DOCUMENT RESUME

ED 132 783 EC 092 351

AUTHOR Griffin, Thomas E.
TITLE A Comparison of the Cognitive Styles of Deaf Students with the Cognitive Styles of Hearing Students.
PUB DATE 76
NOTE 81p.; A major applied research project presented in partial fulfillment of the requirements for the degree of Doctor of Education ; Nova University

EDRS PRICE MF-$0.83 HC-$4.67 Plus Postage.
DESCRIPTORS Aurally Handicapped; Cognitive Processes; *Cognitive Style; Community Colleges; *Deaf; Exceptional Child Research; Higher Education; *Individual Characteristics; Learning Modalities

ABSTRACT

A study involving 25 deaf students mainstreamed in a community college was conducted to investigate differences in cognitive styles between deaf and hearing students. Both normal hearing and deaf students responded to a cognitive style inventory which consisted of 216 descriptive statements with which each student assessed himself in terms of "usually", "sometimes", or "rarely". Cognitive style was studied in terms of three sets of influences: (1) symbols and their meanings, (2) cultural determinants of the meanings of symbols, and (3) modalities of inference. Among findings were that deaf students tend to receive theoretical information more readily if presented and/or interpreted in an auditory quantitative format; that culturally, deaf students are more associate oriented than hearing students, while hearing students are more individual oriented than deaf students; and that hearing students tend to be appraisers in making inferences while deaf students infer more from relationships. Findings pointed out some major differences in cognitive styles that could greatly affect the teaching and learning processes. (Author/SBH)

A Comparison of the Cognitive Styles of Deaf Students with the Cognitive Styles of Hearing Students

THOMAS E. GRIFFIN

A MAJOR APPLIED RESEARCH PROJECT
PRESENTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF DOCTOR OF EDUCATION

NOVA UNIVERSITY

1976

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ACKNOWLEDGEMENTS

My greatest debt is to Joseph E. Hill and his staff at Oakland Community College for developing the conceptual framework of Educational Sciences. I hope I have described his teachings accurately.

I am deeply indebted to my children: Catherine, Thomas Jr. and Todd for their patience and understanding. I am especially thankful to my wife, Peggy, for her support and understanding. I was difficult sometimes.

I am extremely grateful to Gus Boukouvlalas and the entire Special Services Staff of Central Piedmont Community College. Ed Holder, Sharon Jennings, Fredia Ross - all the interpreters were especially helpful.

Special thanks to my advisor, George M. Barton, for his time, his comments and his suggestions. They all made innumerable improvements in this paper.

Thanks to Marshall Lipscomb for her typing.

Perhaps an even greater debt is due all the deaf students who participated in this study. As a result of their cooperation, things will be better. Along with these exceptional people, I am truly grateful to a talented interpreter, Veronica Rodriguez, who has enough empathy, encouragement and belief that deaf students can learn extremely well when they are understood. It was through her insights and teachings that the ideas of this study materialized. Thank you for teaching so many the truth of "I HEAR YOUR HANDS."

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Abstract of a Major Applied Research Project Presented to Nova University in Partial Fulfillment of the Requirements for the Degree of Doctor of Education

A COMPARISON OF THE COGNITIVE STYLES OF DEAF STUDENTS WITH THE COGNITIVE STYLES OF HEARING STUDENTS

By

Thomas E. Griffin

May, 1975

Central Piedmont Community College enrolled large numbers of deaf students during the year 1975. The number of deaf students enrolled in the college has continued to increase quarterly. These deaf students have been included in the mainstream of the college. That is, they attend the same classes as other students with the only difference being that the deaf students have interpreters who interpret the lecture material into sign language. Since the major orientation of Central Piedmont Community College has been toward the non-handicapped student, the primary purpose of this study was to see if the students with the handicap of deafness have different cognitive styles from hearing students.

The instrument used to investigate the differences in cognitive style was a Cognitive Style Interest Inventory developed at Oakland Community College (1973). Cognitive style in the framework of the study relates to three sets of influences: (1) symbols and their meanings (2) cultural determinants of the meanings of symbols (3) modalities of inference, and these combine to form cognitive style.

A comparison was made between a group of twenty-five deaf students enrolled at Central Piedmont Community College in the fall quarter of 1975 and a group of hearing students enrolled during the same quarter. The groups were similar except for the handicap of deafness of one group. Students of both groups responded to a cognitive style interest inventory which consisted of 216 descriptive statements to which each student assessed himself in terms of Usually, Sometimes, or Rarely.

Hypotheses were formulated and tested by a discriminant function analysis with .05 as the acceptable probability level. The hypotheses of the study were expressed in relation to the framework of cognitive style.

In relation to the sets, symbols and their meanings, the results of the study indicated significant differences between the symbolic orientations of deaf students and the symbolic orientations of hearing students. In the set nineteen separate variables were studied. There were significant differences between the two groups on the variables of auditory quantitative, qualitative auditory, tactile, visual, proprioceptive, empathy, esthetic, proxemic, and synnoetic.

In the set, cultural determinants of the meanings of symbols, three variables were studied. Of these three variables, there were significant differences in the variables of individual and associate influences between the deaf and hearing students.

In the third set of variables, modalities of inference, five

variables were considered. Of the five considered, there was a significant difference shown on the variable of appraisal.

In the overall construct of cognitive style which combines the three sets of variables mentioned above, the results of the study indicate significant differences between the cognitive styles of deaf students and the cognitive styles of hearing students. Considering all twenty-seven variables of the study, the overall F ratio was 6.221 and the overall probability was .0001. These differences exist in all three sets of variables of the cognitive style format.

In the set, symbols and their meanings, the results of the study indicate that presentations should vary from deaf students to hearing students. That is, hearing students seem to be aware of certain symbolic meanings while deaf students are aware of other meanings. In terms of the cultural determinants, information should be presented culturally to the deaf students both from an associate point of view and also from a family point of view. The hearing students prefer the same information in an individual frame of reference. In inferential patterns, hearing students tend to be more appraisers while deaf students tend to infer more from relationships.

Cognitive styles of deaf students in contrast to cognitive styles of hearing students suggest many modifications to individualized learning programs. These modifications must take into account the many differences that may exist among the majority groups as well as the differences that may exist among the minority groups.

CHAPTER 1

INTRODUCTION TO THE PROBLEM

In its fifteen year history Central Piedmont Community College (CPCC) has grown from a very small beginning as a technical school to a large and comprehensive community college. In the fall quarter of 1975 more than 23,000 students were enrolled in more than forty different curricula and hundreds of special programs and interest courses. Not until the year 1976 was a thought given to restricting enrollment to anyone from the community who was eighteen or older and who expressed a desire to enroll in the college. Because of budget restrictions for the year, a significant number of courses were limited during the spring quarter of 1976.

These years of rapid growth for CPCC, which are similar in many ways to many other community colleges in the country, emphasize that an "open door philosophy" is apparently not an impractical one if a community is truly interested in updating its citizens' skills and teaching them new ones. The "open door philosophy" has been so successful in attracting students to CPCC that some new problems have been created. With few restrictions on who may enter the college, many new kinds of students have begun to enter community colleges and especially CPCC. Patricia Cross (1974) identifies many of these new kinds of students, and she labels them "New Students." Many of these students are older; many are from minority groups; many are low

achieving students and many are handicapped. It may be that many of these students have always been around, but certainly they have not been in attendance in such large numbers.

At Central Piedmont Community College in Charlotte, North Carolina, these "New Students" are enrolled in increasing numbers. With CPCC openly addressing its instruction to the individual needs of its students:

> ..."This committment carries with it a resolve that the college must have as a major objective the provision of ample opportunities for students to learn at varying rates. It also implies a belief in the concept of individualized control of the rate of learning."
> (1975 Central Piedmont Community College Catalog, p.8)

Each group of "New Students" in relation to the concept of individualizing instruction presents the college with a unique set of problems that have not been seriously considered before.

The allusion to "New Students" suggests that there must be new or different aspects to these students' needs in relation to normal or traditional students. Low achieving students, one group of "New Students," may have difficulty achieving the same amount of information at the same rate as the traditional students might. Any minority group may not be able to understand nor profit from instruction at the same rate nor under the same conditions as traditional students might. Each of these new groups of students that have been introduced to the community college present a unique set of problems to any community college that attempts to individualize the learning process for its students. It is these kinds of students that are

presenting new challenges to the instructional systems at CPCC.

STATEMENT OF THE PROBLEM

Do deaf students have different cognitive styles from hearing students? Can instruction developed primarily for the hearing majority be also successful for the deaf minority? One group of "New Students" to the Central Piedmont Community College is the deaf students, and whether or not the instruction that is individualized for the hearing students is suitable for the deaf students is currently untested.

The broad issue that underlies Central Piedmont Community College's attempts to individualize instruction is whether the programs developed or the education provided to individuals with handicaps are successful. In a period when there is obvious emphasis for the college to be accountable both to the student and to the public with regard to its educational systems, the system used must be defensible. The system must be defensible both educationally and economically The system must also be responsive to the individual needs of the minority groups involved. Previous methods of designing instructional programs assumed that most students had similar capabilities.

During the past five years in community colleges throughout the country, there has been considerable activity to individualize and personalize instruction. This activity has created some more effective teaching methods than previous traditional systems allowed and has made many courses far more adaptable and flexible than in the past.

As the consideration of the concept of individualizing instruction has moved beyond the level of self-pacing, many new variables that relate to the individual and his style of learning are now being considered. Considerations for the design, the diagnosis, the plan of study are being revised more in terms of needs of individuals within a specific environment.

One system that attempts to measure many of the variables that a student may bring to a learning environment is the system of Educational Sciences. In the late 1960's a conceptual framework for education emerged out of Oakland Community College in Michigan which came to be identified as Educational Sciences. This system identifies seven different sciences in the process of education. These sciences by name are: symbols and their meanings, cultural determinants, modalities of inference, memory, cognitive style, teaching, counseling, administrative style and systemic analysis.

Cognitive style, which includes symbols and their meanings, cultural determinants, modalities of inference and memory may be defined as the particular way an individual may receive, process and make inferences about information presented to him or to her. This conceptual framework for education suggests that no two individuals will receive and interpret information in identical ways.

Many exploratory studies in the educational sciences confirm that there are highly individualistic sets of relationships that relate to any individual in any given learning situation. For example, Hill and Nunney (1973) state that any particular element of education

can be analyzed in terms of the educational sciences or by a combination of two or more of them. A student with "more" elements, usually majors, tends to get higher grades, Blosser (1971), Hoosgasion (1970) and Berry (1973).

Griffin (1974) in a study relating to different learning styles showed that there may be as many as thirty-three distinct preferred styles of learning in a class of thirty-three. In a group of thirty-three there were identified six different major theoretical symbolic orientations, twelve different major qualitative orientation patterns, ten different cultural patterns and nineteen different inferential patterns.

Other studies relating to specific disciplines indicate that when specific subject matter is under consideration, very specific influences may affect the individual. These influences may be various symbolic orientations, cultural patterns or inferential patterns. Only a few of these studies relate to developmental students. Griffin (1974, 1975) compared developmental studies students' cognitive styles with non-developmental students. Based on this study there were several significant differences between the two groups. Developmental students were more auditory linguistically oriented where non-developmental students were more visual linguistically oriented. Developmental students were culturally more family oriented where non-developmental students were more individually oriented. Developmental students tend to make inferences based more on relationships while non-developmental students tend to be more

deductive in making inferences.

Another study that approached a different minority group was completed at CPCC in 1975. Griffin (1975) compared the cultural determinant patterns of deaf students with the cultural patterns of hearing students. The results of the study strongly indicated that deaf students tend to relate to two sets of characteristics: family and individual or individual and associate or family and associate. Whereas, the hearing students were strongly oriented to individual characteristics. Deaf students tend to have dual cultural patterns while hearing students tend to have single cultural patterns. In both of these studies, the science of cognitive style as a part of the Educational Sciences was used to compare the groups.

During the academic year 1975, CPCC enrolled 150 handicapped students. Of these, fifty were deaf. These deaf students were expected to participate and learn from the same teaching presentations as hearing students. The only adjustment to the learning environment is the addition of interpreters for the deaf students. The interpreters go to class with the deaf students and interpret using sign language, the information as it is presented. Thus, in many situations the deaf students must rely on the accuracy, speed, and correctness of the interpreters rather than the instructors. Even in a very traditional learning environment the deaf students have had to make adjustments that hearing students have not had to make. In most environments the instructional process has been geared to the majority population, and little attention has been given to the

individual characteristics of specific individuals within the group. Since CPCC has committed itself to personalizing and individualizing learning, it became necessary to gather information about the learning styles of deaf students. The information had to range beyond the facts that deaf students could not use the auditory sense, and they needed interpreters to relay information to them.

It is obvious at once that deaf students have had to learn in different ways from hearing students. The inability to hear and in many cases the inability to speak in ordinary language causes deaf students to develop unique learning styles.

Ross Stuckless (1971), Director for Research and Training of the National Institute for the Deaf, emphasized that individual differences among deaf students are as great, indeed greater, than among hearing students. A study by the National Institute for the Deaf (1971) has as its purpose for instructors to identify possible educationally significant traits of post secondary deaf students. The conclusions were that each deaf student brings to a learning task a set of traits some of which contribute to, and some of which detract from accomplishing a particular learning task.

Cross (1974) stated that evidence is high to indicate that "New Students" to higher education will be primarily students whose performance at academic tasks in the past has been below average. These "New Students" will be students for whom present forms of education are inappropriate. Cross further states that "New Students" which at CPCC includes deaf students will be the losers if we concentrate on

access programs that merely assure entrance of "New Students" into traditional programs of education. Central Piedmont Community College must, to validate its committment to personalize educational programs, develop new educational systems to fit deaf students rather than handing down the old education of hearing students.

Most of the literature on individualizing instruction and most of the statements about new students to the community college recognize that there is a whole new set of considerations relating to individual learning styles. Even so, few researchers or even practitioners are prepared to make conclusive statements about how individuals do learn best--especially the handicapped students.

DEFINITION OF TERMS

For the purpose of this study the following definitions will be used. These definitions are used in Volume I of The Educational Scientist (1975).

Educational Sciences. A conceptual framework for the applied field of knowledge called education. At the present time there are seven Educational Sciences:

1. Symbols and their meanings
2. Cultural determinants of the meanings of symbols
3. Modalities of inference
4. Educational memory
5. Educational cognitive styles of individuals

6. Counseling styles, administrator styles, teaching styles and student styles

7. Systemic analysis decision-making.

Symbols and their Meanings. Two types of symbols, theoretical (e.g. words and numbers) and qualitative (e.g. sensory, programmatic, and codes), are created and used by individuals to acquire knowledge and derive meaning from their environment and personal experiences.

T(VL)-Theoretical Visual Linguistic - ability to acquire meaning from words you see. A major in this area indicates someone who reads with a better than average degree of comprehension.

T(AL)-Theoretical Auditory Linguistic -- ability to acquire meaning through hearing spoken words.

T(AQ)-Theoretical Auditory Quantitative -- ability to acquire meaning in terms of numerical symbols, relationships, and measurements that are spoken.

T(VQ)-Theoretical Visual Quantitative - ability to acquire meaning in terms of written numerical symbols, relationships and measurements.

Q(A)-Qualitative Auditory - ability to perceive meaning through the sense of hearing.

Q(O)-Qualitative Olfactory - ability to perceive meaning through the sense of smell.

Q(S)-Qualitative Savory - ability to perceive meaning by the sense of taste.

Q(T)-Qualitative Tactile - ability to perceive meaning by the sense of touch, temperature, and pain.

Q(V)-Qualitative Visual - ability to perceive meaning through sight.

Q(P)-Qualitative Proprioceptive - ability to synthesize a number of symbolic mediations into a performance demanding monitoring of a complex task involving small, or fine, musculature (e.g. playing a musical instrument).

Q(CEM)-Qualitative Code Empathetic - sensitivity to the feelings of others; ability to put yourself in another person's place and see things from his point of view.

Q(CES)-Qualitative Code Esthetic - ability to enjoy the beauty of an object or an idea. Beauty in surroundings or a well-turned phrase are appreciated by a person possessing a major strength in this area.

Q(CET)-Qualitative Code Ethic - commitment to a set of values, a group of principles, obligations and/or duties. This commitment need not imply morality.

Q(CH)-Qualitative Code Histrionic - ability to exhibit a deliberate behavior, or play a role to produce some particular effect on other persons.

Q(CK)-Qualitative Code Kinesics - ability to understand, and to communicate by nonlinguistic functions such as facial expressions and motions of the body.

Q(CKH)-Qualitative Code Kinesthetic - ability to perform motor skills, or effect muscular coordinations according to a recommended or acceptable form.

Q(CP)-Qualitative Code Proxemics - ability to judge the physical and social distance that the other person would permit, between oneself and that other person.

Q(CS)-Qualitative Code Synnoetics - personal knowledge of oneself.

Q(CT)-Qualitative Code Transactional - ability to maintain a positive communicative interaction which significantly influences the goals of the persons involved in that interaction.

Cultural Determinants - There are three cultural determinants of the meaning of symbols: 1) Individuality 2) Associates 3) Family. It is through these "determinants" that cultural influences are brought to bear by the individual on the meanings of symbols.

I-Individuality - uses one's own interpretation as an influence on meanings of symbols.

A-Associates - symbolic meanings influenced by one's peer group.

F-Family - influence of members of the family, or a few close personal friends, on the meanings of symbols.

Modalities of Inference - There are five possible inferential patterns that make up an individual's modality of inference, i.e., the form of inference he tends to use.

M-Magnitude - a form of "categorical reasoning" that utilizes norms or categorical classifications as the basis for accepting or rejecting an advanced hypothesis. Persons who need to define things in order to understand them reflect this modality.

D-Difference - suggests a tendency to reason in terms of one-to-one contrasts or comparisons of selected characteristics or measurements. Artists often possess this modality as do creative writers and musicians.

R-Relationship - indicates the ability to synthesize a number of dimensions or incidents into a unified meaning, or through analysis of a situation to discover its component parts.

L-Appraisal - is the modality of inference employed by an individual who uses all three of the modalities noted above (M, D, R) giving equal weight to each in his reasoning process. Individuals who employ this modality tend to analyze, question, or, in effect, appraise that which is under consideration in the process of drawing a probability conclusion.

K-Deductive - indicates deductive reasoning, or the form of logical proof used in geometry or that employed in syllogistic reasoning.

Cognitive Style - the fifth science of the seven educational sciences which is defined as the Cartesian product of three sets of information: symbols and their meanings, cultural determinants of

the meanings of symbols and modalities of inference.

Major - refers to the upper percentile (50-99) range of the various cognitive style elements.

Minor - refers to the 26-49 percentile range of the various cognitive style elements.

Negligible - refers to the 0-25 percentile range of the various cognitive style elements.

PURPOSE OF THE STUDY

The purpose of this study was to compare the cognitive styles of a group of twenty-five deaf students with the cognitive styles of a group of twenty-five hearing students. The determination of cognitive style was limited to the definition of cognitive style developed in the framework of educational science. A Cognitive Style Interest Inventory (1973 Oakland Community College) was administered to persons within each group. This inventory measured students' responses to twenty-seven separate variables that relate to: theoretical symbols and their meanings, qualitative symbols and their meanings which include both cultural codes and sensory codes; patterns of cultural determination; patterns of making inferences.

The study was designed specifically to answer the following questions:

1. Are there significant differences between the symbols that deaf students are oriented to when compared with hearing students?

2. Are there significant differences between the cultural determinant patterns of deaf and hearing students?
3. Are there significant differences between the modality of inference patterns of deaf students and hearing students?

GENERAL RESEARCH DESIGN

The cognitive styles of deaf students were compared with the cognitive styles of hearing students. Determination of each individual's cognitive style was based on cognitive style as defined in the Educational Sciences conceptual framework for education. The inventory measured twenty-seven separate variables including orientation to symbols and their meanings, cultural determinants and modalities of inference. Based on these data, cognitive styles of twenty-five deaf students were compared with cognitive styles of twenty-five hearing students. The population of this study was composed of students who entered Central Piedmont in the fall of 1975. Both groups of students were taking a developmental course in reading, or English, or mathematics at the time of their responses to the cognitive mapping inventory.

The data for this study was derived from students' responses to a cognitive mapping interest inventory. The inventory required the students to respond: (A) usually (B) sometimes (C) rarely to a series of items (Appendix A) related to which symbols were more significant, which cultural elements were considered and which

patterns of inference were used in that individual's style. A comparison between the two groups was made after the students' responses to the inventory to determine any significant differences between deaf students and hearing students in their cognitive styles. Each of the twenty-seven variables in the cognitive style inventory were compared. Deaf students' responses to each variable were compared with hearing students' responses to the same variable. The significance of differences between deaf and hearing students was determined by discriminate function analysis using a .05 level of significance.

In order to determine which elements in the cognitive styles of deaf students were more significant when compared with hearing students, each of the twenty-seven elements of the cognitive style construct were compared through the discriminate function analysis using a .05 level of significance.

LIMITATIONS OF THE STUDY

During the summer quarter of 1974, six deaf students were enrolled on the Central Piedmont Community College campus. The following quarter twelve deaf students were enrolled, and the rate of increase has continued so that five quarters later, winter quarter 1976, thirty-four deaf students were enrolled.

This study was restricted to those deaf students who were enrolled at Central Piedmont Community College in the winter quarter

of 1976. The hearing students were also enrolled during the winter quarter.

A further limitation of the study was that the cognitive styles of the individuals were measured only according to the cognitive mapping interest inventory (Appendix A). This inventory measured cognitive style as the student perceived himself/herself to be at the time of the response to the inventory. Theoretical symbolic orientations, qualitative orientations, cultural determinants and modalities of inference comprise cognitive style as presented in this study. This study, however, did not deal with standard test scores or performance in any specific academic discipline.

SIGNIFICANCE OF THE STUDY

The longitudinal aspect of this study dealt with the differences in learning styles of individual students, both deaf and hearing. Many innovations have occurred in the community college movement within the last decade. Moveover, various types of individualized exceptional instructional programs have been developed, Johnson (1969). Most of these innovations make allowances for self-pacing, and some make allowances for different modes of presentation; audio/tape, tape/slide/video tape, pencil and paper package. But most such programs do not thoroughly investigate nor consider the individual characteristics of the individual learners. Such consideration seems especially important when one is dealing with handicapped students. For it is usually obvious that the handicapped cannot always learn

through the normal modalities. The deaf, for example, must have interpreters so that they may understand the presentations. This study was based on the assumption that a handicap such as loss of hearing will also affect qualitative judgements as well as cultural patterns and inferential patterns of the individuals.

In addition to the broad issue dealing with differences in learning styles, a second major aspect of this study dealt with cognitive style characteristics of deaf students. The study was designed to show that deaf students may have sets of characteristics affecting their learning. While hearing students will also have different orientations affecting their learning, this study showed that they are not always the same.

With continued emphasis on individual learning styles and the need to be accountable to all students, not just the well prepared and the majority groups but to all students, any research dealing with how students learn seems important. Another significant aspect of the study was that characteristics of cognitive styles of hearing students could also be determined. One of the questions answered in the study was which characteristics in the cognitive styles of hearing students are most significant.

In addition to these issues which are national and international in scope, the study was also designed with the deaf students of Central Piedmont Community College in mind. In a relatively short time, CPCC has included in its student population a large group of

deaf students. Presently these students are included in regular classes with the majority of the class being hearing students. The study attempted to answer the question: If the instruction is geared to the majority, the hearing students, even with an interpreter, are the deaf students profiting from the instruction to the same degree as the hearing students? Since CPCC is new to the concept of educating the deaf, research with learning styles of these students needs to be conducted.

In summary this study has provided contributions to the literature on the cognitive styles of deaf students as well as the cognitive styles of hearing students. The study has provided for CPCC and the special services staff some new insights into new and perhaps better ways to serve deaf students. There were also significant characteristics in the learning styles of both groups that should influence the instructional design at CPCC. This study was designed primarily to compare the cognitive styles of deaf students with the cognitive styles of hearing students. A secondary purpose was to determine which elements in cognitive style inventories are most significant when comparing two different groups of students.

CHAPTER 2

REVIEW OF RELATED LITERATURE

Organizationally the review of literature is divided into three parts. The first part concerns the background and development of the conceptual framework for Educational Sciences. The second part concerns the applications of the concept of Educational Sciences, and the third part concerns the education of the deaf.

HISTORICAL DEVELOPMENT OF THE EDUCATIONAL SCIENCES

Joseph E. Hill working with staff members at Wayne State University and Oakland Community College in Michigan, developed the Educational Sciences as a common structure for the applied field of knowledge called education.

Educational Sciences is a conceptual framework for educators. The framework is based on the following assumptions:

1. Education is the process of searching for meaning
2. Thought is different from language
3. Man is a social creature with a unique capacity for deriving meaning from his environment and personal experiences through the creation and use of symbols
4. Not content with biological satisfactions alone, man continually seeks meaning. (Hill, 1972)

In an effort to break the lock-step of tradition, Dr. Joseph E. Hill, President of Oakland Community College and Dr. Derek Nunney, (1971) Vice-president working with staff members at Oakland Community

College, created the Educational Sciences as a common structure within which inquiry of significance for the fundamental aspects of the applied field of education can be conducted. The Educational Sciences provide a conceptual framework and scientific language for the applied field of education that approach the level of precision found in such derivative fields as pharmacy, engineering and law.

For the individual student the system perceives his world. The purpose is to help tailor the student's education to reflect the way he or she learns and therby offer him or her the greatest likelihood of success in learning.

The approach is called cognitive style mapping. At Oakland Community College, test results go into a computer to produce a tabular "map" that describes how each student thinks and learns—his or her cognitive style.

The measured traits can produce 2,304 combinations that show how each student handles qualitative and theoretical symbols, how cultural influence affects the way the student gives meaning to symbols, and how the student derives meaning from the symbols he or she perceives. In practice, the "maps" have produced up to nineteen ways of teaching the same course material, each one aimed at a particular kind of learning style.

From a beginning at Oakland Community College in 1969, developments have occurred in many different areas. At Corning Community College in Corning, New York, counselors have been utilizing cognitive style for staff and faculty development. Kent State is doing research

with cognitive style in the military in an attempt to assist in military personnel career assessment. At Cannadore College, Ontario, Canada, studies are being conducted to apply the Educational Sciences as a conceptual framework to personalize Adult Basic Education.

Other studies have investigated selected cognitive style elements as predictors of achievement from a didactic film. A recent book, Media Prescription and Utilization as Determined by Educational Cognitive Style, DeNike and Strother (1976), specifies ways that media can be selected for individual students and their styles.

A student's style will vary for different content areas and for different teachers. The way to overcome the negative attitudes which underlie various alienated students is to increase the degree of involvement in education on order to reduce the resentment. At the present time, there are seven Educational Sciences:

1. Symbols and their meanings
2. Cultural determinants
3. Modalities of inference
4. Memory - concern
5. Cognitive style
6. Teaching, administrative, and counseling styles
7. Systemic analysis decision making.

In this study only sciences one, two, three, and five are considered.

The basic assumption of the first science, symbols and their meanings, is that man uses two kinds of symbols: the theoretical and qualitative. This distinction is derived primarily from the

work of Champlin (1952) and Villemain (1952, 1959). These writers used ideas from C. Pierce (1932) and J. Dewey (1929, 1060). Further support for the distinction can be found in the writings of Korzyleski (1949, 1950), who emphasized the symbol influences the functioning of the nervous system and Rapaport (1962) who argued that man can mediate more than one type of symbol. Dissertations by Moorshead (1963) and Saunders (1963), under the direction of N. Champlin, emphasized the necessity of symbolic precision in teaching, research, and suggested methods for obtaining precision.

The second science, cultural determinants, was initially entitled "Perception, cultural effect on the meaning of the symbol." In education the development and change of the meaning of symbols whether theoretical or qualitative are influenced by the culturally created roles of expression and communication.

The work of Earl Kelly (1947, 1962) is the basis for the second science. Sherif (1936) was the first to demonstrate experimentally that group "norms" and "roles" can influence judgements. Parsons (1951) developed the concept of "individuality." The role-set theory of Merton's (1957, 1968) was also important. Work by Homans (1950) and Newcomb, et al (1965), clarified the definition and the influence of "norms" and "roles" on behavior. Related early work in this area may be found in Tolmar (1962).

The third science deals with the person's modality of inference, i.e., the form of inference he tends to use. Concepts from statistical

inference and logic supplemented by the works of Piaget (1952), Wertheimer (1959), Bruner (1966), and Guilford (1967) served as the foundation of this science. Rankin (1964) in a dissertation made a contribution by delineating modes of inference in terms of models, isomorphisms, and hypotheses.

The fifth science is that of cognitive style. Allport (1937, 1961), suggested the concept of "style" which he defined as the consistency and pattern of expressive behaviors. During the past twenty-five years the concept of cognitive style has been studied in the context of personality and social variables. This approach is found in the work of Broverman (1960), Gardner (1953), Kagan, Moss, and Sigel (1963), and Wirtkin (1948, 1950, 1954).

The construct of cognitive style, which was developed as one of the Educational Sciences, is different from those defined in the field of psychology. Employing a modified form of Guttman's (1954, 1955, 1959) metatheory of facets as a model, the concept of cognitive style is defined as the Cartesian product of the following four sets: (1) symbols and their meanings, (2) cultural determinants, (3) modalities of inference, (4) memory - concern. In this context, cognitive style is somewhat related to Guilford's "dimensions of intellect" (1967).

The concept of the field of education as a possible set of "disciplines" of "sciences" is found directly in the work of Conant (1960) and indirectly in Dewey (1929). Flannagan's (1939) early

paper had implications for measurement while McClelland's (1966) article had implications for the application of the educational sciences. Bloom's (1968) work served as the basis for personalized education program concept, i.e., application of certain "sciences" in mass education.

RECENT STUDIES AND MONOGRAPHS DEALING WITH EDUCATIONAL SCIENCES

Collective cognitive styles have been found to exist for groups such as administrators Zuessman (1968), "successful" teachers Dehnke (1966) and Blanzy (1970) with positive and negative attitudes. Another set of studies has shown that similarity or nonsimilarity of cognitive style is related to evaluations. DeLoach (1969) found that teachers with cognitive style which was similar in a high degree to that of administrators were evaluated more favorably than those teachers whose cognitive style were low in similarity to that of the administrator. Both Blanzy (1970) and Schroeder (1969) found that a similarity between a student's cognitive style and a teacher's cognitive style resulted in a more favorable rating of the teacher by the student than with students whose cognitive styles are different from the teacher's style. Further studies by Wasser (1969), Schroeder (1969), and Fragale (1969) devised that those students who had cognitive styles similar to their teacher's cognitive style achieved higher grades than students whose cognitive styles differed from their teachers. This trend seems to hold at the elementary as well as the college level.

At times research has shown that cognitive style may be related to academic performance. Hoogasian (1970) and Beny (1973) identified "collective" cognitive styles for letter grades. A student with "more" elements, usually majors, tends to get higher grades.

Cotter (1970) and Ort (1971) found that one must use information of three sets and not one to predict curriculum choices and grades. Blooser (1971) found that academic achievement motivation is reflected in terms of cognitive style.

Cognitive style and academic performance has been studied in various curriculum areas such as mathematics (Blanzy, 1970; Shuert, 1970; and Spitler, 1970), nursing (Lange, 1972); life science (Warner, 1970), and English (Hoogasian, 1970). Urban and suburban student groups in terms of their cognitive styles have been studied by Jalkanen (1970) and Waters (1970). Robinson (1969) studied high risk students at a university. Baecher (1973) studied the cognitive styles of Mexican Americans and Puerto Rican American students in fourth and fifth grades. Zapinski (1973) found differences in the collective cognitive styles of students who receive various forms of financial aid.

EDUCATION OF THE DEAF

Until recently nearly all deaf students who went to school at any level went to special schools. The implementation of the philosophy of mainstreaming (educating the deaf along with other members of society)

is a current wave in American education. Brill (1975) indicates that there are many problems with "mainstreaming" deaf students, for not enough information research has been done regarding the complex patterns of teaching the deaf and their doubly complex learning patterns.

Robinson and Dawson (1975) in a study of EEG and REM Sleep Studies in Deaf People found that deaf people, just like normal hearing people, in general have an extended period of continuous sleep (five to eight hours) during each twenty-four hour period. When compared with hearing students, deaf children were found to be socially disadvantaged due to direct as well as indirect consequences of deafness. Freeman, Malkin, Hastings (1975) found significant differences in early hospitalization, frequency of home moves, certain areas of behavior, activities permitted by parents, amount of play, and parental expectations. Peterson (1973) in "Insight Into My Deaf World" indicates that for the deaf adult there are limited job training facilities and limited job opportunities. In addition the deaf person misses out on radio, movies, television, plays and encounters many embarrassing situations.

Hardy (1967) found that deaf children almost invariably have other problems and that remediation, both medical and educational must be directed towards the needs of the "whole" child, not just to his communication problem. Levine (1960) confirms that language is the key to mental development. Brill (1974) points out that the

majority of deaf students are still educated in public residential schools for the deaf. For the most part the professional field of education of deaf students has been split by controversy for the past century, and perhaps in no other area of education have the cleavages been as deep, lasted as long, and reached such an emotional level. Schein (1968) in a description of the deaf community concludes "To expect the average deaf child to achieve as much as the average hearing child is as fantastic as to expect a man to walk on the moon." Silverman (1970) states that advancing technology is changing the world of work. Of 22,000 jobs listed in the Dictionary of Occupational Titles, over 6,000 were new since 1959 and over 8,000 that had existed then are extinct. This means that flexibility and the capacity to be retrained are primary requirements for vocational survival; deaf people often have great difficulty in conventional retraining programs and may, therefore, be relatively inflexible vocationally.

SUMMARY

A description of any educational activity always occurs in the light of the author's biases. Development provides many possibilities for interpretation for it encompasses the entire range of educational endeavor. The field has not suffered from lack of interest, for the writings noted here represent only a portion of the work that might be included. Investigations indicate that many studies related to uses of educational sciences are currently in progress. From the

current state of the art, one might surmise that minimally such procedures would require specification, field testing and revision as the foundation for development work. The possible ways in which each of the aspects of a cognitive map might be translated into practice must be explored.

As educational research moves forward in the use of better instrumentation, precise, subtle relationships are discovered and new discoveries can more easily be converted into practice. Teachers have taken courses in learning as a part of their training for years with at best modest success in identifying the behavioral characteristics of each individual learning task, Holland and Doran (1973). The progress of technical development is all too slow. For in contrast to the electronic competencies the nation possesses, educational research is in a most primitive state.

The core problem in a science of instruction is still the process by which the individual student learns. The concept for educational sciences seems to provide a framework whereby many of the characteristics of individual learners can be discovered.

Much of the research in education does support the fact that there is no one best method of teaching, for there are many variations in student characteristics, Cohen and Trent (1973). The development of many different methods of presenting the same material to students has led to numerous studies designed to determine which method is more effective. Interpretations of the results have often been misleading in terms of educational

development of individual students.

Nunney (1975) showed that whether instruction was presented by lecture, by programmed instruction, by television or by audio-tutorial methods; the top 10-20 percent of the students would achieve an A or B regardless of the presentation. Other research supports the concept that a variety of instructional methods are needed in almost any learning situation. The idea of personalizing instruction through cognitive style mapping as presented by the Educational Sciences seems to have much merit.

Most research dealing with deaf students is restricted to special schools for the deaf. Mainstreaming (placing deaf students into the regular program of a community college) is relatively new; only in the 1970's has the concept been utilized. To date, little research has been done comparing the cognitive styles of deaf students with the cognitive styles of hearing students. However, there is mounting evidence to demonstrate the need to develop more flexible methods of teaching hearing students. Cross (1974) emphasizes that education must not be content to continue to teach "new students" to the community college in the same ways as we have in the past. The community college will have to be much more responsive to the different needs of those entering.

Stuckless (1974) speaking for the Institute for the Deaf states that deaf students bring at least as many variables into the learning situation as do hearing students. Many of them bring even more. Again and again research in education demonstrates

that teaching in many respects follows models that "hold power" for awhile (Nuthall and Snook, 1973) and then new models emerge. This phenomenon suggests that there must be far more variables in a teaching-learning situation than educators have previously suggested. The fact that a person is deaf and enrolls in a community college as a regular student adds a complicating variable that education has given little attention to except by saying to the student "you may enroll." The methods of teaching these students has not sufficiently been researched, nor has the hypothesis of whether or not there are significant variables in the learning styles of deaf students other than their inability to hear that may cause them to learn differently from hearing students.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

The purpose of this study was to compare the cognitive styles of deaf students with the cognitive styles of hearing students. The comparison was based on a cognitive mapping interest inventory. This chapter will (1) describe the design used to measure the cognitive styles (2) describe the selection of the population, (3) specify the procedures used to collect data, and (4) state the research hypotheses that were tested.

DESIGN OF THE STUDY

The basic design of this study was a quasi-experimental research design of the "ex post facto" mode described by Campbell and Stanley (1963). The intent of this model is to equate experimental and control groups after the fact by matching them on characteristics found before the treatment.

The most satisfactory design employs a random assignment of the subjects to the experimental and control groups. This kind of randomization, however, is impossible to practice in many educational institutions. Most administrators resist setting up special programs for conducting research. In this study the problems which threaten internal validity were somewhat alleviated by the nature of the study and the groups involved.

To select the experimental group of the study, all deaf students

on campus were invited to participate. The total population of deaf students at the time of the study was thirty. Of the thirty enrolled, twenty-five chose to participate. These twenty-five deaf students became the sample of the experimental group of the study. The random nature of the twenty-five students of the control group, the hearing students, was maintained by selecting a class of students in a developmental studies English class. Most of the experimental group were involved in developmental studies courses, and the most commonly taken course was developmental studies English. Another factor that reduced the threat to internal validity posed by the selection process was the nature of the treatment. The treatment given to each group was a cognitive mapping interest inventory. The theory supporting the concept of such an inventory suggests that people do learn differently, and, therefore, regardless of the initial selection process of the population, the treatment itself would cause a randomization in the population of the study.

The instrument used was the Cognitive Mapping Interest Inventory by Joseph E. Hill, Oakland Community College in Michigan (1973). Hill related cognitive style of an individual to a combination of relationships between three sets of influences: (1) symbols and their meanings (2) cultural determinants and (3) modalities of inference. Cognitive style is one of the sciences of the framework of the seven Educational Sciences.

A series of cognitive style tests are used to yeild maps of

the students at Oakland Community (O.C.C.). The battery of tests was developed at O.C.C. in 1968 and has been revised and updated several times since its inception. The instrument used in this study was the 1973 revision. For the purpose of this study, validity and reliability coefficients associated with the O.C.C. test battery and inventory were considered to be adequate. The values of these respective coefficients were approximately $r_{xx} = .89$, and $r_{bis} = .80$, where r_{xx} denotes the value of the Kuder-Richardson formula, and r_{bis} is the validity index employed by J. C. Flannagan.

The inventory of this study of 216 descriptive statements which the subject used to portray his own style. The inventory is self administering for individuals or groups. The subject responds to each item with Usually, Sometimes or Rarely. Scoring may be done manually or by computer. Total scores on the inventory are read in terms of majors, minors, and negligibles. Scoring is based on five points for usually, three points for sometimes and one point for rarely. Raw scores for each variable of the inventory were computed for each subject of each group. These individual scores on the twenty-seven variables of the inventory were the bases for comparison in this study.

The Cognitive Style Interest Inventory measures cognitive style in terms of three sets of relationships: symbols and their meanings, cultural determinants of the meaning of symbols and modalities of inference. The set, symbols and their meanings, included both

theoretical symbols and qualitative symbols. Theoretical symbols are symbols that mean something other than what they themselves are. For example, a word is a theoretical symbol. In this study, the theoretical symbols measured were theoretical visual linguistic, theoretical auditory linguistic, theoretical auditory quantitative and theoretical visual quantitative. Each of these symbolic orientations may be measured in terms of their relative strengths.

Qualitative symbols are symbols that represent to the observer whatever they (the symbols) are. For example, if the observer is looking at a cat, then that particular cat would become the qualitative measure of cat. The qualitative symbols measured in this study were the sensory orientations: auditory, olfactory, savory, tactile, visual and proprioceptive. The cultural codes measured were empathetic, esthetic, ethic, histrionic, kinesic, kinesthetic, proxemic, synnoetic and transactional.

The second set of influences measured were cultural determinants of symbols and their meanings. In this set, each subject in the study was measured in terms of individual influences, associate influences, and family influences.

The third set, modalities of inference, measured the subjects' inferential patterns. The patterns measured in this study were relationship, difference, magnitude, appraisal and deductive.

The measurement of the major and minor and negligible influences of the three sets of relationships: symbols and their meanings,

cultural determinants of the meanings of symbols and modalities of inference determines the cognitive styles of the subjects of this study.

DEFINITION OF THE SAMPLES

The samples of the study were a group of twenty-five deaf students and a group of twenty-five hearing students. All of the subjects of the study were enrolled at Central Piedmont Community College in the fall quarter of 1975. All the students involved in the study were enrolled in one or more courses in the developmental studies program of the college.

The twenty-five deaf students included thirteen females and twelve males. The mean age of the deaf group was twenty-two years. The twenty-five hearing students included thirteen males and twelve females. The mean age of the hearing group was twenty-two years and four months.

Both groups of the study came from a wide variety of educational, economic and cultural backgrounds. Each group included five black students and twenty white students. Even though it would be extremly difficult to match two groups of students in a community college setting, the samples of this study were very similar in terms of age, sex, cultural and economic background; and based on English expression, reading ability and mathematical ability, they were at the approximate same level of educational development. The major difference between the groups

was the handicap of deafness of the experimental group.

COLLECTION OF DATA

The comparison of the cognitive styles of deaf students with the cognitive styles of hearing students was based on the measurement of individual cognitive styles. Although it was necessary to collect data on individual students, group mean scores for each of the twenty-seven variables of the inventory were used in the assessments. Grade-point averages, credits earned, terms completed and withdrawals were not considered in this study.

The collection of the data for the study required that each subject of the study respond to a cognitive mapping interest inventory during fall quarter 1975. This inventory consisted of 216 items that were designed to relate to twenty-seven different variables in an individual's cognitive style.

In order to compare deaf students' and hearing students' cognitive styles, each student of the study responded to the Cognitive Style Interest Inventory (See Appendix A). The inventory was untimed, but most students were able to complete the inventory within one hour. The participants of the study were not grouped together to be tested. Rather each individual was to complete the inventory according to individualized schedules.

After all the students had responded to the inventory, raw scores for each of the twenty-seven variables for each subject of the study were recorded. There were eight separate test items for each variable of the test, and these items were not listed

consecutively. According to the scoring procedures of the inventory, it was possible to attain a score of forty for any given variable.

A total score for each of the twenty-seven variables for each participant was determined, and these scores were then combined to produce a mean score for each variable. Scores for each participant on each of the twenty-seven variables were used as data for a Discriminant Analysis Function to produce mean scores, F-Ratios and probability factors for each variable.

HYPOTHESES

The following null hypotheses concerning the subject's cognitive styles were tested.

Hypothesis 1: There are no significant differences between the mean scores of hearing students and the mean scores of deaf students on each of the nineteen variables in the set symbols and their meanings as measured on The Cognitive Style Interest Inventory.

Hypothesis 2: There are no significant differences between the mean scores of deaf students and the mean scores of hearing students on the three variables in the cultural determinant set as measured on The Cognitive Style Interest Inventory.

Hypothesis 3: There are no significant differences between the mean scores of deaf students and the mean scores of hearing students on the five variables in the modality of inference set as measured on The Cognitive Style Interest Inventory.

Hypothesis 4: There are no significant differences between the total number of majors in the cognitive styles of deaf students and the total number of majors in the cognitive styles of hearing students as measured on The Cognitive Style Interest Inventory.

A Discriminate Function Analysis was used to test the hypotheses. The hypotheses of the study were accepted or rejected on the basis of the .05 level of significance.

CHAPTER 4

SUMMARY OF FINDINGS

The overall F for the discriminate Function Analysis was 6.221. This indicates that there is a significant difference between the two groups in cognitive styles.

Univariate F's were calculated for each variable to determine which variables made the greatest contribution to the overall difference. F scores ranged from 40.0959 to .0011.

Each hypothesis of this study reflected a group of variables. In the data presentation, the variables (elements in a cognitive style) that comprised each hypothesis are presented. Each variable is shown in relation to each of the other variables within a given set. The relationships are expressed in terms of mean scores, F scores and probability.

The four sets of variables that are presented are: (1) symbols and their meanings (2) cultural determinants of the meanings of symbols (3) modalities of inference (4) cognitive style.

SYMBOLS AND THEIR MEANINGS

Null hypothesis 1: There are no significant differences between the mean scores of deaf students and the mean scores of hearing students on each of the nineteen variables in the set, symbols and their meanings, as measured on the Cognitive Style Interest Inventory.

Included in the set, symbols and their meanings, are both theoretical

symbols and qualitative symbols. The group of theoretical symbols are theoretical auditory linguistic (TAL), theoretical visual linguistic (TVL), theoretical auditory quantitative (TAQ) and theoretical visual quantitative (TVQ). The group of qualitative symbols includes qualitative auditory (A), olfactory (O), savory (S), tactile (T), visual (V), proprioceptive (P), empathetic (EM), esthetic (ES), ethic (ET), histrionic (H), kinesic (K), kinesthetic (KH), proxemic (CP), synnoetic (S) and transactional (T).

Null hypothesis 1 was rejected. Deaf students do have signficant differences in their orientations to symbols and their meanings when compared with hearing students. As shown in Table 1, there were significant differences on nine out of a possible nineteen variables. Table 2 shows the comparisons of the theoretical symbolic orientations of the two groups. Of the four theoretical symbolic orientations studied, there was a significant difference in theoretical auditory quantitative ($F=7.4406$; $P<.008$). Table 3 shows only qualitative symbols. As would be expected there was a significant difference in the qualitative auditory orientations of the two groups ($F=40.09$; $P<.000$). Other qualitative symbolic orientations with significant differences were tactile ($F=5.6537$; $P<.020$), visual ($F=22.2573$; $P<.0001$) and proprioceptive ($F=9.454$; $P<.003$) in the sensory codes. It should be noted that the results of this study indicate that deaf students are significantly more proprioceptive than hearing students.

TABLE 1

A COMPARISON OF DEAF AND HEARING STUDENTS IN THEIR ORIENTATIONS TO SYMBOLS AND THEIR MEANINGS WITH MEAN SCORES, F-RATIOS AND SIGNIFICANCE (P) **

SYMBOL	MEAN SCORE* DEAF	MEAN SCORE HEARING	F RATIO	P
T(AQ)	24.28	20.44	7.440	.008
Q(A)	19.72	30.88	40.095	.000
Q(T)	29.20	33.32	5.653	.020
Q(V)	22.84	29.64	22.573	.001
Q(P)	21.52	26.12	9.454	.003
Q(CEM)	25.80	31.28	11.632	.001
Q(CES)	24.84	32.60	26.156	.000
Q(CP)	24.20	28.84	9.806	.003
Q(CS)	25.32	30.56	9.682	.003

* A score of 40 on any item was the maximum score.

** This table contains only the symbolic orientations with significant differences.

TABLE 2

A COMPARISON OF DEAF AND HEARING STUDENTS IN THEIR ORIENTATIONS TO THEORETICAL SYMBOLS WITH MEAN SCORES, F-RATIOS AND SIGNIFICANCE (P)

SYMBOL	MEAN SCORE DEAF	MEAN SCORE* HEARING	F RATIO	P
THEORETICAL AUDITORY LINGUISTIC T(AL)	20.96	24.40	3.513	.063
THEORETICAL AUDITORY QUANTIATIVE T(AQ)	24.28	20.44	7.440	.008**
THEORETICAL VISUAL LINGUISTIC T(VL)	25.80	27.76	1.307	.257
THEORETICAL VISUAL QUANTITATIVE T(VQ)	25.80	23.92	.478	.500

* A score of 40 was the maximum obtainable score for any item.

** Significant at the .05 level or below.

TABLE 3

A COMPARISON OF DEAF AND HEARING STUDENTS IN THEIR ORIENTATIONS TO QUALITATIVE SYMBOLS WITH MEAN SCORES, F-RATIOS AND SIGNIFICANCE (P)

SYMBOL	MEAN SCORE* DEAF	MEAN SCORE HEARING	F RATIO	P
AUDITORY (A)	19.72	30.88	40.09	.000**
OLFACTORY (O)	25.48	26.28	.187	.670
SAVORY (S)	27.28	30.00	3.196	.076
TACTILE (T)	29.20	33.32	5.653	.020**
VISUAL (V)	22.84	29.64	22.573	.001**
PROPRIOCEPTIVE (P)	21.52	26.12	9.454	.003**
EMPATHETIC (EM)	25.80	31.28	11.632	.001**
ESTHETIC (ES)	24.84	32.60	26.156	.000**
ETHIC (ET)	24.20	26.32	1.455	.231
HISTRIONIC (H)	21.36	22.00	.193	.665
KINESIC (K)	24.64	24.68	.001	.971
KINESTHETIC (KH)	25.80	28.44	3.152	.078
PROXEMIC (CP)	24.20	28.84	9.806	.003**
SYNNOETIC (CS)	25.32	30.56	9.682	.003**
TRANSACTIONAL (CT)	26.60	25.84	.233	.636

* A score of 40 was the maximum obtainable score for any item.

** Significant at the .05 level or below.

In the qualitative symbolic orientations, there were significant differences in the cultural codes. They were qualitative empathetic (F=11.632; P<.001), qualitative esthetic (F=26.156; P<.000), qualitative proxemic (F=9.806; P<.003) and qualitative synnoetic (F=9.682; P<.003). Out of the ten qualitative cultural codes measured, there were significant differences in five of them. The greatest differences were in qualitative esthetic and qualitative empathetic.

CULTURAL DETERMINANTS

Null hypothesis 2: There are no significant differences between mean scores of deaf students' and the mean scores of hearing students' on the three variables in the cultural determinant set as measured on The Cognitive Style Interest Inventory.

Included in the set of variables, cultural determinants, are associate orientation, individual orientation and family orientation. In reference to the cognitive styles of individuals, the arrangement of this set of variables determines how information received through the major and minor symbolic orientations will be processed. Thus, information may be processed in terms of major associate influence, in terms of major family influence or in terms of major individual influence. In addition to any one of these three being a distinct major influence, any combination of the three influences may operate as an individual's cultural determinant pattern.

Null hypothesis 2 was rejected. There was a significant difference

in the associate influence of deaf and hearing students. Table 4 shows the relationships between the cultural influences of the two groups. It should be noted that the results of this study indicate that the deaf students are much more associate oriented in terms of cultural influences than the hearing students. On the other hand, the results also indicate that hearing students were significantly more individually oriented than deaf students.

MODALITIES OF INFERENCE

Null hypothesis 3: There are no significant differences between the mean scores of deaf students and the mean scores of hearing students on the five variables in the modality of inference set as measured on the Cognitive Style Interest Inventory.

Included in the set of variables, modality of inference, are the inferential patterns of difference (D), appraisal (L), magnitude (M), relationship (R) and deductive (K).

Null hypothesis 3 was rejected, for the results of this study indicated a significant difference in the appraisal patterns of deaf and hearing students as Table 5 will show. Hearing students tend to infer more from an appraisal pattern than do deaf students ($F=6.612$; $P<.012$). The differences between the two groups on the other inferential patterns, difference, magnitude, relationship and deductive were only slight and not statistically significant.

TABLE 4

A COMPARISON OF DEAF AND HEARING STUDENTS' CULTURAL DETERMINANT PATTERNS WITH MEAN SCORES F-RATIOS AND SIGNIFICANCE (P)

CULTURAL PATTERN	DEAF* MEAN SCORE	HEARING MEAN SCORE	F RATIO	P
ASSOCIATE (A)	26.72	20.32	30.2469	.000**
FAMILY (F)	28.04	27.84	.0137	.903
INDIVIDUAL (I)	26.20	29.84	5.1125	.026**

*A score of 40 is the maximum score.

** Significant at the .05 level or below.

COGNITIVE STYLE

Null hypothesis 4: There are no significant differences between the total number of "majors" in the cognitive styles of deaf students and the total number of majors in the cognitive style of hearing students as measured on the Cognitive Style Interest Inventory.

The cognitive style of an individual is defined as the Cartesian product of the sets: symbols and their meanings, cultural determinants and modalities of inference. An individual's cognitive style, then is a unique combination of relationships that exist at any moment for a given individual. The combination of which symbols have the most meaning, which cultural influence is stronger and which inferential pattern is predominant is an individual's cognitive style and will affect whatever he or she may perceive at any given moment.

Null hypothesis 4 was rejected. The results of the study indicate significant differences in the cognitive styles of deaf students when compared with hearing students. Considering all twenty-seven variables that comprised the cognitive style inventory, the overall F ratio was 6.221; $P \leq .0001$. To illustrate the significance of this difference, Table 6A shows the cognitive style profile of symbols and their meanings for the deaf students, amd Table 6B shows the profile for cultural determinants of the meanings of symbols and modalities of inferences. Table 7A shows

TABLE 5

A COMPARISON OF THE MODALITY OF INFERENCE PATTERNS OF DEAF AND HEARING STUDENTS WITH MEAN SCORES, F-RATIOS AND SIGNIFICANCE (P)

INFERENTIAL PATTERN	DEAF* MEAN SCORE	HEARING MEAN SCORE	F RATIO	P
DIFFERENCE (D)	25.24	25.36	.0074	.9296
APPRAISAL (L)	25.84	30.52	6.6120	.0127**
MAGNITUDE (M)	25.00	26.84	1.0999	.2999
RELATIONSHIP (R)	27.20	27.84	.1466	.7051
DEDUCTIVE (D)	24.96	25.52	.0584	.8052

* A score of 40 is the maximum score.

** Significant at the .05 level or below.

a cognitive style profile for symbols and their meanings for the hearing students, and Table 7B shows the profile for cultural determinants of the meanings of symbols and modalities of inference. These tables give the mean scores for each variable of the inventory and also indicate which of the variables might have the most influence on an individual's cognitive style based on major and minor influences of the variables in a cognitive style. For each set of variables, the scores are displayed in order from the strongest to the least strong.

The deaf students' profile indicates no major theoretical orientation and three qualitative majors, tactile, savory and transactional. All three cultural patterns, associate, family and individual are strengths or are ranked as majors according to the scoring pattern of the profile. Family is the strongest cultural pattern for deaf students. Individuality is the strongest cultural pattern for hearing students with a secondary strong family pattern, and the weakest cultural pattern for hearing students is associate.

In the third set, modalities of inference, the only significant difference between the two groups was in appraisal. The hearing students, according to the results of this study, are more apt to make inferences based on an appraisal pattern while the deaf students tend to make inferences in terms of relationships and then infer in terms of difference, magnitude and appraisal as a secondary pattern.

Out of twenty-seven variables tested in this study of cognitive

TABLE 6A

MEAN SCORES OF DEAF STUDENTS IN RANK ORDER FOR THE SET SYMBOLS AND THEIR MEANINGS

	VARIABLE	MEAN SCORE
1	THEORETICAL VISUAL LINGUISTIC	25.80
2	THEORETICAL VISUAL QUANTITATIVE	25.08
3	THEORETICAL AUDITORY LINGUISTIC	24.96
4	THEORETICAL AUDITORY QUANTITATIVE	24.28
5	QUALITATIVE TACTILE	29.20*
6	QUALITATIVE SAVORY	27.28*
7	QUALITATIVE TRANSACTIONAL	26.62*
8	QUALITATIVE KINESTHETIC	25.80
9	QUALITATIVE EMPATHETIC	25.80
10	QUALITATIVE SYNNOETIC	25.32
11	QUALITATIVE OLFACTORY	25.48
12	QUALITATIVE KINESIC	24.84
13	QUALITATIVE ESTHETIC	24.84
14	QUALITATIVE PROXEMIC	24.20
15	QUALITATIVE ETHIC	24.20
16	QUALITATIVE VISUAL	22.84
17	QUALITATIVE PROPRIOCEPTIVE	21.36
18	QUALITATIVE HISTRIONIC	21.36
19	QUALITATIVE AUDITORY	19.72

*Indicates major strength according to inventory scoring.

TABLE 6B

MEAN SCORES OF DEAF STUDENTS IN RANK ORDER FOR THE SETS CULTURAL DETERMINANTS AND MODALITIES OF INFERENCE

VARIABLE	MEAN SCORE
CULTURAL DETERMINANTS	
20 FAMILY	28.04*
21 ASSOCIATE	26.72*
22 INDIVIDUAL	26.20*
MODALITIES OF INFERENCE	
23 PARTNERSHIP	27.20*
24 APPRAISAL	25.84
25 DIFFERENCE	25.24
26 MAGNITUDE	25.00
27 DEDUCTIVE	24.76

* Indicates major strength to inventory scoring.

TABLE 7A

MEAN SCORES OF HEARING STUDENTS IN RANK ORDER FOR THE SET SYMBOLS AND THEIR MEANINGS

	VARIABLE	MEAN SCORE
1	THEORETICAL VISUAL LINGUISTIC	27.76*
2	THEORETICAL AUDITORY LINGUISTIC	24.40
3	THEORETICAL VISUAL QUANTITATIVE	23.92
4	THEORETICAL AUDITORY QUANTITATIVE	20.44
5	QUALITATIVE TACTILE	33.32*
6	QUALITATIVE ESTHETIC	32.60*
7	QUALITATIVE EMPATHETIC	31.28*
8	QUALITATIVE AUDITORY	30.88*
9	QUALITATIVE SYNNOETIC	30.56*
10	QUALITATIVE SAVORY	30.00*
11	QUALITATIVE VISUAL	29.64*
12	QUALITATIVE PROXEMIC	28.84*
13	QUALITATIVE KINESTHETIC	28.44*
14	QUALITATIVE ETHIC	26.32*
15	QUALITATIVE OLFACTORY	26.28*
16	QUALITATIVE PROPRIOCEPTIVE	26.12*
17	QUALITATIVE TRANSACTIONAL	25.84
18	QUALITATIVE KINESIC	24.68
19	QUALITATIVE HISTRIONIC	22.00

* Indicates major strength according to inventory scoring.

TABLE 7B

MEAN SCORES OF HEARING STUDENTS IN RANK ORDER FOR THE SETS CULTURAL DETERMINANTS AND MODALITIES OF INFERENCE

VARIABLE	MEAN SCORE
CULTURAL DETERMINANTS	
20 INDIVIDUAL	29.84*
21 FAMILY	27.84*
22 ASSOCIATE	20.32
MODALITIES OF INFERENCE	
23 APPRAISAL	30.52*
24 RELATIONSHIP	27.84*
25 MAGNITUDE	26.84*
26 DEDUCTIVE	25.52
27 DIFFERENCE	25.36

* Indicates major strength according to inventory scoring.

styles, the results indicate significant differences for twelve of them. For the other variables of the inventory, there were some differences, but they were slight and not statistically significant. Based on the total results of this study, cognitive styles of deaf students were found to be significantly different from the cognitive styles of hearing students.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

The concept of individualized learning has been given much attention in the community college system in the last decade. Attempts have been made in numerous colleges to conduct experiments that would validate new methods and programs to improve the quality of education provided to all the people who enroll in community colleges. Many of these efforts have been addressed to modifying the learning experience to account for the different rates at which individuals may learn. Many of these modifications have been based upon Bloom's (1956) theory that given enough time most people can learn. Sufficient experiments have been completed to validate the idea that students do learn at varying rates. However, very little conclusive research has been completed to determine how individuals do learn differently.

Attempts have been made at Central Piedmont Community College to establish programs and courses of study with enough different means of accomplishing a set of objectives so that the maximum number of individuals may profit from instruction. However, many of these modifications have accomplished a means of self-pacing for many courses, but they have not been able to account for the many variables in learning styles that exist in a community college. The variations that may exist in learning styles has been especially

complicated by the inclusion of minority groups such as handicapped students into the community college.

At Central Piedmont Community College in the past two years, more than 100 deaf students have enrolled in various programs of the college. Previously most of these students did not enroll in a community college, but if they pursued post secondary education at all, they entered special schools for the deaf. The idea of "mainstreaming" deaf students is new, and little research has been conducted comparing the learning styles of deaf students with the learning styles of hearing students. Knowing that deaf students have to learn in modes other than auditory may cause other differences in the ways deaf and hearing students learn.

During the fall quarter 1975, a group of twenty-five deaf students who were enrolled at Central Piedmont Community College responded to a cognitive style interest inventory. A similar group of hearing students responded to the same inventory. These responses to the cognitive style interest inventory were the basis of the study to determine whether or not there were significant differences between the cognitive styles of hearing students and the cognitive styles of deaf students. Various comparisons of the data gathered from these inventories were analyzed in terms of variables included in a cognitive style.

The data gathered was analyzed according to symbols and their meanings, cultural determinants of the meanings of symbols, modalities

of inference and cognitive style. In this chapter the results of the analyses of the hypotheses were used to answer the questions listed in Chapter 1. These answers were then used to formulate recommendations related to the cognitive styles of deaf students and the cognitive styles of hearing students.

Concerning symbols and their meanings:

Question 1: Were there significant differences between the symbols that deaf students were oriented to when compared with hearing students?

As a result of the comparisons of deaf and hearing students in orientations to symbols and their meanings, it can be concluded that there were significant differences between the two groups. In the set, symbols and their meanings, there were comparisons made between both theoretical and qualitative symbolic orientations, the deaf students were significantly more auditory quantitative than the hearing students. This difference suggests that deaf students even though they do not hear, still tend to think of themselves, as making mathematical computations mentally rather than writing them on paper. The deaf students do this kind of thinking to a greater degree than the hearing students. For the other theoretical symbols, there were no significant differences; however, the mean scores indicated a tendency for the hearing students to be more visual linguistically oriented while the deaf students tended to be more visual quantitative than the hearing students.

In the comparisons of the qualitative symbolic orientations, the results of the study indicated significant differences between the two groups on eight out of fifteen variables studied. The most significant difference was qualitative auditory. This difference could easily be expected since the deaf have little or no use of the auditory sense. The second most significant difference was qualitative esthetic. The hearing students showed a much stronger response to esthetics than did the deaf students. Next in order of greater significance between the groups was qualitative visual. The hearing students are more dependent on their visual sense than the deaf students of this study. The results also indicate that hearing students are more proprioceptive than deaf students. In terms of proxemic ability, hearing students are more aware of physical social distance and its implication than the deaf students of this study. The hearing students also tend to have a stronger self concept since synnoetics is a significantly stronger variable than with the deaf students. In addition to these differences, the tactile sense is stronger in the hearing students.

Perhaps the other variables of the study were also significant, at least in terms of the total study. In the theoretical symbols, auditory linguistic, visual linguistic, and visual quantitative, there were no significant differences. For the qualitative variables of olfactory, savory, ethics, histrionic, kinesic, kinesthetic and transactional, there were no significant differences between the two groups.

Therefore, in the complete set, symbols and their meanings, there were nineteen separate variables studied. Out of the nineteen symbolic variables, the results of the study did indicate significant differences between the two groups on nine of them. However, there were ten of the variables with no significant differences shown between the two groups.

Concerning cultural determinants of the meanings of symbols:

Question 2: Were there significant differences between the cultural determinant patterns of deaf students when compared with the cultural determinants of hearing students?

The results of the study did indicate significant differences between the cultural determinant patterns of deaf and hearing students. The study considered the variables of individual orientation, associate orientation and family orientation. Of these three variables considered in the study, the results indicate significant differences relating to both associate influence and individual influence.

The results indicate that deaf students are more strongly associate oriented than hearing students. Hearing students of the study were more individually oriented than deaf students. In terms of family orientation, there was no significant difference. Another interesting result was that the deaf students tended to react to situations culturally with almost equal strength regarding individual, associate and family influences, while the hearing

students showed stronger individual influence and only a secondary influence of family. These differences seem to indicate that deaf students tend to depend largely on associate influences and tend to react to information culturally in more than one way while hearing students tend to react to information culturally as an individual much stronger than with the other influences.

Concerning modalities of inferences:

Question 3: Were there significant differences between the modality of inference patterns of deaf students and hearing students?

Of the five modality of inference patterns looked at in this study, magnitude, difference, relationships, appraisal and deductive, hearing students tend to make inferences more in an appraisal fashion than deaf students. With respect to the other modalities of inference patterns, there were no significant differences between the two groups.

The answers to these questions together have indicated that there were significant differences between the cognitive styles of the deaf students and the hearing students of this study. Each of the groups of variables studied indicated significant differences between the deaf and hearing students' cognitive styles. The largest number of differences occurred in the set, symbols and their meanings. The findings indicate that deaf students receive information differently from hearing students. After reacting to the information culturally, deaf students also tend to infer in a different pattern from hearing students.

CONCLUSIONS

The assumption was made in this study that The Cognitive Style Interest Inventory developed and used at Oakland Community College and other places is a valid measuring instrument of cognitive styles. Even though there are other definitions of cognitive style and other means of measuring cognitive styles, the findings of this study support the following general conclusions about the differences in the cognitive styles of deaf students and the cognitive styles of hearing students. These general conclusions are presented according to the three sets of influences studied.

Theoretical symbolic orientations

As theoretical information is presented to a group of deaf and hearing students, the deaf students tend to receive the information more readily if presented and/or interpreted in an auditory quantitative format. With reference to theoretical information presented in auditory linguistic, visual linguistic and visual quantitative formats, the deaf students and the hearing students are essentially alike.

Qualitative symbolic orientations

For the deaf students, the qualitative symbolic orientations to auditory, tactile, visual, proprioceptive, empathy, esthetic, proxemic and synnoetic are not as strong as those of the hearing students. The other qualitative symbolic orientations of olfactory, ethic, histrionic, kinesic and

transactional are similar in strength for both groups.

Cultural determinants

Culturally deaf students are more associate oriented than hearing students. Hearing students are more individual oriented than deaf students.

Modalities of inference

Inferential patterns of deaf and hearing students are different. Hearing students tend to be appraisers in making inferences while deaf students infer more from relationships.

RECOMMENDATIONS

Deaf students have been included in the regular program of the college at Central Piedmont for more than a year. The Special Services Staff has been largely responsible for orienting the deaf students to the campus and also to the instructional programs of the college. For the most part the deaf students have had to adjust to regular classes on the campus.

The deaf students have been provided with interpreters who go to classes with them and interpret the presentations into sign language. Essentially the assumption of the college has been that if deaf students are provided with an interpreter, they can learn the same material from the same presentation as hearing students.

The results of this study indicated that deaf students and hearing students have different reactions to material presented because of significant differences in the cognitive styles of the two groups. These differences will need to be incorporated into the educational development program of the college.

As a result of the findings of this study with respect to the Division of Special Services and to other departments of the college, it is recommended that:

1. Each deaf student should be given a Cognitive Style Interest Inventory in pre-enrollment procedures.
2. Continued study of the elements of cognitive style should be conducted both in special services and in the other divisions of the college, and this study should be focused both on the deaf students and the hearing students.
3. Interpreters who work most closely with deaf students should become thoroughly familiar with major and minor patterns of the cognitive styles of the deaf students who are assigned to them.
4. Deaf students should be advised to enter classes (especially in the first terms) that will allow them to utilize the major elements of their cognitive styles.
5. Analysis of courses that deaf students will take should be made to determine the major elements of cognitive style that deaf students need to function in that class.
6. Counselors who work with deaf students should utilize information gained through initial cognitive style

inventories so as to advise these students of their major strengths.

7. Workshops and training sessions in the use of cognitive style should be made available to all instructors on campus but especially to those who work with deaf students.
8. Teaching presentations made to deaf students and to hearing students should be revised so as to take into account major elements of the students' or participants' cognitive styles.

Because the findings of this study were limited and inconclusive in some respects, it is recommended that additional research be done. The research should especially examine the following:

1. The changes that take place in students' cognitive styles with respect to the courses that the students take
2. A long range comparison of the cognitive styles of deaf students and hearing students as students take more courses to see if the differences in cognitive styles become lesser or greater
3. The academic success of deaf students who have knowledge of their own cognitive styles and who are learning in programs that are adjustible to those different cognitive styles
4. The reasons deaf students withdraw from courses or from college in relation to those students' cognitive styles
5. The relationship between the success of deaf students who have similar cognitive styles to those of their interpreters

and the success of those who have dissimilar cognitive styles

6. The effectiveness of individual features of courses in relation to cognitive styles of students, like self-paced courses or lecture courses
7. The effect of implementing in the secondary school program a teaching and learning environment for the deaf students based on the conceptual framework of cognitive style.

Because the deaf students who were the sample of this study represented the majority of deaf students enrolled at Central Piedmont Community College, it can be concluded that there are significant differences between their cognitive styles and the cognitive styles of hearing students. (See Appendix B) However, the sample of the hearing group did not represent the majority but were selected from students taking developmental studies in English. This selection process may have caused the difference in cognitive styles to appear less than they may be if a broader sample were selected. Nevertheless, the findings of this study do point to some major differences in cognitive styles that could greatly affect the teaching and learning processes. The findings also warrant continued investigation of individual learning styles of all groups but especially for minority groups. In addition to these kinds of investigations, the results will need to be fed into the system of educational development for the entire college.

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APPENDIX B

MULTIPLE DISCRIMINATE ANALYSIS OF THE COGNITIVE STYLES OF DEAF STUDENTS AND HEARING STUDENTS SHOWING VARIABLES, F-RATIO AND PROBABILITY *

VARIABLE	F-RATIO	P
1. T(AL)	3.5135	.0637
2. T(AQ)	7.4406	.0087**
3. T(VL)	1.3074	.2574
4. T(VQ)	.4782	.5005
5. Q(A)	40.0959	.0000**
6. Q(O)	.1875	.6707
7. Q(S)	3.1963	.0766
8. Q(T)	5.6537	.0203**
9. Q(V)	22.5731	.0001**
10. Q(P)	9.4547	.0038**
11. Q(CEM)	11.6320	.0017**
12. Q(CES)	26.1564	.0000**
13. Q(CET)	1.4553	.2317
14. Q(CH)	.1937	.6658
15. Q(CK)	.0011	.9119
16. QCKH)	3.1522	.0786
17. Q(CP)	9.8065	.0033**
18. Q(CS)	9.6827	.0034**
19. Q(CT)	.2311	.6367
20. A	30.2469	.0000**
21. F	.0137	.9032
22. I	5.1125	.0267**
23. D	.0074	.9296
24. L	6.6120	.0127**
25. M	1.0999	.2999
26. R	.1466	.7051
27. (K)	.0584	.8052

* Overall F-Ratio 6.221; $P_{..} < .0001$

** Significant at the .05 level or below