the learners. The assessment tool is called the Child Rating Form (Dunn, DeBello, Brennan, Krimsky & McMurrain, 1981). It is a checklist which records the teacher's direct observation. Older students are able to rate themselves. This research procedure is being extended toward assessment of other cultural groups.

Another major researcher whose research focuses on the cognitive domain is David Kolb. He (Kolb, Rubin, & McIntyre, 1974, p. 28) developed the Experiential Learning Model to demonstrate that the learning requires opposite abilities and that the learner must continually choose which set of learning abilities to bring to bear in each situation. He demonstrated the process through which a learner goes in the following model:

Figure 2

Experiential Learning Model



Kolb (1976), whose work is in the field of business management, stated that each learner needs four kinds of abilities: concrete experience (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE). Each person must

continually choose from each of these four areas. A person's preferred style is formed as a result of heredity, life experiences, and the demand of the environment.

To measure these skills, he has developed the Learning Style Inventory (Kolb, 1976). This self-report instrument requires the learner to rank order four words in each of nine sets. Each of these words represent one of the four learning modes: feeling (CE), watching (RO), thinking (AC), doing (AE). This test, for use with young adults, takes approximately five to ten minutes to administer. The results of the questionnaire are used to help build individual awareness of personal learning style and other ways of solving problems. (Dunn, DeBello, Brennan, Krimsky, & McMurrain, 1981).

Following closely the work of Kolb, Gregorc has become a leader in research on learning styles in the field of education. While Kolb used the terms active/reflective, Gregorc used random/sequential (Ferrell, 1981). Gregorc (1984) divides learning style into four categories: concrete sequential, abstract sequential, abstract random, and concrete random. He states that each channel can be observed by distinctive behavior and mannerisms. People use elements from each category, but about 90% of the population are

predisposed to use one or two categories as the preferred way of learning. The following description is given for each of the four learning styles (Gregorc & Ward, 1977):

Abstract sequential: The person can decode written, verbal, and image symbols. They conceptually picture in the mind, prefer information to have much substance, and to be presented rationally and in sequence. They have low tolerance for distractions.

Abstract random: These people pay attention to human behavior. They like people and sense nuances and moods. They prefer unstructured learning environments in which to gather information. They are very reflective and evaluate things globally.

Concrete sequential: These people like direct experiences and have extraordinary development of the senses. They like order, logical sequence, and prefer to work through things in a step by step order. They have no tolerance for distractions.

Concrete random: These learners work by trial and error and make intuitive leaps to solve problems. They like stimulation and a rich environment.

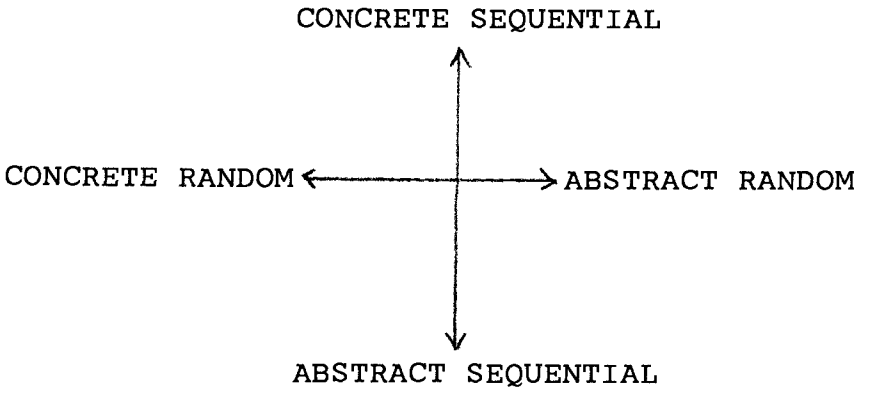
They like to experiment.

Each learning style requires different types of materials. For example, Gregorc (1979) states that while the concrete sequential learner does best with workbooks, manuals, programmed instruction, and hands-on materials, the concrete random learner prefers games, simulations, independent study, and problem solving activities. The abstract sequential learner prefers reading, assignments, lectures, tapes, and analytical thinking, while the abstract random learner prefers movies, discussions, lectures, and television.

To assess learning styles, Kolb developed the Transaction Ability Inventory. In 1982, this instrument was copyrighted under the name of Gregorc Style Delineator (Gregorc, 1982.) This instrument is a self-report instrument based upon a rank order of four words in each of ten sets. Observation and interviews are suggested to help in categorizing learning preferences. The test takes approximately five minutes and is designed for junior high school to adult levels (Dunn, DeBello, Brennan, Krimsky, & McMurrain, 1981). The following is a picture of the profile used to graph a person's learning style (Gregorc, 1982a):

Figure 3

Gregorc's Learning Style Model



Gregorc writes that most people have abilities in all four areas, but tend to focus in one or two.

Another researcher in the area of cognitive style is Ronald Schmeck. Schmeck states that learning styles come about as individuals organize to complete a learning task (Dunn, DeBello, Brennan, Krimsky, & McMurrain, 1981). He says that people remember when they use the following (Schmeck, 1981):

1. Elaborative processing - making information concrete and personally relevant.
2. Synthesis and analysis-- making semantic or categorical judgments about new information
3. Fact retention
4. Study methods

People who use the first two categories tend to do better than those who utilize categories three or four which tend to be very shallow activities.

To test the skills, Schmeck (1982) developed the Inventory of Learning Processes. This is a 62 item, true-false, self-report test which measures the four activities. The approximate testing time is twenty minutes. Information from the test can be used to help students develop more elaborative processing.

Another researcher working in the cognitive area and making some very practical applications to his research is Charles Letteri at the University of Vermont. Letteri (1980) has studied people across seven cognitive domains as follows:

1. Field dependence vs. field independence
2. Scanning (focus vs. non-focus)
3. Breadth of categorization (broad-narrow)
4. Cognitive complexity vs. simplicity (complex-simple)
5. Reflectiveness vs. impulsivity (reflective vs. impulsive)
6. Leveling vs. sharpening
7. Tolerance for incongruous or unrealistic experiences (tolerant vs. intolerant)

From these studies, Letteri was able to identify three cognitive profiles. The profiles are as follows:

1. Cognitive Profile I - analytical focuser, narrow, complex, reflective, sharpener,

tolerant, high performer.

2. Cognitive Profile II- middle on all levels
3. Cognitive Profile III-global, non-focuser, broad, simple, impulsive, leveler, low performer

His research showed that a cognitive profile is a basic determinant of an individual's level of academic achievement and can accurately identify specific thinking and learning deficits. Letteri (1982) developed strategies to train students in areas that would transfer over to the academic areas. This assessment approach is a clear shift from the approach taken by many researchers who have studied cognitive domain in a single dimension. Garger(1982) states that Letteri's approach would seem to allow for a more comprehensive and accurate analysis of the subject's learning style.

One researcher whose work primarily centered in the cognitive dimension, but also cut across the other two categories was Joseph Hill. Hill's Cognitive Mapping, which was developed extensively at Oakland Community College in Bloomfield Hills, Michigan, in 1969, is a comprehensive model which does not have an easily accessible source (Guild, 1980). Kuchinskas (1979) wrote that the system looks at the way a person

handles theoretical symbols (words and numbers), qualitative symbols (sensory input, asthetic input, physical input), and cultural influences (family, self, and peer). It looks at the way a person reasons and makes references. It is a model that contains twenty-seven distinguishable characteristics that are assessed and then through prescription are addressed (Warner, 1982).

The process of Cognitive Mapping involves four steps: An inventory, a paper and pencil test of 219 items, is first given. This test, called the Cognitive Style Interest Inventory, can be used with elementary through high school students and takes approximately fifty minutes to administer (Dunn, DeBello, Brennan, Krimsky, & McMurrain, 1981). From this information, a "Map" is drawn up which addresses strengths and weaknesses. Then validation is completed by observation of the student in a one to one situation and a group session, conversation with the student, and examination of the student's work. Finally a prescription is developed and a curriculum adaptation occurs (Guild, 1980)

There are many other researchers who are working in the cognitive area and may well develop some assessment tools or approaches that may become as well known as the ones mentioned. For example, the Rational

Thinking Style developed by Davis (1981) may become well recognized. This review, however, has been limited to include those researchers whose assessment approaches are more commonly being used in the field of education.

Affective Domain

The second area of the comprehensive model addresses the affective domain. The affective category of learning styles includes one very well-known researcher who wrote about conceptual level. His name is David Hunt. Hunt (1979) defined learning styles as the amount of structure a person requires in order to learn best. His research was based on a theory of personality development. Information for this learning style can come from the student himself, his peers, parents, teachers, or tests. His primary assessment tool is the Paragraph Completion Method, which is usually given to students above grade five. Six topics must be answered in about twenty minutes. Students answer and are scored on the structure of the response instead of the content. The kind of questions asked include what I think about rules, when I am criticized, what I think about parents, when someone disagrees with me, when I am not sure, and when I am told what to do (Hunt, 1974, p. 37). After the test is

scored, the teacher varies the structure of the approach, then observes the results. The student must be observed for one week in a structured situation and then for one week in a unstructured learning environment (Hunt, 1979) This process is called the "Teacher Assessment of Student Learning Styles"(Dunn, DeBello, Brennan, Krimsky, & McMurrain, 1981). Thus, Hunt utilized both a written test and observation to obtain the desired learning style.

Another team of researchers who worked with affective learning styles, as well as some cognitive elements, was Canfield and Lafferty. They believed that individual learning style was derived from academic conditions, structural conditions, achievement factors such as competition and goal setting, content material, the mode of preferred learning, and the expectation of performance level (Dunn, DeBello, Brennan, Krimsky, & McMurrain, 1981).

Canfield and Lafferty used a Learning Style Inventory which was a self-reporting instrument in which the learner rank ordered answers to about thirty questions. This test is to be used with junior high through adult levels and takes about fifteen minutes to complete. From this inventory the teacher can counsel and help students with attitude or academic problems.

Renzuelli and Smith are another team of researchers who work within the affective definition of learning styles. These two researchers, working especially with the talented and gifted, developed a Learning Style Inventory to assess the learner's preferred mode of instruction (Renzuelli and Smith, 1978). This assessment tool assessed the learners' attitudes toward nine instructional strategies: projects, drill and recitation, peer teaching, discussion, teaching games, independent study, programmed instruction, lecture, and simulation (Guild, 1980). Students are asked to respond to statements indicating a preference on a five point-scale from very infrequently to very frequently. From the analysis of test scores, individual and class profiles are compiled. This information can then be used to achieve a match between students and their learning environment.

Parallel to the Learning Styles Inventory is a Teaching Styles Inventory, which is used to measure teacher preference and actual use of these nine modes. This information is then used in the matching process (Renzuelli & Smith, 1978).

Physiological Domain

Although some of the researchers mentioned have crossed several of the categories, the team of researchers who now have a learning styles approach that crosses all three categories are Rita and Kenneth Dunn and their partner Gary Price. The Dunns, known as the most prolific writers on learning style, define the response to specific elements of the learning situation as the learner's style. (Guild, 1980). In defining style, the Dunns do not center on why a student learns in a particular way. They emphasize the patterns learners show when responding to several elements (Dunn, Dunn, & Price, 1985). The elements of the learning style definition include the following:

1. Environmental: sound, light, temperature, design
2. Emotional: motivation, persistence, responsibility, structure
3. Sociological: peers, self, pair, team, adult, varied
4. Physical: perceptual, intake, time, mobility
5. Psychological: analytic/global, hemispheric preference, impulsive/reflective

The latter category was added within the last few years and as of yet is not included in the assessment process (Dunn, 1981).

In the seventies the Dunns had developed a questionnaire that teachers could use to assess learning styles. After years of observation and experience and several small studies, it was found that the questionnaire was too lengthy and was not used accurately and effectively by teachers. In 1975, the first Learning Style Inventory was developed. The purpose of this LSI was to assesss student preference to various stimuli. This information would provide a detailed account of a student's learning style and aid in prescribing the type of environment, instructional activities, social groups, and motivating factors that maximize personal achievement (Dunn, Dunn, & Price, 1985). In addition to the Learning Style Inventory for grades three through twelve, there is now a primary version and the Productivity Environmental Preference Survey (Price, Dunn, and Dunn, 1979), an adult version of the Learning Styles Inventory.

The Dunns are unique in the field because their work is very accessible to teachers (Guild, 1980). They also were instrumental in beginning the Learning Styles Network Newsletter, a quarterly publication with articles on learning styles and an update of what's

happening in the field of research. In addition, they have published several books and numerous articles which explain the application of their approach to learning styles.

Although this research has centered on researchers who have developed assessment tools to match their definitions, attention should be given to an approach to learning styles assessment developed by Fischer and Fischer (1979). Through observation, they write that ten types of learners can be identified. They are as follows:

1. Incremental learner: works step by step until the whole is reached
2. Intuitive learner: skips about making generalizations from gathered information
3. Sensory specialist: depends on one sense
4. Sensory generalist: uses all senses (Oversensitive learner)
5. Emotionally involved: does best in visually & auditorally stimulating room
6. Emotionally neutral: low-keyed and neutral
7. Explicitedly structured: needs structure
8. Open-ended structure: needs open classroom

9. Damaged learner: has a social problem, poor self-concept or aesthetic sensitivity
10. Eclectic learner: can learn anywhere

This approach is quite different, but does deserve attention and consideration of a different way to assess learning styles. Certainly it does consider all three categories in the comprehensive model.

These are but a few of the researchers who have contributed to the comprehensive model. Others have definitions which fit into the model and assessment approaches which may be used in future research studies.

Justification Through Research

For years researchers have been developing theories about how people learn. With the recent research on learning styles, there has been an increasing need to show that the body of literature is indeed practical and can be applied to the field. Dunn (1981a) has listed some of the questions that need to be researched to gain acceptance into the body of knowledge. These questions are listed as follows:

1. Are learning styles genetic or environmental in origin?
2. How early are learning styles formed?

3. Is there a difference between learning style and cognitive style?
4. Does learning style change over time?
5. Can learning style be changed by instruction?
6. Why does environment affect learning?
7. Can teachers meet individual needs in areas in which they are not confident?

Ellis (1979) suggests several questions which need to be researched:

8. Which learning style characteristics are most important?
9. How do you measure conceptual level, maturity, and maturation?

Dunn and Carbo (1981) add two other questions to this list;

10. Which modalities are prevalent among the young or the old?
11. Should students be taught through their strengths or their weaknesses or both?

Other researchers have suggested more questions to be answered.

12. Do certain groups of people have similar characteristics?
13. Can students accurately identify their learning styles?
14. Can the use of learning style assessment

results affect learning?

15. What is the impact of matching student to learning environment or teacher based on learning styles?
16. Are there any other alternatives?
17. How should teachers be trained about learning styles?

These questions and many others are ones which researchers are attempting to answer. The following discussion summarizes some of these research studies that have been done:

Modality Preferences

One of the most controversial questions is at what age do modality preferences emerge? Barbe and Swassing (1979) wrote that change occurs in the elementary years. As cognitive development occurs, students move through visual and kinesthetic modalities. Auditory is the slowest to develop. Later on modalities become more integrated. Students with mixed modalities do better in school. When stressful situations arise, one will resort to the dominant modality. Price (1980) has opposing information to offer. In a study of 3,972 third through seventh-graders, he found that the younger the child was, the more tactile and kinesthetic the child was. He found that visual strengths develop

as students moved through the grades. Auditory development occurred by the fifth or sixth grade.

Heredity

Another controversial subject about learning styles concerns the role of heredity. Kolb stated that it is inherited, while Dunn writes that there are no common learning styles among family members (Dunn, DeBello, Brennan, Krimsky, & McMurrain, 1981). Barbe tried the middle road by stating that a person's heredity, maturation, learning, and cultural upbringing were the most likely contributing factors (Barbe & Milone, 1980). Thies (1979) stated that environmental, emotional, psychological elements of learning styles seemed to be related to brain research. Sociological elements do not seem to be related. Dunn, Price, Bacilious, and Zenhausen (1982) stated that preference on right or left brain can be described by actions. They also stated that these are biological and correlate with achievment. Dunn and Reckinger (1982) used learning styles in teaching both sides of the brain and in counseling. Certainly the relationship of learning styles to heredity and brain research will be ongoing.

Group characteristics

A large number of research studies have been done to investigate that learning styles can be used to identify certain populations. Vigna (1983), in a study involving 347 Canadian high school students who were administered Witkin's Embedded Figures test and Dunn's LSI, found that gifted students when compared to non-gifted students were more analytical, more complex, preferred to learn visually or kinesthetically, and liked to be with an authority figure. Avise (1982), using Dunn's LSI and PEPS, found high achievers to be more responsible, more motivated, less touching, and less involved with peers. In this study, it was possible to predict 72-76% of the learning styles of the students based on the criteria given. Furthermore, when the teacher and student were similar in self-motivation, responsibility, and preferring to learn alone, high grades occurred.

Johnson (1984) studied 179 dropouts in Maryland. Using the Dunn LSI, it was found that dropouts have the following characteristics: prefer noise, can't sit still, like to work with peers and have teacher around, like late morning/afternoon classes, like an informal learning situation, like mobility, like warm temperatures, and low light levels. Griggs (1982)

suggests that since data from studies indicate that certain groups have specific learning styles, counselors should consider these learning styles in the approach they use with students.

In addition to the study of students in the elementary and high school, there are research studies on different groups of adults in various careers. Copenhaver (1979) found in the research that learning styles did not change as people moved across the fields. Guinta (1983), using the Dunn LSI and the PEPS, also found that the learning styles of teachers do not change across the disciplines. In addition, the only relationship found between learning style and teaching styles were in the areas of sound and authority factors. Kotar (1980), in a study using the Kolb LSI, compared elementary teachers, undergrads in fields other than education, and pre-service teachers. The inservice teachers and pre-service teachers were accommodators, while the students in other fields were assimilators. The results showed that there is a relationship between learning styles and career choices. These studies show that different groups have identifiable learning styles.

Test Studies

Few research studies exist which assess the validity of learning style instruments. Ferrell (1981) compared four tests which appeared to have the greatest support of the educational community and some degree of reliability and validity to see if any of these truly measured all four constructs of the learning style paradigm as described in the study. These tests were the Grasha-Reichman Model SLSS, Kolb LSI, Dunn LSI, and Johnson's Decision Making Inventory. The results showed that each test measured a different aspect of learning styles, and only the Kolb LSI could be validated by factor analysis.

Other researchers are attempting to develop tests which will assess the learning styles of various groups. For example, Christenson (1981) has developed an instrument for identifying elementary and secondary teacher learning styles. Thomson (1982) states that there is a need for developing a new instrument which will assess learning styles in all the areas of the comprehensive model. This topic should become the focus of many research studies as assessment is a critical part of the learning styles movement.

Guidance and Learning Styles

There are several studies that show the use of learning styles in guidance programs. Cavanaugh (1979) demonstrated how information gained from the process of Cognitive Mapping helped guidance counselors in their work with students while the teachers were using information gained from Dunns' LSI. Garger (1982) in the development of a curriculum design used learning styles information to help counselors and teachers learn about students. Triplett (1980) researched the attitudes of principals, counselors, and English teachers in the state of Ohio to determine their attitude toward learning styles. There were no significant difference among the groups. They all felt that about one-third of the students need attention to learning styles and that they do get this attention. Research on the use of learning styles in the schools should increase the attitude toward the importance of using learning style information for all students.

Teacher Training and Inservice

Another area of research involves the use of learning styles in the area of teacher training and teacher inservice. Spires (1983), in a study involving 793 elementary school students in grades K-6, found

that inservice made an impact on student achievement. The study concluded that if learning style theory is to hold any promise for incorporation into the schools, it must be done through inservice. Kusler (1982) wrote that teachers must own the curriculum and system to make it work. Furthermore, all researchers agreed that teachers must start by understanding their own learning style (Kusler, 1982; Lyons, 1982; Cornett, 1983; Lindelow, 1983; Hawk, 1983; Spires, 1983; Tappenden, 1983; & Freely, 1984). Lindelow (1983) voiced the opinion of many authors by stating that one good way to motivate teachers is to administer one of the inventories to teachers and let them discuss the results with their peers. In this way when they appreciate the differences in their own styles, they may be more receptive to recognizing the learning styles of students within the classrooms. They may also be able to influence style changes in students when they can model styles (Cornett, 1983). In addition to recognizing the needs of students and trying to modify situations for students to have success, teachers can also train students to recognize their own learning styles and to help teachers understand more about their own learning styles. In this way, researchers such as (Tappendem, 1983) will be able to state that teachers are trained to understand the needs

of a particular group of students, rather than the opposite. As of this date no teacher inservice programs have been directed at teaching teachers how to observe students for learning styles without the use of a test instrument.

In addition to training teachers about themselves and students, several research studies have been directed at how inservice should be presented. Hawk (1983) stated that it is important to analyze the teachers' learning styles and then use the information to provide inservice. He found that most teachers wanted morning or evening times for inservice, not afternoons. Most teachers preferred to learn in several ways and not to be limited by learning by one's self. Most of them also preferred kinesthetic and visual approaches. He suggested the use of the Dunns' PEPS as a valuable tool in planning for inservice. Freely (1984) supported the need for matching teachers' learning styles in the area of time preference in all inservice activities. Spires (1983) found that inservice to teachers about learning styles had a tremendous impact on students performance in reading and math. He recommended that inservice training needs to extend over a period of time and that it should be delivered in the building where instruction occurs at a time convenient to teachers. Kulp (1981) suggested

that there are specific ways to implement inservice to teachers and that it is not the same for all groups. Hardy (1979) wrote that there should be a difference between inservice to teachers and the training of pre-service teachers. The latter group needs to focus on how to structure the environment for students prior to focusing on student needs. This idea suggests that attention to student learning styles must follow the implementation of good classroom management. The research regarding teacher training shows the importance of using learning styles with all ages and in several aspects of the instructional environment.

Learning Styles and Achievement

Most of the research on learning styles demonstrates the impact of a learning styles program on student achievement. Dunn & Dunn (1979a) stated that the use of learning styles in instruction improves self-image and retention, increases enthusiasm for learning, and raises test scores. In general, the information aids teachers in reaching students who had previously had academic difficulties. Anderson & Bruce (1979) showed the impact of using learning styles in the Model Schools' Project in Bakersfield, California. The students, matched for the cognitive styles of field independence, field dependence, and locus of control,

made gains in English scores. Pizzo (1981) found that there was a significant difference in student achievement when students were matched in the testing situation. David Cavanaugh (1981) related significant gains in achievement of students in Worthington, Ohio, when teaching approaches matched the learning styles of the students. Hodges (1982) saw changes in anti-social behavior, truancy, achievement, and attitudes toward schoolwork at Madison Prep in New York City when instruction was built around student learning styles. Ballinger (1982) wrote that when students were taught foreign language in a style that matched their learning styles they made better gains. Shea (1983) demonstrated that matching students for the element of design made a significicant difference in achievement. Several researchers suggested that one reason many students do not achieve well in school is because instruction does not match the learning styles of the learners (Price, Dunn, & Sanders, 1981).

Matching for Instruction

While the research supports the need for attention to learning styles, there is some controversy over how this should be done. Doyle (1984) stated that there needs to be more research in this area. The following questions need to be answered:

1. Which learning style dimension should be considered the most important for matching?.
2. How should this dimension be measured?
3. Which possible combination should be be used?
4. How should instruction be designed?

He advised that matching may be affected by the nature of the task, the relationship between teacher and student, and the time of the year. Furthermore, he emphasized that uniform instruction is easier for teachers to manage. Cornett (1983) suggested answering six questions as follows:

1. Why - What are the goals?
2. Who - Should the teacher be matched to the student or should the student adapt?
3. What -Which aspects should be matched?
4. Where-In which environment should it occur?
5. When- At what time of the year should it occur?
6. How- What type of matching should be done?

Only through research will these questions be answered.

Barbe & Milone (1981) felt it is too early to require matching on modality strengths because some people don't use their strongest modality, some students change back and forth, and there is often an interaction between student and teacher modality strengths. Cornett (1983) suggested that flexing is very important. Lindelow (1983) believed that the

judgment of the educator should be the final determinant on how closely teaching and learning styles are matched and that learning styles should provide information, not dictate decisions. Turner (1979) felt that teachers should be taught several effective styles of instruction so that students learn to adapt to many different styles. Hunter (1979) stated reality when she says that teachers will not always be able to adapt. The student needs to learn to adapt, but the teacher must remain sensitive to the needs of the learner.

Keefe (1979b) suggested that schools can take one of three aproaches when considering the implementations of a learning styles program:

1. Remedial approach- looking at a single test.
2. Diagnostic program
3. Organize the entire school for advisement

Butler (1982) suggested three options of a different type for implementation:

1. Attitudinal option- Teachers and students work to understand their own styles.
2. Technical option - The learner is matched to the curriculum or the curriculum to the learner.
3. Interactional option - The student and teacher

learn about each other and style flex. There is not enough research to address all of the problems that go along with matching. Until this information is collected, the controversy on matching will go on.

Controversy on Assessment

As can be seen by the brief summary here, research regarding learning styles has taken many directions. The one area where there is a dirth of research studies is in the area of assessment. Perhaps that is because there is not yet one assessment tool which will assess a comprehensive learning styles model or maybe it is because there is still controversy as to how this assessment should be done. This problem of how assessment can be done has become the stimulus for this reasearch project.

Guild (1980) wrote that there is no one instrument which is able to meet all situations. Keefe (1982) called for the development of a comprehensive instrument which can be used in the schools. In 1985, there is still no comprehensive tool developed.

For those wishing to purchase an assessment tool, there are several from which to choose. The choice becomes difficult and may involve choosing several instruments. This may be costly for many schools and

might deter some from considering any involvement with the topic of learning styles. This possibility has highlighted the need to look at an alternative approach to assessment suggested throughout the literature.

The use of observation as an approach to assessment is expressed throughout the literature (Keefe, 1979; Fischer & Fischer, 1979; Hunter, 1979; Barbe & Swassing, 1979; Davis, 1981; Warner, 1981; Hunt, 1981; Davidman, 1981; Cornett, 1983; & Lindelow, 1983). There are several different reasons for the support of observation reported in the literature. Guild (1980) suggested observation as the best approach to assessment until a comprehensive assessment tool is created. Keefe (1979a) suggested that it will be difficult to build a test that will cover all of the characteristics. Some of the characteristics will not be testable; therefore, observation is essential to assessment.

Gregorc (1979a) is opposed to the use of self-reporting instruments because he feels that students can read into questions. Barbe & Swassing (1979) stated that young children will respond to test questions in socially acceptable ways as they want to please. Davidman (1981) suggested that students can't always determine their preferences from ways they have learned to respond. He felt that elementary students

don't have enough experience with different ways of learning. Gregorc (1979a) wrote that some students lie on tests, while Warner (1981) reminded us that learning styles can change making testing information invalid. Cornett (1983) states that a test is a measure of a student at that time only and may provide the examiner with a false sense of knowing about the student. These researchers thus support observation for they feel it is a more valid way of reporting.

Other researchers suggest that observation may be a quick, natural, and cost-effective approach to assessment. Fischer & Fischer (1979) supported this view by stating that while assessment can be done by questionnaires or highly sophisticated tests, for now, observation can be used to identify which variables to act upon. They have developed ten definitions of learners that can be identified through observation. Davis (1981) eplained that if learning styles are to be identified, they must be easily recognized without the teacher having to pour through volumes of information to locate them. Hunt (1981) wrote that when experienced teachers are given time to share their intuitions they can use nearly every word or concept that researchers have proposed and often are found implementing models that appear in theory in the literature. Furthermore, he stated that diagnosis of

learning styles is what goes on in good classroom instruction. Madeline Hunter (1979) stated that informal diagnosis is the heart and core of diagnostic teaching and although it may be less accurate than the results from formal diagnosis, it is more readily available. Furthermore, the good teacher should be able to shift approaches if one approach does not seem to match the learner as observed. Keefe, (1979b) supported Hunter's approach. He adds that if no special testing budget is available, the teacher can begin by observing and answering a few diagnostic questions.

Many researchers use observation to verify the findings of their assessment tools. For example, the Dunn, Dunn, and Price recommend that the teacher observe the findings on their LSI. Gregorc, Ramirez & Castenada, and Hill also use observation as means of verifying their findings (Dunn, DeBello, Brennan, Krimsky, & McMurrain, 1981). For Hill, the verification by observation is considered the most critical step and essential to the process of Cognitive Mapping.

In the early research on learning studies, the Dunns developed an observation checklist for use by teachers. They wrote that teachers did not use this well and as found in a 1975 study, they could not

accurately identify the learning styles of students. (Dunn, Dunn, and Price, 1977). In this study in May/June of 1975, 110 students and their teachers in grades 3, 4, 7, and 11 were selected to participate. Teachers rated the students and then the students rated themselves. It was found that teachers could recognize only the following elements of learning style well: amount of light students needed, whether the student was adult motivated, if they learned in several ways, if they were tactile/kinesthetic learners rather than auditory or visual learners, and whether they were visual instead of auditory learners. Teachers seemed to have the greatest difficulty identifying the elements of self-motivation and persistence. In 1977, Marcus (1979) found that teachers could not determine what learners would say about themselves. However, he stated that teachers could interview students to learn about their styles. It was information such as this which prompted the Dunns to develop an inventory which could be completed by students and the data used by teachers. It is interesting to note that the Dunns still use observation to back up the student inventory. As of this date, no one has used observation as a primary means of assessing learning styles after receiving inservice training on the subject.

In summary, there is some controversy over the ability of teachers to use observation as an accurate assessment approach. With the quantity of available information on the topic of learning styles, the success that inservice programs are having with the implementation of learning styles, the literature seems to support the need for a study that will identify how accurately teachers are able to identify the learning styles of students when provided inservice training on the topic. This is the focus of this research study.

CHAPTER III

METHODOLOGY OF THE STUDY

The primary purpose of this study was to examine the effect of inservice on the ability of teachers to observe accurately the learning styles of students. Furthermore, this study explored which elements were more accurately identified and which were least accurately identified in both the pre and posttest settings.

This chapter deals with four major topics related to the design of the study: (1) Subjects, (2) Design and Data Analysis, (3) Materials, and (4) Procedures.

Subjects

The target population for this study consisted of teachers in grades 5-12 of semi-rural school districts. The accessible population was compared via demographic data gained from the Oregon School Directory, State Department of Education collection of data on school districts, and federal census information provided by the Center for Population Research and Census on school districts in the following four counties: Polk, Marion, Benton, and Linn. Utilizing information on district enrollment, cultural and language diversity, occupational employment, medium family income, and

staffing, the two districts--Jefferson and Scio--were found to be similar and appropriate for this study.

A further study was completed to determine if the teachers' residences would create situations in which they might easily communicate about the project. No major relationships were found, except for those living in the larger communities of Lebanon, Albany, and Salem. The following is a summary of the residences of teachers participating in the project.

Table 1

Residences of Project Teachers

	Jefferson	Scio
Scio	1	10
Albany	9	6
Corvallis	1	3
Jefferson	7	3
Salem	12	3
Lebanon	4	3
Stayton	0	3
Sweet Home	0	1
Marion	1	0
Sublimity	1	1

Jefferson is located in the southeast corner of Marion County, halfway between Albany and Salem. In addition to farming, many residents work in Albany or Salem. Scio, ten miles east of Jefferson, is located in the northeast section of Linn County. Like Jefferson, it is both a farming community and a bedroom community with many residents working in Albany, Stayton, and Lebanon.

The study included teachers and students from Jefferson Middle School (Grades 5-8), Jefferson High School (Grades 9-12), Centennial Elementary School (Grade 5) in Scio combined with Scio MIddle School (Grades 6-8), and Scio High School. In the Jefferson schools failure to return parent permission eliminated some students from participating, while all Scio students had the opportunity to participate. At Jefferson Middle School, only those teachers who were teaching students during the fifth period of the day participated in the study. In the other three schools, all teachers participated. The following chart represents the breakdown of teachers and students by schools that participated in the study:

Table 2

Total Accessible Population

Participants	Experimental		Control	
Site	Jefferson		Scio	
Schools	JMS	JHS	SMS	SHS
Total Students	220	286	173	228
Students Participating	193	183	173	228
Teachers Participating	15	21	14	19

All identified teachers and students with permission in the accessible population participated in the study. Out of the total students who participated,

for statistical purposes two samples were selected as follows: Each teacher was matched with one student randomly chosen using the table of random numbers. This created the first sample which consisted of 36 teachers and 36 students in the experimental group and 33 teachers and 33 students in the control group. Then the same teachers were matched with another set of students picked at random using the table of random numbers. This created a second sample with the same numbers as the first. Although the samples were used in the statistical analysis, all participating students in the accessible population were observed by teachers, took the LSI, and were included in the descriptive data analysis.

Design and Data Analysis

A quasi-experimental non-random pretest-posttest design was used in the study. Jefferson served as the experimental site while Scio served as the control site. A treatment was provided to the experimental group.

Analysis of covariance was chosen as the main statistical tool for the project because it provided a means of reducing the effects of differences that existed between the groups at the beginning of the project (Borg & Gall, 1983 & Slavin, 1984). This

statistical procedure adjusted the posttest scores--the dependent variable--for the differences found among the groups in the pretest scores--the covariate. It thus measured the significance of the null hypothesis on each of twenty-two elements in the study. This hypothesis, developed from the major research question, is stated as follows:

> There is no significant difference in the ability of teachers to identify student learning styles when provided inservice training.

To check on the appropriateness of using analysis of covariance as a statistical tool, analysis of variance was used to check for equal slopes. This statistical tool was also used to check for a big difference in improvement.

In addition to the data analysis completed on the two random samples, an analysis of the data for the entire population involved in the study was run. This data listed the means for each of the twenty-two elements for each teacher involved in the project with all students they observed. From this data, it was possible to observe the differences among teachers in their ability to observe students.

A final statistical analysis was run to determine the percentage of agreement that teachers and students

made in both sample groups and the total accessible population. This analysis grouped student and teacher scores into the three categories shown on the student Preference Summary sheet. These were"low preference", "no strong preference", and "high preference". The percentage of agreement was determined for both pretest and posttest scores. This data provided the answers for the four research questions.

Materials

The testing tool used to measure student learning style was the Learning Style Inventory (LSI) developed by Dunn, Dunn, and Price (1985). This is a standardized assessment tool which yields information on the environmental, emotional, sociological, and physical preferences a student has for learning. It does not attempt to answer why these preferences exist or what caused them. It does not measure underlying psychological factors, value systems, or the type of attitudes a student has. Instead, it provides information about the ways through which learning occurs. (Dunn, Dunn, & Price, 1985).

This test was chosen from the tests reviewed in the literature because it appeared to be the most comprehensive measure available which can address the model of learning styles described in the review of the

literature. The following are reasons found throughout the literature that have influenced the selection of it as a research tool:

1. It provides a more complete assessment of learning style elements (Johnson, 1984).

2. It is the only test which assesses all three areas of the comprehensive model, although the assessment in the cognitive area is very limited (Keefe, 1982).

3. It has good reliability and commendable validation (Avise, 1982 & Kirby, 1979).

4. The terms are easily understood by teachers, students, and parents without the need to go through technical definitions. (Avise, 1982)

5. The LSI is easy to administer, taking usually only one period, and students have no difficulty with it (Avise, 1982 & White, 1980).

6. It has been normed for students in grades 3-12 with many samples being tested in the four revisions of the test (1975, 1978, 1984, 1985).

7. It has a scoring system that allows for several useful summaries to be developed.

8. It is practitioner-oriented (Keefe, 1982).

9. Extensive research studies have been completed using this tool; studies include the relationship of learning styles to self-concept, counseling, gifted

students, learning disabilities, achievement, and brain research. Several of the factors of the test have been tested for their validity. (Tappenden, 1983 & Johnson, 1984).

10. The test manual offers useful suggestions for the adaptation of the learning environment (Avise, 1982).

In 1968-69 Rita and Kenneth Dunn developed a set of questions be used by teachers to assess student learning style (Dunn, Dunn, & Price, 1979). In 1974, after five years of research in New York State, reliability and consensual validity were established. In 1974, Price completed a content analysis of the items in the questionnaire and compiled those with 90% consistency into a shortened form. In 1975 this became the first LSI.

The 1985 version of the Learning Style Inventory includes the following elements:

1. Noise level
2. Light
3. Temperature
4. Design
5. Unmotivated/motivated
6. Persistent
7. Responsible
8. Structure
9. Learning alone/peer oriented learner
10. Authority figures present
11. Prefers learning through several ways
12. Auditory preferences
13. Visual preferences
14. Tactile preferences
15. Kinesthetic preferences

16. Intake
17. Evening/morning
18. Functions best in late morning
19. Functions best in afternoon
20. Mobility
21. Parent-figure motivated
22. Teacher motivated

Reliability and validity have been established over the past ten years since the test was first published. It was first given to 1200 students in five states and three provinces, establishing high internal consistency (Price, 1982). In 1979 after a two year study, Ohio State University's National Center for Research in Vocational Education verified that the LSI had impressive reliability and face and construct validity (Kirby, 1979, p.42). In addition, three to four years after the development of the the LSI, research studies had helped establish predictive validity (Dunn, Dunn, and Price, 1985). These studies included studies by Krimsky, 1982; Pizzo, 1981; Spires, 1983; Shea, 1983; Virostko, 1983; and White, 1980.

At first the LSI was used in correlational studies which looked at the different elements of the test; then the LSI was used, as described in the review of the literature, to identify the learning styles of various groups of students; to show how teaching to learning styles can improve achievement; and to tie learning theory to brain research. Currently the LSI

is being used in many experimental studies at the doctoral level (Dunn, Dunn, & Price, 1985).

The 1984 and 1985 revisions included several major changes. Several items were eliminated, leaving twenty-two elements instead of the previous twenty-four. Some items were reworded for clarification purposes. Finally, the scoring system was revised for grades 5-12 to include a 5-point likert scale. Research for the 1984 version shows that 77% of the reliabilities are equal to or greater than .60 as indicated in Table 3.

Table 3

LSI Reliabilities
(1984 Likert Scale in English)
[Hoyt's Reliability (equivalent to a KR-20)]

Area	Reliability
1. Noise Level	.75
2. Light	.66
3. Temperature	.72
4. Design	.66
5. Motivation	.70
6. Persistent	.72
7. Responsible	.80
8. Structure	.55
9. Learning Alone/ Peer Oriented	.83
10. Authority Figures Present	.72
11. Learn in several ways	.54
12. Auditory	.40
13. Visual	.26
14. Tactile	.64
15. Kinesthetic	.62
16. Requires Intake	.82
17. Evening - Morning	.73
18. Late Morning	.49
19. Afternoon	.70
20. Needs Mobility	.78
21. Parent Figure Motivated	.71
22. Teacher Motivated	.67

N=1046, Grades 6-12 (Dunn, Dunn,& Price, 1985, p.95)

This analysis was based on the scores of 1,046 students in grades 5-12 who took the 1984 revised instrument (Dunn, Dunn & Price, 1985). Grade 5 was not included in the reliability study. Virostko's (1983) study showed a correlation reliability of .929 between an initial test and retest of the LSI in the area of time of day administration within a one year time span. This supports the research done by Copenhaver (1979) and that done by Kirby (1979).

Students in grades 5-12 answer the statements on a 5-point likert scale with extremes of strongly disagree to strongly agree for each statement. These answers are then converted to a scoring continuum going from 20 to 80 with a median of 50 and a standard deviation of 10. Scores below 40 represent a low or opposite preference for the element and scores above 60 represent a strong preference for an item. (There are two exceptions to this scoring in that learning alone/peer-oriented and evening/morning are along a continuum.) Scores between 40 and 60 are indicating that the element is not very important to the individual. Generally, individuals prefer between six and fourteen elements with the rest being relatively unimportant (Dunn, Dunn, & Price, 1985). A consistency score of 70% is required on all items for the test to be considered valid.

A Preference Summary (PS) sheet was developed by this researcher to match the LSI student summary sheet which was sent from the scoring service. This PS sheet was the form on which the teachers recorded their opinion of the students' learning styles. A copy of this form is included in the Appendix G.

The Productivity Environmental Preference Survey (PEPS) developed by Dunn, Dunn, and Price in 1979 was used in the inservice training program to help teachers

measure their own learning style. This instrument is the adult version of the LSI. It is a tool which helps analyze the conditions under which an adult learns best. The PEPS, like the LSI, has been through a lengthy process to obtain reliability and validity. Sixty-eight percent of the reliabilities are equal to or greater than .60 (Price, Dunn, & Dunn, 1982, p. 19). The PEPS has one less learning style element than the LSI. Like the LSI, it is being used in many research projects to compare various groups of adult workers.

A videotape entitled "The Look of Learning Styles" was purchased from the Learning Styles Network housed at St. John's University in Jamaica, New York. This videotape was used in the inservice training to demonstrate ways the learning style elements of the Dunns' model could be observed in the classroom.

Procedures

In November teachers were matched with the individual students that they would observe in the study. These students were ones with whom the teachers had direct contact daily. Using any knowledge they had about the students and information that they could observe, the teachers in both the control and experimental schools were asked to complete a Preference Summary (PS) sheet on each student.

Teachers were given several days to complete this activity with both the control and experimental groups completing the activity at the same time. These pretests were then collected by the building principals and returned to the researcher.

During the week after the pretest, the students in all schools were asked to complete the 1985 version of the Learning Style Inventory. Students answered 104 questions on a computer scoring form. These inventories were then collected by the building principals, sent to the researcher, and mailed to Price Scoring Service in Lawrence, Kansas.

In December and in January four inservice training sessions were held for teachers in the two experimental schools. Each session was held twice, in the morning at one school and in the afternoon at the other school,so that staff could attend an inservice convenient to their daily schedule. In this way if a staff member had a conflict, coaching assignment, or was sick during one presentation, they had the option of attending another session. All teachers were able to attend one session of each of the four training sessions.

The content of the inservice training sessions is outlined below:

Session 1

1. Introduction of the topic of learning styles
2. History of the early pioneers on the topic
3. Discussion of the "Comprehensive Model" of learning styles as defined by Keefe
4. Presentation of the Dunns' learning style elements (Appendix M)
5. Completion of the PEPS by the teachers (Appendix N)

Session 2

1. Review the comprehensive model developed by Keefe
2. Group participation in categorizing Dunns' elements into the comprehensive model
3. Viewing of the videotape, "The Look of Learning Styles"
4. Review of research going on throughout the nation's schools on the topic of learning styles

Session 3

1. Review of Dunns' 22 categories (Appendix I)
2. Small group work in listing observable learning style traits in the classroom (See Appendix O)

3. Sharing of team findings
4. Compiling of group information with information on an overhead screen (See Appendix P)

Session 4

1. Review of data compiled from group work
2. Observing and rating peers (teachers) using the Preference Summary Sheet (PS)
3. Sharing of this information with partner
4. Comparing observation information with the scored results of the PEPS
5. Summary of the four in-service sessions

The inservice training sessions were from 30-45 minutes in length depending upon the arrival time of teachers. Teachers were provided nourishing foods and drink at each session. A relaxed atmosphere was the goal of the investigator.

The inservice training sessions were led by one trainer, screened according to a given criteria, and trained prior to each session. Five trainers were considered with the finalist chosen according to the following criteria: experience as a secondary teacher, a building-level administrator, background in curriculum and instruction, and some experience in presenting new methods and materials to staff. The

hiring of a trainer minimized the "investigator effect". In addition, the training of another person in delivery of the information gave credibility to the transportable nature of this program into other districts. To monitor any deviations from the format and to be sure that training was consistent for all sessions, this researcher observed each training session.

Two weeks after the completion of the inservice, the teachers in all four schools were asked to complete the posttest by again observing students and recording the information on the Preference Summary (PS) sheet. Because this work fell near the end of the semester in one site and at the end of the quarter in the other school, participants were given extra time to complete the posttest. Posttests were returned directly to the principals and then returned to the investigator for the compilation of data.

The information from the pretest, student LSI profile, and the posttest were collected and placed in a computer in an Apple IIE file by secretaries. This file was then transferred to an IBM file and was sent to the computer center at Oregon State University for processing using the statistical procedures described earlier in this chapter.

Student LSI profiles were returned to the districts involved with appropriate information provided to staff on how to use the profiles. The teacher profiles were returned to the teachers involved in the project.

CHAPTER IV

PRESENTATION AND ANALYSIS OF THE DATA

This study was undertaken to determine the impact of an inservice training program on the ability of teachers to identify the learning styles of students in grades 5-12. Furthermore, there was a desire to determine which of the learning style elements were more easily identified and which were more difficult to identify.

The information in this chapter will be presented through the following topics: (1) descriptive analysis of the subjects, (2) discussion of the major hypothesis, and (3) discussion of the research questions.

Descriptive Analysis of the Subjects

The total accessible population who participated in and completed the study were 706 students and 69 teachers. Out of this population, two samples were picked for the data analysis using the table of random numbers. The 69 teachers were each matched with one student to form the first sample; then the process was repeated with the same 69 teachers being matched with another student, thus forming sample two. This data is summarized in Table 4 and Table 5.

Table 4

Students Participating in the Study

Total Population	Experimental 350		Control 356	
	JHS	JMS	SHS	SMS
Students Completing Data	173	177	214	142
Students in Sample One	21	15	19	14
Students in Sample Two	21	15	19	14

Table 5

Teachers Participating in the Study

Total Population	Experimental 36		Control 33	
Teachers in Study	21	15	19	14

Discussion of the Major Hypothesis

The major hypothesis for the study was examined for both samples utilizing analysis of covariance procedures. The hypothesis was tested at the .05 level of significance using the Statistical Package for the Social Sciences (SPSS).

Upon completion of the above analysis, two analysis of variance tests (two-tailed) were run to determine the appropriateness of the use of the analysis of covariance and to determine if big differences in improvement could be statistically determined with the given data from the samples. Both

of these tests were conducted at the .05 level of significance.

Hypothesis

There is no statistically significant difference in the ability of teachers to identify student learning styles when provided inservice training.

Based on the data from the two samples, the null hypothesis was rejected for only two items, element 7 (responsible) and element 21 (parent-figure motivated). For all other elements, the tests showed no significant difference for the experimental group.

In the first sample, the covariate was significant ($p < .05$) in all but five of the twenty-two elements. The dependent variable (the posttest) was significant at $p < .05$ for two elements, but not for the experimental group. Element number 2 (light) was significant at .024 with the control group mean being 9.98 while the experimental group mean was 13.41. Element number 18 (late morning) was also significant at .038 with the control group mean being 9.65 while the experimental group mean was 14.32.

The derived data for the analysis of covariance is presented in Table 6:

Table 6

Analysis of Covariance Decision Table

Sample 1 ($p<.05$)

LSI Element	Covariate	Dependent
1. Noise level	.008 (S)	.511 (NS)
2. Light	.000 (S)	.024 (S)
3. Temperature	.077 (NS)	.547 (NS)
4. Design	.060 (NS)	.297 (NS)
5. Motivation	.003 (S)	.051 (NS)
6. Persistent	.000 (S)	.281 (NS)
7. Responsible	.042 (S)	.896 (NS)
8. Structure	.128 (NS)	.655 (NS)
9. Learning alone/ peer oriented	.268 (NS)	.349 (NS)
10. Authority figures present	.011 (S)	.195 (NS)
11. Learns in several ways	.287 (NS)	.349 (NS)
12. Auditory	.011 (S)	.482 (NS)
13. Visual	.000 (S)	.459 (NS)
14. Tactile	.000 (S)	.410 (NS)
15. Kinesthetic	.000 (S)	.553 (NS)
16. Requires Intake	.003 (S)	.820 (NS)
17. Evening-Morning	.000 (S)	.070 (NS)
18. Late morning	.000 (S)	.038 (S)
19. Afternoon	.000 (S)	.926 (NS)
20. Needs mobility	.010 (S)	.254 (NS)
21. Parent-figure motivated	.000 (S)	.854 (NS)
22. Teacher motivated	.003 (S)	.790 (NS)

n=69

Analysis of covariance was conducted for the second random sample. In the second sample the covariate was significant for all but three of the elements. The dependent variable was significant for three elements. Element number 7 was significant at .034 with the the experimental group closer to the student group mean with an adjusted mean difference of

10.33, while the control group had an adjusted group mean of 14.97. Element number 21 was also significant at .016 with the experimental group having an adjusted mean of 16.63 while the control group had an adjusted mean of 24.26. Element number 15 was also significant at .047; however, the control group was closer to the student mean with an adjusted mean of 9.84 while the experimental group had an adjusted mean of 14.55. The data for sample number 2 was derived from Table 7:

Table 7

Analysis of Covariance Decision Table

Sample 2 ($p < .05$)

LSI Element	Covariate	Dependent
1.Noise level	.009 (S)	.637 (NS)
2.Light	.000 (S)	.074 (NS)
3.Temperature	.002 (S)	.294 (NS)
4.Design	.020 (S)	.529 (NS)
5.Motivation	.001 (S)	.988 (NS)
6.Persistent	.000 (S)	.691 (NS)
7.Responsible	.000 (S)	.034 (S)
8.Structure	.074 (NS)	.499 (NS)
9.Learning alone/ peer oriented	.000 (S)	.347 (NS)
10.Authority figure present	.034 (S)	.902 (NS)
11.Learns in several ways	.115 (NS)	.980 (NS)
12.Auditory	.002 (S)	.791 (NS)
13.Visual	.000 (S)	.074 (NS)
14.Tactile	.123 (NS)	.619 (NS)
15.Kinesthetic	.002 (S)	.047 (S)
16.Requires intake	.038 (S)	.389 (NS)
17.Evening - morning	.000 (S)	.737 (NS)
18.Late morning	.000 (S)	.471 (NS)
19.Afternoon	.045 (S)	.622 (NS)
20.Needs mobility	.000 (S)	.946 (NS)
21.Parent figure motivated	.000 (S)	.016 (S)
22.Teacher motivated n=69	.005 (S)	.075 (NS)

To check on the appropriateness of the analysis of covariance as a procedural tool, analysis of variance was used to test for slopes. On sample one the slopes for elements 5, 13, 14, 16, and 19 were determined to not be equal; as equal slopes are a requirement for using analysis of covariance, it was inappropriate to use this procedure for those items. None of these elements were determined to be significant in the

sample. In sample two, only element 1 and element 3 had slopes that were not equal. From this analysis of variance for slopes, it was determined that the use of analysis of covariance was appropriate for the elements determined to be significant at the .05 level of significance in both samples. The data for the analysis of variance on slopes is listed in Table 8:

Table 8

Analysis of Variance for Slopes

LSI Element	F-Sample 1	F-Sample 2
	($p<.05$)	
1. Noise level	.7456 NS	.0392 S
2..Light	.3384 NS	.6201 NS
3. Temperature	.4290 NS	.0421 S
4. Design	.6367 NS	.3709 NS
5. Motivation	.0037 NS	.4568 NS
6. Persistent	.1874 NS	.2145 NS
7. Responsible	.1475 NS	.2162 NS
8. Structure	.2107 NS	.9509 NS
9. Learning alone/ peer oriented	.1582 NS	.4595 NS
10.Authority Figures present	.2972 NS	.0841 NS
11.Learns in several ways	.3393 NS	.1979 NS
12.Auditory	.9663 NS	.8166 NS
13.Visual	.0453 S	.0971 NS
14.Tactile	.0493 S	.7786 NS
15.Kinesthetic	.6131 NS	.5069 NS
16.Requires Intake	.0271 S	.6710 NS
17.Evening/morning	.6111 NS	.0553 NS
18.Late morning	.9792 NS	.3919 NS
19.Afternoon	.0297 S	.9518 NS
20.Needs mobility	.4901 NS	.6669 NS
21.Parent figure motivated	.4885 NS	.3557 NS
22.Teacher motivated	.1813 NS	.7356 NS

n=69

A second analysis of variance was conducted on the two samples to check for big differences in improvement. In sample one three elements showed big differences in improvement at the .05 level of significance. Element 2 (light) was significant at .0094 with the control group improving 2.4242 points, while the experimental group declined 1.8889 points. Element 6 (persistant) was significant at .0312 with the control group improving 3.5152 points while the experimental group declined 1.4722 points. Element 17 (evening/morning) was significant at .0148 with the control improving 3.3636 while the experimental group declined 2.2500.

In the second sample, on element 7 (responsible) significant at .0128, the experimental group improved .4167, while the control declined 2.8181 points. On element 15 (kinesthetic),significant at .0422, the control group improved 2.5152 points while the experimental group declined 3.000 points. This data was derived from Table 9:

Table 9

Analysis of Variance Decision Table for Improvement

($p<.05$)

LSI Element	F-Sample 1	F-Sample 2
1. Noise level	.4336 NS	.0662 NS
2. Light	.0094 S	.1744 NS
3. Temperature	.6783 NS	.1091 NS
4. Design	.0952 NS	.3806 NS
5. Motivation	.1939 NS	.7067 NS
6. Persistent	.0312 S	.6589 NS
7. Responsible	.0849 NS	.0128 S
8. Structure	.8451 NS	.4820 NS
9. Learning alone/ peer oriented	.9660 NS	.0767 NS
10.Authority figures present	.2156 NS	.9122 NS
11.Learns in several ways	.1156 NS	.7606 NS
12.Auditory	.0706 NS	.6288 NS
13.Visual	.3617 NS	.0870 NS
14.Tactile	.8983 NS	.9637 NS
15.Kinesthetic	.1738 NS	.0422 S
16.Requires intake	.5584 NS	.2372 NS
17.Evening/morning	.0148 S	.3734 NS
18.Late morning	.0504 NS	.6586 NS
19.Afternoon	.3116 NS	.7892 NS
20.Needs mobility	.8106 NS	.6224 NS
21.Parent figure motivated	.7864 NS	.1307 NS
22.Teacher motivated	.8278 NS	.3565 NS

N=69

Discussion of Research Questions

In addition to determining whether the null hypothesis was significant, this study posed the following research questions:

Research Question 1

Which elements of learning style can teachers identify most accurately prior to inservice?

From the analysis on percentage of agreement, teachers in both samples identified element 5 (motivation) with 75% and 56% degree of accuracy and element 22 (teacher-motivated) with 64% and 67% accuracy level. Element 6 (persistent) was identified in sample one with 83% accuracy, while in sample 2 teachers identified element 2 (light) with 61% accuracy and element 3 (temperature) with 67% accuracy.

Research Question 2

Which elements of learning style can teachers identify least accurately prior to inservice?

From the data on percentage of agreement, there are a number of elements with less than a 40% accuracy of agreement. Teachers in both samples one and two identified element 1 (noise) with 33% and 31% respectively, element 8 (structure) with 33% and 39%, element 10 (authority figures present) with 33% and

31%, element 13 (visual) at 33% and 31%, element 16 (requires intake) at 33% in both, and element 20 (needs mobility) with 39% and 28%. In sample two only, element 4 (design) was identified with 36% accuracy, element 11 (learns in several ways) at 33%, element 12 (auditory) at 33%, and element 17 (evening/morning) at 39%.

Research Question 3

Which elements of learning style show the greatest gain in identification after the inservice?

Element 13 (visual) increased 5.6% in sample one and 16.7 in sample two. Element 19 (afternoon) increased 8.3% in sample one. In sample two, element 6 (persistent) gained 8.4%, element 11 (learns in several ways) improved 13.9%, and element 12 (auditory) increased 19.5%.

Research Question 4

Which elements of learning style show the least gain after inservice?

Five elements showed the least gain after the inservice. Element 22 (teacher motivated) was one of the most accurately identified elements prior to inservice. After inservice, the percentage of accuracy fell 13.9% in both samples. Element 2 (light) which

had been identified well by sample two lost 16.7% in the posttest. Element 4 (design) which was least accurately identified in the pretest by sample 2 fell 13.9% in sample one and 11.1% in sample two in the posttest. In sample one, element 9 (learning alone/peer oriented) declined 13.9% , while element 14 (tactile) fell 11.2%.

The data listed after each of the research questions was derived from Tables 10 and Table 11.

Table 10

Percentage of Agreement Decision Table

Sample 1

	Experimental			Control		
LSI Element	Pre	Post	Diff	Pre	Post	Diff
1. Noise level	33.3	19.4	-13.9	39.4	30.3	-9.1
2. Light	41.7	38.9	-2.8	36.4	39.4	+3.0
3. Temperature	41.7	47.2	+5.5	54.5	54.5	0.0
4. Design	41.7	27.8	-13.9	24.2	33.3	+9.1
5. Motivation	75.0	66.7	-8.3	78.8	51.3	+27.5
6. Persistent	83.3	72.2	-11.1	51.5	48.5	-3.0
7. Responsible	61.1	61.1	0.0	33.3	51.5	+18.2
8. Structure	33.3	30.6	-2.7	39.4	33.3	-3.1
9. Learning alone/ peer oriented	55.6	41.7	-13.9	27.3	33.3	+6.0
10. Authority figures present	33.3	27.8	-5.5	24.7	45.5	+21.3
11. Learn in several ways	50.0	41.7	-8.3	39.4	36.4	-3.0
12. Auditory	41.7	36.1	-5.6	36.4	51.5	+15.1
13. Visual	33.3	38.9	+5.6	33.3	36.4	+3.1
14. Tactile	55.6	44.4	-11.2	45.5	42.4	-3.1
15. Kinesthetic	47.2	44.4	-2.8	30.3	36.4	+6.1
16. Requires intake	33.3	38.9	+5.6	45.5	54.5	+9.0
17. Evening-morning	50.0	38.9	-11.1	39.4	33.3	-6.1
18. Late morning	55.6	41.7	-13.9	54.5	57.6	+3.1
19. Afternoon	50.0	58.3	+8.3	45.5	48.5	+3.0
20. Needs mobility	38.9	38.9	0.0	39.4	42.4	+3.0
21. Parent figure motivated	55.6	47.2	-8.4	51.5	51.5	0.0
22. Teacher motivated	63.9	50.0	-13.9	54.5	45.5	-9.0

n=69

Table 11
Percentage of Agreement Decision Table
Sample 2

		Experimental			Control		
LSI	Element	Pre	Post	Diff	Pre	Post	Diff
1.	Noise Level	30.6	38.9	+8.3	30.3	42.4	+12.1
2.	Light	61.1	44.4	-16.7	60.6	69.7	+9.1
3.	Temperature	66.7	44.4	-22.3	45.5	42.4	-3.1
4.	Design	36.1	25.0	-11.1	39.4	27.3	-12.7
5.	Motivation	55.6	47.2	-8.4	51.5	54.5	+3.0
6.	Persistent	47.2	55.6	+8.4	36.4	42.4	+6.0
7.	Responsible	44.4	50.0	+5.6	39.4	57.6	+18.2
8.	Structure	30.6	36.1	+5.5	33.3	54.5	+21.2
9.	Learning alone/ peer oriented	30.6	27.8	-2.8	24.2	36.4	+12.2
10.	Authority figures present	30.6	25.0	-5.6	33.3	36.4	+3.1
11.	Learn in several ways	33.3	47.2	+13.9	42.4	45.5	+3.1
12.	Auditory	33.3	52.8	+19.5	42.4	48.5	+6.1
13.	Visual	38.9	55.6	+16.7	39.4	48.5	+9.1
14.	Tactile	44.4	41.7	-2.7	42.4	36.4	-6.0
15.	Kinesthetic	58.3	50.0	-8.3	42.4	45.5	+3.1
16.	Requires intake	33.3	33.3	0.0	60.6	45.5	-15.1
17.	Evening-morning	38.9	38.9	0.0	42.4	45.5	+3.1
18.	Late morning	33.3	38.9	+5.6	42.4	42.4	0.0
19.	Afternoon	52.8	50.0	-2.8	40.4	57.6	+17.2
20.	Needs mobility	27.8	30.6	+2.8	30.3	39.4	+9.1
21.	Parent-figure motivated	55.6	55.6	0.0	48.5	33.3	-15.2
22.	Teacher-motivated	66.7	52.8	-13.9	51.5	42.4	-7.1

n=69

Data analysis of the entire accessible population showed some similar patterns as that of the two sample populations. Element 1 (noise), element 3 (design), element 8 (structure), element 9 (learning alone/peer oriented), element 10 (authority figures present), element 13 (visual), and element (20) (needs mobility) were very low in the percentage of agreement analysis. This data is derived

from Table 12.

Table 12

Percentage of Agreement Decision Table

Accessible Population

	Experimental			Control		
	Pre	Post	Diff	Pre	Post	Diff
1. Noise Level	38.6	38.6	0.0	36.2	35.1	-1.1
2. Light	56.3	48.3	-8.0	43.8	48.3	+4.5
3. Temperature	49.4	45.7	-3.2	45.5	48.3	+2.8
4. Design	36.6	33.4	-3.2	34.3	33.7	-0.6
5. Motivation	53.1	52.3	-0.8	57.0	52.5	-4.5
6. Persistent	56.9	53.4	-3.5	51.1	46.1	-5.0
7. Responsible	38.6	41.1	+2.5	40.2	44.4	+4.2
8. Structure	33.1	28.6	-4.5	39.3	42.7	+3.4
9. Learning alone/ peer oriented	36.6	35.7	-0.9	30.1	30.6	+0.5
10. Authority figures present	40.0	33.7	-6.3	35.7	37.1	+1.4
11. Learn in several ways	42.0	43.7	+1.7	41.3	44.1	+2.8
12. Auditory	42.6	43.7	+1.1	37.9	44.1	+6.2
13. Visual	41.7	38.6	-3.1	37.4	39.6	+2.2
14. Tactile	46.9	43.7	-3.2	40.4	42.4	+2.0
15. Kinesthetic	51.1	46.9	-4.2	42.4	48.3	+5.9
16. Requires intake	42.0	42.6	+0.6	43.5	43.0	-0.5
17. Evening-morning	46.6	38.0	-8.6	38.8	35.1	-3.7
18. Late morning	50.6	46.0	-4.6	40.2	46.1	+5.9
19. Afternoon	57.1	54.9	-2.2	46.3	55.3	+9.0
20. Needs mobility	35.7	37.7	+2.0	37.1	37.6	+0.5
21. Parent-figure motivated	54.9	64.6	+9.7	55.6	54.8	+0.8
22. Teacher-motivated	56.3	53.7	-2.6	50.3	51.7	+1.4

n=69

CHAPTER V

SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Within the last decade there has been an increase in research on the topic of learning styles. The variety of definitions has brought forward an attempt to group the information into some usable comprehensive model. Along with this has come the concern as to how this new research can be implemented in the schools. For the state of Oregon with the financial problems that exist regarding school funding, the implementation of a learning styles program which is costly becomes only a dream. It was the search for a solution to this dilemma that provided the impetus for this research project.

The purpose of this research study was to determine the effect of inservice training on the ability of teachers to observe the learning styles of students. Specifically, this research sought to answer the following major research question:

Does the given inservice training cause a significant difference in the ability of teachers to identify students' learning styles?

In addition to this major research question, the study sought answers for each of the following questions:

1. Which elements of learning style can teachers identify most accurately prior to inservice training?
2. Which elements of learning style can teachers identify least accurately prior to inservice training?
3. Which elements of learning style show the greatest gain in identification after the inservice training?
4. Which elements of learning style show the least gain after inservice training?

The accessible population for the study consisted of students and teachers in grades 5-12 in Jefferson, Oregon, and Scio, Oregon school districts. Seven hundred six students and sixty-nine teachers participated in the study. Two samples of sixty-nine students were selected at random to be paired with the sixty-nine teachers for the statistical analysis.

The study consisted of a non-random quasi-experimental design with Jefferson serving as the experimental site and Scio serving as the control site. Teachers in both districts were asked to observe a given group of students on each of the Dunns' twenty-two learning style elements and then to record their observations on a student Preference Summary sheet. Students were then asked to complete the

Learning Style Inventory (Dunn, Dunn, & Price, 1985), after which the tests were sent to the publisher for scoring. Next, four inservice training sessions were given to the teachers in the experimental group to provide a good understanding of the Dunns' learning style model and how to observe elements in the classroom. Finally, both the experimental and control groups were asked to complete the posttest activity by again observing and recording the learning styles of the given group of students.

The data for all students as well as the samples was recorded and used in the data analysis. Analysis of covariance was run on both samples for each of the twenty-two elements. Analysis of variance was completed for each of the twenty-two elements to search for big differences in scores which would show improvement. Finally, the data from both the teachers and the students was grouped into three categories as identified on the Preference Summary sheets and percentage of agreement tests were completed. All statistical procedures were completed at Oregon State University's computer center utilizing the Statistical Packages for the Social Sciences (SPSS).

Analysis of the data provided the following statistical results:

1. Analysis of data for the two samples led to the rejection of the null hypothesis for only two elements, responsible and parent-figure motivated. All other tests were not significant for the experimental group. These results supported the findings of the 1975 study reported by Dunn, Dunn, and Price (1977). The findings for the element of responsible also supported the 1976 study by Marcus (1977), though the studies were different in design.

2. Teachers identified the elements of motivation, teacher-motivated, persistent, light, and temperature with from 60% to 83% accuracy prior to the inservice. Only motivation and persistent made gains after the inservice; however, this gain was evident in only one sample or in the opposite group in which the pretest strength was observed. These same elements were identified in the 1975 study reported by Dunn, Dunn, and Price (1977). With the exception of two elements of teacher-motivated and motivation, these results support the findings by Marcus (1977).

3. Teachers Identified the elements of noise, design, structure, learning alone/peer oriented, authority figures present, learns in several ways, auditory, visual, requires intake, evening/morning, and needs mobility with less than 40% accuracy before the inservice. After the inservice, design and learning

alone/peer oriented made the least gain in improvement. In addition, teacher-motivated which had been identified with some degree of accuracy on the pre-test tumbled 13.9%. While in the two previous studies forementioned (Dunn, Dunn, & Price, 1977 and Marcus 1977) the teachers were rated on their agreement with high and low preference for the element, this study rated on the agreement of match for either high or low. Therefore, for several elements, it is difficult to determine if a total match was evident. However, for the elements of structure, evening/morning, and needs mobility, the findings were consistent in all three studies. The elements (authority figures present, visual, tactile, and kinesthetic) match the findings of the Marcus (1977) study, while the findings on the elements of noise, design, and learns in several ways were quite inconsistent with the findings of both studies.

Conclusions

1. The findings of this study (that teachers were not able to observe more accurately the learning styles of students when given inservice training) support those found in previous studies of different designs.
2. The wide variance of individual teacher means seen in the data in both the experimental and control

population indicates the wide variance in teacher observation skills. This supports the work of Dunn, Dunn, and Price and many others who have developed standardized assessment tools.

3. The inservice training sessions which incorporated several of the techniques suggested in the review of the literature (Lindelow, 1983; Cornett, 1983; Hawk,1983; & Freely, 1984) made little impact on the ability of teachers to observe learning styles of students.

4. A study of the reported scores of control group teachers indicates the same scores being reported for each element on the student Preference Summary sheet.

Implications

1. Teachers may need to add techniques, such as interviewing students to the process of observing to improve accuracy.

2. The element of teacher committment to observing accurately may be a factor in this study.

3. For districts who wish to implement a learning styles program, the best approach at this time may be through the use of a commercially standardized test.

Recommendations for Further Research

1. This study should be replicated at the elementary level where teachers observe students for longer periods of time to determine if inservice can make an impact there thus supporting those in the literature who state observation can make a difference.
2. This study should be replicated with two groups of volunteers to reduce the non-committal to the process that was evidenced in some of the pretest and posttest scores submitted to this researcher.
3. A study should be completed in which the technique of interviewing is added to the observation process to determine if this will increase teacher accuracy.
4. Within an inservice training program add the element of paired observations so that teachers can share their skills with each other and improve techniques of observation.

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APPENDICES

APPENDIX A

PERMISSION LETTER TO PARENTS

November 14, 1985

Dear Parents/Guardians:

A research study on student learning styles will be conducted in grades 5-12 of the Jefferson School District by Shirley Beaty. The Jefferson School Board approved the research study at a meeting in August, 1984.

In this study, students will have the opportunity to complete a questionnaire on how they prefer to study. Questions will cover such topics as noise level, temperature preference, time of day preference, brightness of lights, preferred learning modalities, and structure of the learning environment. A summary of each questionnaire will identify student preferences for many elements that affect learning. After the research is completed, each student will have the opportunity to review the summary sheet. You may also review this if you are interested.

We would like your student to participate in this study. Please check the appropriate boxes below, sign, and return this letter to the school as soon as possible.

Sincerely,

Penny Steward, Principal
Jefferson Middle School

Maurice Paul, Principal
Jefferson High School

_____I give permission for _____to participate in the research study.

_____I give permission for the staff to see the results of the testing and to use it in helping my student at school.

_____
Parent/Guardian/Student (18)

APPENDIX B

LETTER TO PRINCIPAL AT EXPERIMENTAL SITE

November 15, 1985

Dear Principal,

The following is an outline of the activites and a proposed timeline for the research study on learning styles:

November 18-24	Obtain parental permission
December 2-4	35 teachers identify student learning styles on summary sheets (Pre-test activity)
December 5-6	Students take learning style test (30 minute test and make-up test)
December 9-13	One teacher inservice (test)
December 16-20	One teacher inservice (video)
January 6-10	One teacher inservice (discussion)
January 13-17	One teacher inservice (summary)
January 23-26	35 teachers complete post-test activity

At the completion of the research study, you will be given the following information:

1. Copies of the student test information and group summaries.
2. Interpretative information and information on how the test information is being used throughout the country.
3. A summary of research findings.

Thank you for your time and cooperation in making this research study possible. If adjustments are necessary in the timeline, please let me know.

Sincerely,

Shirley Beaty

APPENDIX C

LETTER TO TEACHERS AT EXPERIMENTAL SITE

November 15, 1985

Dear Teacher,

Jefferson and Scio School Districts have been asked to participate in a research project centering on the identification of student learning styles. As this project will provide us valuable information about our students which we may use after the research is completed, we are asking for your input and cooperation as "experts" in the field in completing the following tasks during the months of December and January:

1. Helping obtain parental permission from all students.
2. Completing a pre-test activity.
3. Reading to students and/or monitoring a student test of approximately 30 minutes.
4. Attending and participating in four in-service sessions on the topic of learning styles.
5. Completing a post-test activity.

Thank you for any time and effort you give that will make this research project possible as well as help us obtain useful information about our students.

Sincerely,

Penny Steward, Principal

Maurice Paul, Principal

APPENDIX D

LETTER TO PRINCIPAL AT CONTROL SITE

November 15, 1985

Dear Principal,

The research project on learning styles will involve the following activities:

1. 35 teachers from grades (5-12) will be asked to identify the learning styles of students with whom they have had contact on a regular basis. This is the pre-test activity.
2. All students in grades 5-12 will be given a test which should take approximately 30 minutes of class time. It will be machine scored.
3. The same 35 teachers will be asked to complete the post-test activity approximately six weeks later.

At the completion of the research study, you will be given the following:

1. Copies of the student test information and group summaries.
2. Interpretative information and ideas on how to use the test data for instructional improvement..
3. The opportunity to share in any of the inservice activities completed by the experimental group.
4. A summary of the research findings.

Thank you for your time and ccoperation in making this research study possible.

Sincerely,

Shirley Beaty

APPENDIX E

LETTER TO TEACHERS AT CONTROL SITE

November 15, 1985

Dear Teacher,

Jefferson and Scio School Districts have been asked to participate in a research project centering on the identification of student learning styles. As this project will provide us with valuable information about our students which we may use after the research is completed, we are asking for your input and cooperation as "experts" in the field in completing the following tasks during the months of December and January:

1. Completing a pre-test activity.
2. Reading to students and/or monitoring a student test of approximately 30 minutes.
3. Completing a post-test activity.

Thank you for any time and effort you give that will make this research project possible as well as help us obtain useful information about our students.

Sincerely,

Your pincipal

APPENDIX F

LETTER GIVING DIRECTIONS FOR PRETEST ACTIVITY

Dear Teacher,

As you know, students have preferred learning styles. In some cases, they have strong preferences for a particular situation or environment. At other times or in other situations, they do not show any special preference. As you have worked with students, you have become familiar with their particular styles. Would you please indicate what you think is the student's learning style BY PLACING A NUMBER AT THE APPROPRIATE PLACE ON EACH LINE IN THE STUDENT PREFERENCE SUMMARY. The following information may be helpful to you:

1. Numbers between 0 and 80 can be placed on each line.
2. With the exception of two areas (learning alone/peer learning and evening/morning), the scores indicate the following:

   0-40 Low preference for the area

   41-59 No strong preference and not critical to the learning style

   60-80 High preference for area

   In the two areas (learning alone/peer learning and evening/morning), the scores indicate the following:

   0-40 Preference for the first area of each pair

   41-59 No strong preference for either area

   60-80 Preference for the second area of each pair
3. An explanation of each area is attached for your use.

Thank you for your time and effort in completing the summaries and participating in the research study. Please place the surveys in the envelope and return them to your principal.

Sincerely,

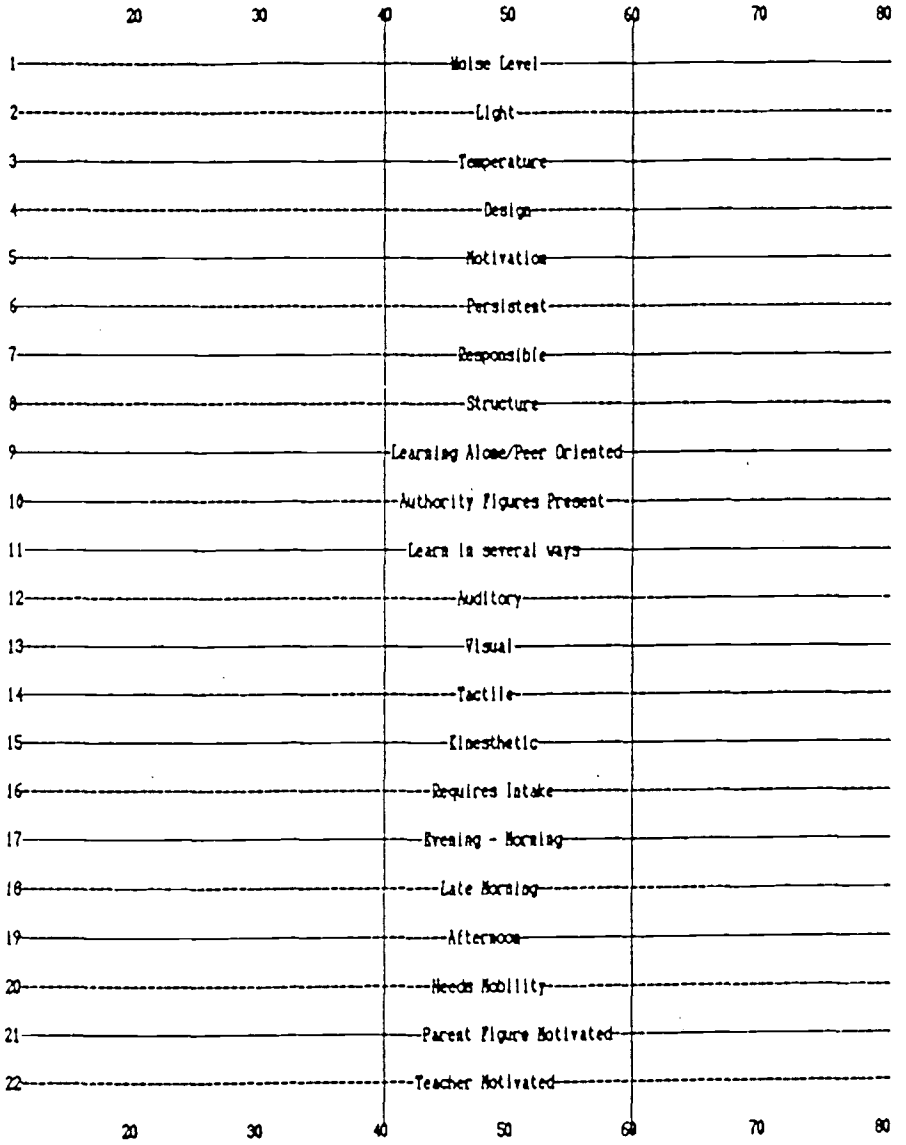
Shirley Beaty

APPENDIX G

PREFERENCE SUMMARY SHEET

STUDENT NAME (last, first) _____ GRADE _____ TEACHER _____ DATE _____

PREFERENCE SUMMARY



APPENDIX H

INDIVIDUAL PROFILE - PREFERENCE SUMMARY LSI

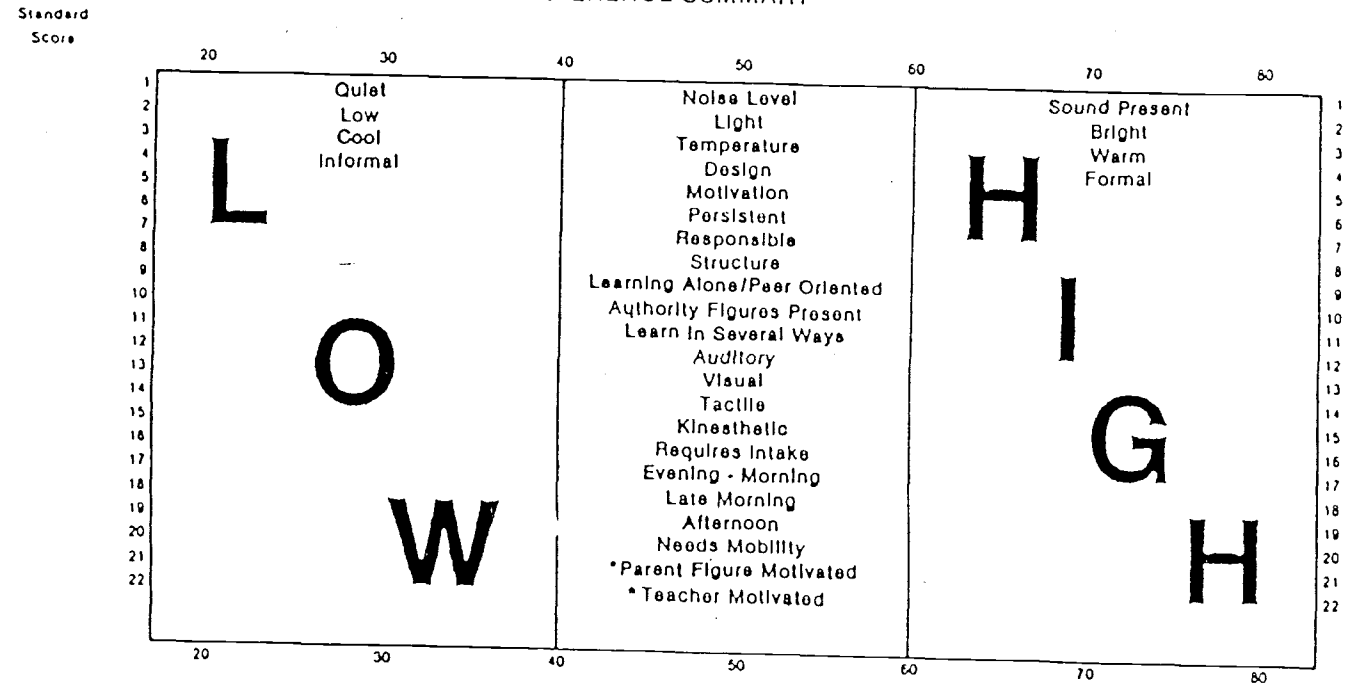
INDIVIDUAL PROFILE

Name: Sex: Year in School: Date of Birth: I.D. No.:

Yr / Mo

Group Identification: Special Code: Date: Group No.:

PREFERENCE SUMMARY



Dunn, Dunn, & Price, 1985, p.100.

PROFILE NO.:

APPENDIX I

DEFINITIONS OF LEARNING STYLE ELEMENTS

FROM LSI MANUAL

1. NOISE LEVEL - Quiet or Sound. Some people need quiet when they are learning, while others notice neither noise nor movement once they begin to concentrate; they can "block out" sound. Some people need sound; they invariably turn on a radio, stereo, or television whenever they study as a screen against random noise distractions.

2. LIGHT - Low or Bright. Some people work best under very bright light whereas others need dim or low light.

3. TEMPERATURE - Cool or Warm. Many students "can't think" when they feel hot, and others can't when they feel cold; some concentrate better in either a warm or cool environment.

4. DESIGN - Informal or Formal. Many students think best in a formal environment - seated on wooden, steel, or plastic chairs like those found in conventional classrooms, a library, or a kitchen. However, some learn better in an informal environment - on a lounge chair, a bed, the floor, on pillows, or on carpeting.

5. UNMOTIVATED/MOTIVATED. Motivation is the desire to achieve academically.

6. IMPERSISTENT/PERSISTENT. This element involves a person's inclination either to complete tasks that are begun or to take intermittant "breaks" and return to assignments or learning-activities later.

7. IRRESPONSIBLE/RESPONSIBLE. This element involves students' desire to do what they think they ought to do. In schools, responsibility often is related to conformity or following through on what a teacher asks students to do.

8. STRUCTURE - Needs or Does Not Need Structure. This element involves a student's need for specific directions or explanations prior to undertaking or completing an assignment.

9. LEARNING ALONE/ PEER ORIENTED LEARNER. Some individuals prefer to study by themselves while others prefer to learn with a friend or colleague; in the latter situation, discussion and interaction facilitate learning. Sometimes students prefer to study alone but in close proximity to someone.

10. AUTHORITY FIGURES PRESENT. Some people feel better or more comfortable when someone with authority or recognized special knowledge is present.

11. PREFERS LEARNING IN SEVERAL WAYS. This element has alternate meanings. It suggests that the person may learn easily alone and also with other people present (peers, or with an authority, or in any combination) or that the person needs variety, as opposed to routine.

12. AUDITORY PREFERENCES. This perceptual area describes people who can learn best when initially listening to a verbal instruction such as a lecture, discussion, or recording.

13. VISUAL PREFERENCES. A learner whose primary perceptual strength is visual can recall what has been read or observed; such people, when asked for information from printed or diagramatic material, often can close their eyes and visually recall what they had read or seen earlier.

14. TACTILE PREFERENCES - Students with tactile perceptual strengths need to underline as they read, take notes when they listen, and keep their hands busy - particularly if they also have low auditory ability.

15. KINESTHETIC PREFERENCES - Learners with kinesthetic preferences require whole-body movement and/or real-life experiences to absorb and retain material to be learned. Such people learn most easily when they are totally involved. Acting, puppetry, and drama are excellent examples of kinesthetic learning; others include building, designing, visiting, interviewing, and playing.

16. REQUIRES INTAKE - This area describes those students who often eat, drink, chew, or bite objects while concentrating - as opposed to those who prefer no intake until after they have finished studying.

17. FUNCTIONS BEST IN EVENING/MORNING - These are two of the four "time of day preferences". Evening and Morning are on a continuum; if a score falls below 40, the student tends to be an evening person; if the score is above 60, the student most prefers to learn in the morning.

18. FUNCTIONS BEST IN LATE MORNING - The energy curve for these students is highest in the late morning and they prefer to learn during this time of day.

19. FUNCTIONS BEST IN AFTERNOON - The energy curve for these students is highest in the afternoon and they prefer to learn during this time of day.

20. MOBILITY - How quietly can the person sit - and for how long? Some people need frequent "breaks" and must move about the instructional environment. Others can sit for hours while engaged in learning - particularly if they are interested in the task.

21. PARENT FIGURE MOTIVATED - These individuals want to achieve to please their parents or parent figures. They often complete tasks because a family member will be proud of their accomplishments.

22. TEACHER MOTIVATED - These individuals want to learn and complete assignments because their teachers will be pleased with their efforts.

Dunn, Dunn, & Price, 1985, p. 3-6

APPENDIX J

LETTER INTRODUCING SECOND ACTIVITY

December 5, 1985

Dear Teachers,

Thank you for your time and effort in completing part one of this research study. You may have found this activity easy with some students and very difficult with others. I appreciate your efforts in doing this activity and trust that the end product of this study will provide some valuable information for you and the students.

The second activity in the study involves the students completing a questionnaire. With your guidance, this part of the study should be completed within a short time period. Directions for the administration of the inventory are included with the answer sheets.

Again may I say thank you for your cooperation in this study.

Sincerely,

Shirley Beaty

APPENDIX K

ADMINISTRATION PROCEDURE FOR LSI

ADMINISTRATION PROCEDURE
for
LEARNING STYLE INVENTORY

The Learning Style Inventory gives students the opportunity to state HOW THEY WORK BEST WHEN TRYING TO LEARN NEW AND/OR DIFFERENT INFORMATION AND SKILLS. Students should be encouraged to give immediate reactions to each statement on a feeling basis and not to ponder over statements and worry about exceptions. They should not worry about statements about which they have no strong feelings. All statements should, however, be marked in one of the five circles. Please use the following procedures in giving the inventory:

1. Tell students the purpose of the inventory and encourage them to mark their true feelings. Remind them that this does not affect their grades.

2. Make sure every student uses a NUMBER TWO PENCIL for the test as the test will be machine scored.

3. Have students complete the identification data as follows: NAME, GRADE, SEX, BIRTHDAY. Do not worry about the special codes or identification number. Please have students BLACKEN IN THE BUBBLES below the boxes.

4. Read the directions in the middle of the answer sheet with the students. Please make sure they understand the meaning of the choices indicated by the letters.

5. Read the inventory to the students as they mark their choices or let them go at their own pace if they have no problems with reading. (It is important that every student have the opportunity to complete the inventory with success.)

6. Allow students enough time to complete the inventory. This may take up to 40 minutes.

7. Please place all completed inventories and extra copies of the inventory in the white envelope and return them to your principal.

Thank you for your time and effort in administering this inventory to your students.

APPENDIX L

LSI ANSWER SHEET

LEARNING STYLE INVENTORY ANSWER SHEET GRADES 5-12 Dunn, Dunn and Price

FORM #9

USE NO. 2 PENCIL ONLY

DO NOT FOLD OR STAPLE

LAST NAME FIRST

DO NOT MARK HERE

BIRTHDAY YEAR MONTH

SEX FEMALE MALE

SPECIAL CODES

IDENTIFICATION NUMBER

NCS Trans-Optic® M30-70032-321

Write your name, sex, and birthdate in the space provided.
Blacken the bubbles below each of the boxes you filled out.

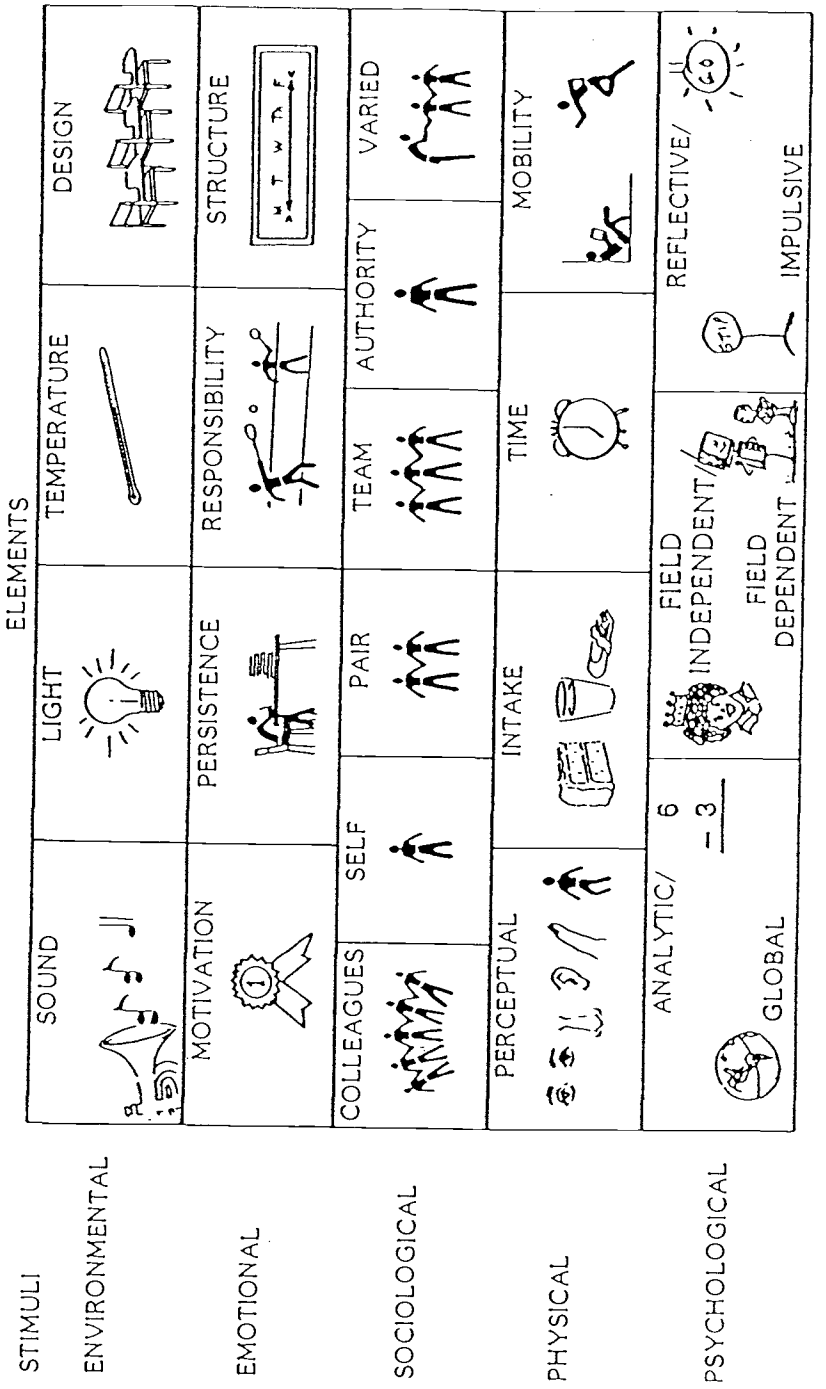
Read each statement and decide to what extent you would agree or disagree with that statement if you had something new or difficult to learn. Mark (SD), if you strongly disagree, or (D), disagree, or (U), uncertain, or (A), agree, or (SA), strongly agree, as the response that best describes how you feel most of the time. Some of the questions are repeated to help make the inventory results more reliable. Answer the repeated questions the same as you did the first time you read the question. Give your immediate or first reaction to each question. Please answer all questions with a no. 2 pencil.

1. I study best when it is quiet. ..... SD D U A SA
2. I like to make my parents happy by getting good grades. ..... SD D U A SA
3. I like studying with lots of light. ..... SD D U A SA
4. I like to be told exactly what to do. ..... SD D U A SA
5. I concentrate best when I feel warm. ..... SD D U A SA
6. I study best at a table or desk. ..... SD D U A SA
7. When I study I like to sit on a soft chair or couch. ..... SD D U A SA
8. I like to study with one or two friends. ..... SD D U A SA
9. I like to do well in school. ..... SD D U A SA
10. I usually feel more comfortable in warm weather than I do in cool weather. ..... SD D U A SA
11. Things outside of school are more important to me than my school work. ..... SD D U A SA
12. I am able to study best in the morning. ..... SD D U A SA
13. I often have trouble finishing things I ought to do. ..... SD D U A SA
14. I have to be reminded often to do something. ..... SD D U A SA
15. I like making my teacher proud of me. ..... SD D U A SA
16. I study best when the lights are dim. ..... SD D U A SA
17. When I really have a lot of studying to do I like to work alone. ..... SD D U A SA
18. I do not eat, drink, or chew while studying. ..... SD D U A SA
19. I like to sit on a hard chair when I study. ..... SD D U A SA
20. Sometimes I like to study alone and sometimes with friends. ..... SD D U A SA
21. I remember instructions best when I read them. ..... SD D U A SA
22. I think better when I eat while I study. ..... SD D U A SA
23. I like an outline for how I should do my school work. ..... SD D U A SA
24. I often nibble something as I study. ..... SD D U A SA
25. It's hard for me to sit in one place for a long time. ..... SD D U A SA
26. I remember things best when I study them early in the morning. ..... SD D U A SA
27. I like to learn by talking with people. ..... SD D U A SA
28. I hardly ever finish all my work. ..... SD D U A SA
29. I usually start my homework in the afternoon. ..... SD D U A SA
30. I really don't care much for school. ..... SD D U A SA
31. I like to feel what I learn inside. ..... SD D U A SA
32. Sound usually keeps me from concentrating. ..... SD D U A SA
33. If I have to learn something new, I like to learn about it by having it told to me. ..... SD D U A SA
34. At home I usually study under a shaded lamp while the rest of the room is dim. ..... SD D U A SA
35. I really like to do experiments. ..... SD D U A SA
36. I usually feel more comfortable in cool weather than I do in warm weather. ..... SD D U A SA
37. When I do well in school, grown-ups in my family are proud of me. ..... SD D U A SA
38. It is hard for me to do my school work. ..... SD D U A SA
39. I concentrate best when I feel cool. ..... SD D U A SA
40. I like to relax on rugs, carpets, a couch, a soft chair, or a bed when I study. ..... SD D U A SA
41. I think my teacher feels good when I do well in school. ..... SD D U A SA
42. I remember to do what I am told. ..... SD D U A SA
43. I like to learn by reading. ..... SD D U A SA
44. I can block out sound when I work. ..... SD D U A SA

OVER

APPENDIX M

LSI ELEMENTS



Dunn, R., Dunn, K., and Price, G. E. (1979). Identifying individual learning styles. In Student Learning Styles: Diagnosing and Prescribing Programs (p. 42). Reston, Virginia: National Association of Secondary School Principals.

APPENDIX N

PRODUCTIVITY ENVIRONMENTAL PREFERENCE SURVEY ANSWER SHEET

PRODUCTIVITY ENVIRONMENTAL PREFERENCE SURVEY

Dunn, Dunn and Price

FORM #8

PRINT INSIDE BOXED IN AREA ONLY

NAME
LAST
NAME
FIRST

GRADE OR EDUCATION

Major or Occupation

USE A NO. 2 PENCIL, DO NOT FOLD OR STAPLE

DO NOT MARK HERE

SEX FEMALE ○ MALE ○

IDENTIFICATION NUMBER

BIRTHDAY YEAR MONTH

SPECIAL CODES

Write your name, sex, and birthdate in the space provided.
Blacken the bubbles below each of the boxes you filled out.

NCS Trans-Optic M30-19206-321 A1811

Read each statement and decide to what extent you would agree or disagree with that statement if you had something new or difficult to learn. Mark (SD), if you strongly disagree, or (D), disagree, or (U), uncertain, or (A) agree, or (SA), strongly agree, as the response that best describes how you feel most of the time. Give your immediate or first reaction to each question. Please answer all the questions on both sides of form.

1. I prefer working in bright light. ..... SD D U A SA
2. I like to work alone. ..... SD D U A SA
3. It is easy for me to concentrate late at night. ..... SD D U A SA
4. I like to draw or use diagrams when I work. ..... SD D U A SA
5. I often have to be reminded to complete certain tasks or assignments. ..... SD D U A SA
6. The one job I like doing best, I do with an expert in the field. ..... SD D U A SA
7. I can think better lying down than sitting. ..... SD D U A SA
8. I prefer cool temperatures when I need to concentrate. ..... SD D U A SA
9. I can block out noise or sound when I work. ..... SD D U A SA
10. People keep reminding me to do things. ..... SD D U A SA
11. It is difficult for me to concentrate when I am warm. ..... SD D U A SA
12. The one job I like doing best, I do with two or more people. ..... SD D U A SA
13. I often work in an area where the lights are low. ..... SD D U A SA
14. When I concentrate I like to sit on a soft chair or couch. ..... SD D U A SA
15. I usually finish what I start. ..... SD D U A SA
16. The *things I remember best are the things that I hear.* ..... SD D U A SA
17. I enjoy tasks that allow me to take breaks. ..... SD D U A SA
18. I can work more effectively in the afternoon than in the morning. ..... SD D U A SA
19. I like to "snack" when I'm concentrating. ..... SD D U A SA
20. When I really have a lot of work to do I like to get it done with several colleagues. ..... SD D U A SA
21. Noise or extraneous sound usually keeps me from concentrating. ..... SD D U A SA
22. I often forget to do the things I've said I would do. ..... SD D U A SA
23. I like working with my hands better than reading. ..... SD D U A SA
24. I like to work or analyze an assignment with another individual. ..... SD D U A SA
25. I prefer cool temperatures when I'm working. ..... SD D U A SA
26. The one job I like doing best, I do with several people. ..... SD D U A SA
27. I concentrate best in the late afternoon. ..... SD D U A SA
28. The things I remember best are the things that I read. ..... SD D U A SA
29. I usually complete tasks that I start. ..... SD D U A SA
30. I think best sitting up. ..... SD D U A SA
31. I like to learn or work with a person in authority. ..... SD D U A SA
32. I work best early in the morning. ..... SD D U A SA
33. I get a lot done when I work on my own. ..... SD D U A SA
34. When I work I turn all the lights on. ..... SD D U A SA
35. I prefer that others share responsibility for a task we're doing. ..... SD D U A SA
36. I really enjoy television. ..... SD D U A SA
37. I like either a teacher or supervisor to outline tasks I have to complete. ..... SD D U A SA
38. I like to sit on a straight-back chair when I concentrate. ..... SD D U A SA
39. I work or study best by myself. ..... SD D U A SA
40. I can remember things best when I study them in the evening. ..... SD D U A SA
41. The things I remember best are those I have seen in a book or magazine. ..... SD D U A SA
42. I always finish tasks that I start. ..... SD D U A SA
43. If I have to learn something new, I prefer to learn about it by hearing a record, tape, lecture. ..... SD D U A SA
44. I am most alert in the evening. ..... SD D U A SA

APPENDIX O

INSERVICE WORKSHEET

Worksheet

1. Noise Level

Low High

2. Light

Low High

3. Temperature

Low High

4. Design

Low High

5. Motivation

Low High

6. Persistent

Low High

7. Responsible

Low High

8. Structure

Low High

9. Learning Alone Peer Oriented

10. Authority Figures Present

Low High

11. Learns in Several Ways

Low High

12. Auditory

Low High

13. Visual

Low High

14. Tactile

Low High

15. Low — Kinesthetic — High

16. Low — Requires Intake — High

17. Evening — Morning

18. Low — Late Morning — High

19. Low — Afternoon — High

20. Low — Needs Mobility — High

21. Parent Figure Motivated

Low High

22. Teacher Motivated

Low High

APPENDIX P

OBSERVING LEARNING STYLES SUMMARY SHEET

PHYSICAL:

AUDITORY

Low	High
Wants to be shown	Likes to listen to tapes
Asks to see things	Needs things explained after reading
Dsoesn't remember directions when told	Remembers verbal jokes
Asks things to be repeated	Short time on task with visual tasks
Wants to write or demonstrate learning	Wants to discuss, debate, rather than write
	Listens to radio a lot

VISUAL

Low	High
Avoids reading	Prefers to see material
Prefers listening or doing	Reads, watches films
Misses visual clues	Picks up on visual clues
	Reads body language

TACTILE

Low	High
Doesn't like lab situations	Touches things, builds
Avoids writing	Doodles while listening
Keeps distance from others	Takes things apart

KINESTHETIC

Low	High
Sits for long periods	Always moving

REQUIRES INTAKE

Low	High
Works with eating, chewing	Chews gum, nails
	Put things in mouth

EVENING	MORNING

LATE MORNING

AFTERNOON

NEEDS MOBILITY

Low	High
Comatose	Wiggles leg
Remains at task for long times	Moves about/drops books
Walks slowly	Throws paper airplanes, drops books
_____	_____
_____	_____
_____	_____

OBSERVING LEARNING STYLES

ENVIRONMENTAL:

NOISE LEVEL

Low	High
Plugs or cover ears	Sing/talk to self/others
Moves away from group	Requests radio/sound
"Sh"/Remind others to be quiet	
Distracted by people talking	

LIGHT

Low	High
Pulls shades	Raises shades
Turns off lights	Asks for more light
Covers eyes	Sits near window
Lowers head close to desk	Limited energy in low light
Forgets to turn on lights	
Complains about light	

TEMPERATURE

Low	High
Minimal clothing, no socks	Sits on heater
Opens windows	Wears coat in class
Complains of heat	Complains of cold
Drowsy when warm	

DESIGN

Low	High
Has sloppy posture	Sits up at table/desk
Puts feet on desk	Chooses to sit in desks
Tips chair	
Lays on floor	

EMOTIONAL:

MOTIVATION

Low	High
Does not complete work	Desires to know grades
Is frequently tardy	Punctual
Has poor attendance	Finishes work on time
Complains about learning	Asks about upcoming tasks

PERSISTENT

Low	High
Works intermittently	Works for long periods
Takes time getting done	Completes tasks quickly

RESPONSIBLE

Low	High
Changes tasks to suit self	Completes tasks as asked
Does not complete assignments	Volunteers to do things
Does not organize	Takes initiative on tasks

STRUCTURE

Low	High
Begins without directions	Needs specific directions
Needs only goal/due date	Needs time limits
Develops own guidelines	Needs checkpoints
	Needs sequence

SOCIOLOGICAL:

LEARNING ALONE	PEER ORIENTED
Doesn't function in group	Moves by friends
Sits by himself	Shares information easily
Moves away when reading or studying for test	Choose group projects over individual ones
Doesn't like lab situations	Likes lab classes

AUTHORITY FIGURES PRESENT

Low	High
Works without teacher	Likes teacher approval
	Asks if things are right
	Sits near teacher

PARENT FIGURE MOTIVATED

Low	High
Does opposite of parent wants	Returns signed papers
Negative response about parents	Asks about grades
Hides from parents	Seeks parent approval

TEACHER MOTIVATED

Low	High

LEARNS IN SEVERAL WAYS

APPENDIX Q

LETTER INRODUCING FINAL ACTIVITY

January 21, 1986

Dear teachers,

It is now time to complete the last activity in this research project-the posttest. It has been two months since you rated the students on what you felt were elements of their learning styles. During this time you may have learned more about the students or changed your mind on some of the terms. Therefore, I am asking you to please rate the students again using ANY numbers between 0 and 80. (Please do not use only Xs.) To assist you with student names, I have written on the top of the preference summaries the names of students that were included in the pretest. As soon as you have completed the posttest, please turn in the envelope to your principal.

Thank you for your time and effort in participating in this project. At the completion of the project, I will share with you the information that I have gathered during the research process as well as provide you information from the student tests.

Sincerely,

Shirley A. Beaty