AN EXAMINATION OF RELATIONSHIPS BETWEEN THE MEASURABLE COGNITIVE CHARACTERISTICS OF A FRENCH I TEACHER AND THE STUDENT'S SUCCESS IN THAT COURSE

Thesis for the Degree of Ph. D.

MICHIGAN STATE UNIVERSITY
BARBARA ORT

1971

This is to certify that the

thesis entitled

AN EXAMINATION OF RELATIONSHIPS BETWEEN THE MEASURABLE COGNITIVE CHARACTERISTICS OF A FRENCH I TEACHER AND STUDENT'S SUCCESS IN THAT COURSE

presented by

Barbara Ort

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Education

Dale V. Adam

Major professor

Date June 23, 1971

ABSTRACT

AN EXAMINATION OF RELATIONSHIPS BETWEEN THE MEASURABLE COGNITIVE CHARACTERISTICS OF A FRENCH I TEACHER AND THE STUDENT"S SUCCESS IN THAT COURSE

By

Barbara Ort

The purpose of this study was to investigate data relevant to more improved curricular conditions within foreign language classrooms by determining the relationship of several variables (i.e., teacher, cognitive style diagnosis, and "like" and "unlike" characteristics of teacher and student) upon the success of these students' course.

The new audio-lingual approach to foreign language education proposed to correct all omission in the process of producing fluent speakers of a foreign language. Indications are that, even with new methodological and technical treatment of students, little change has occurred in foreign language drop-out rates. New data concerning contributions to successful achievements in foreign language instruction appeared to be timely.

It is generally agreed that all children do not learn alike. The literature reviewed in this study indicates that little is known about the structure of learning. This study deals with the interrelationship of measurable cognitive characteristics and, in doing so, provides more data relevant to student learning.

The diagnostic procedure utilized at Oakland Community College in Bloomfield Hills, Michigan, was used with two classes in French I at two schools, East Lansing High School and Hannah Middle School (also at East Lansing, Michigan). Measurable cognitive elements were provided for each student and both teachers.

The data were analyzed by use of the analysis of variance technique to show interaction of cognitive sets or categories of cognitive elements on the hypotheses. In order to further search for significant elements or characteristics, the data were further broken down by use of the Kolmogorov-Smirnov Statistical Test Model.

The findings emanating from the Anova Techniques appear to reject the null hypotheses and call for the acceptance of the "alternate" hypotheses, i.e., the null hypothesis--there is no difference between the mean grade point associated with teacher I and teacher II, is rejected and the alternative hypothesis--there is a difference between the mean grade point associated with teacher I and teacher II, is accepted. In other words, there is a relationship

between the variables of cognitive style groupings and both teachers and the evaluation both teachers made of their students.

When component sets of cognitive style were broken down into discrete characteristics, it was impossible to show any "like" or "unlike" group relationship of student and teacher characteristics. However, this was the first study which attempts to analyze "like" and "unlike" groupings in terms of individual sets as opposed to the Cartesian product of three sets which indicate the cognitive style of an individual.

The implications of the study do have an impact on curriculum even though discrete characteristics influencial in predicting relationship to teacher and success in a foreign language course were not discovered. The analysis of variance findings, however, did indicate a relationship of all the variables (teacher, cognitive style set, like and unlike relationships) to student success as measured by grades. The fact that "unlike" seems to have been more associated with success seems to indicate a need for the total profile including all data to be treated in place of isolated characteristics. This is compatible to the need to view the whole child and sheds some doubt on the practice of "treating" students within the educational environment based on very limited data (i.e., reading level).

The cognitive process described in this study does add data usually not included in student profiles, but it does not claim an all inclusive completely predicable picture of the human organism in his learning environment. The constant need is for more knowledge regarding the human learning process not an attempt or even a feeling that the complete organism can be or should be cognitively diagnosed.

AN EXAMINATION OF RELATIONSHIPS BETWEEN THE MEASURABLE COGNITIVE CHARACTERISTICS OF A FRENCH I TEACHER AND THE STUDENT'S SUCCESS IN THAT COURSE

By

Barbara Ort

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

College of Education

1971

ACKNOWLEDGMENTS

Special appreciation is extended to the Michigan Department of Education and its staff for their cooperation and encouragement.

Gratitude is also expressed to the East Lansing Public Schools including the two French I classes and their teachers for making the data available.

Particular thanks are also due to Dr. Joseph Hill, President of Oakland Community College, and his staff for many hours of counsel and advice and for making available the cognitive style diagnostic instruments used in this study.

A very special note of thanks to my family for their patience and understanding.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

THE PROBLEM

Need

In 1957 Sputnik soared around the world showing the world the inventive genius and "educational superiority" of the Russian people. The initial shock waves produced the first legislation of a large scale federal support program for education in the United States.

The National Defense Education Act in its first fiscal year (1958) allocated some 40 millions to the states to upgrade the teaching of math, science, and foreign languages.

Twelve years later the foreign language teaching profession finds itself completely revolutionized in method, teacher training, equipment and textbooks. The so-called "traditional" method so prevalent in 1958 has all but disappeared in American schools. This can be substantiated through the virtual disappearance of texts emphasizing the skills of reading and writing at beginning levels. Long laborious oral translations from French to English of major French writers have been discontinued and in its place came a new reliance on the "natural method" of language learning. This method assumes that a child

learns a second language the same way he learns a first. This resulted in a method dubbed "audio-lingual." The term is somewhat misleading in that it indicates the development of only two skills, understanding and speaking. In fact, the method and all audio-lingual texts are based on the development of four skills, understanding, speaking, reading and writing. The basic difference between "audio-lingual" and traditional is the order of teaching skills (1) understanding, (2) speaking, (3) reading, and (4) writing and the reinforcement quality of dialogue and drill presentation.

Major publishers prepared "programs" consisting of texts, tapes, workbooks and, in some cases, visuals in a tightly controlled linguistic sequence. Great claims were made of the materials. N.D.E.A. only reimbursed programs following audio-lingual criteria. The new day of foreign language instruction had arrived.

In 1970, twelve years later, we cannot substantiate the claims for the "new method." The best that can be said is that many colleges say students seem to be better prepared. Indeed, not only do we not have any hard data to prove the advantages of the new method, there are some controversial studies which purported to prove "no significant difference." The so-called Keating Report out of

Columbia University indicates the "no significant difference" hypothesis regarding the use of language laboratories.[1]

The now famous "Pennsylvania Study" done under a grant from the U. S. Office of Education listed as its first implication:

> Perhaps the greatest implication inherent in the conclusions of Projects 5-0683 and 7-0133 is that the foreign language education profession has for the past decade or more been predicating teaching strategies, materials, and electro-mechanical devices on theoretical assumptions, that may not be entirely valid. While the research conducted by the Project is admittedly imperfect, it hopefully represents the reality of the typical classroom. The implication for a re-examination of the theoretical basis for second language learning in the secondary school environment is evident in the research.
>
> The implication that foreign language teaching should revert to the strict 'traditional' classroom techniques of the 1930's must not be read into the research. 'Traditional' teachers as defined in the research had many more insights into human growth, personal interrelations and the learning process than did their predecessors of forty years ago.
>
> Countless improvements have been made in the physical classroom, text format and arrangement, and curriculum development. The generation of students utilized in this research has always known television, traveled more widely and seen the world grow smaller. Neither the teacher, the school, nor the students are the same from year to year. Retrogression is not possible and cannot be regarded as an implication of the research. The recasting of theory, perhaps once adequate, into current society is implied.[2]

---

[1] R. F. Keating, A Study of the Effectiveness of Language Laboratories (New York: Columbia University, Institute of Administrative Research, Teachers College, 1963).

[2] Philip D. Smith, Jr., and Helmut A. Baranyi, A Comparison Study of the Effectiveness of the Traditional

School millages are failing. Teachers are demanding and, in many cases receiving higher salaries.

The cost of teaching materials and plant construction and maintainance is going up. Schools find themselves in an environment of rising costs and incomes unable to meet these basic obligations. Hundreds of teachers have received letters indicating the possibility of the non-renewal of contracts.

Foreign languages, once the "in" thing in the curriculum, are now looked upon as one of the easiest areas for cuts. In 1957 there were about fifty (FLES--foreign languages in the elementary school) programs throughout the state of Michigan. As of September there was one FLES program located in Alpena. Foreign language programs such as the one located in Birmingham, Michigan received national acclaim just three short years ago as the most nearly perfect model. That program has now been dropped due to a successive series of millage failures. In fact, the junior high program finds itself under attack.

Therefore, faced with the disappearing foreign language requirement and a need to attract students to the classroom, foreign language teachers and administrators are seeking answers to some of the still unsolved pedagogic

---

and Audiolingual Approaches to Foreign Language Instruction Utilizing Laboratory Equipment (Washington, D.C.: U.S. Department of Health, Education and Welfare, Office of Education, 1968).

problems, i.e., that very sensitive relationship which exists between students and teachers.

At a conference held at Higgins Lake, made up of students at various levels of foreign language instruction (junior high through college) who were picked by their teachers as successful, the most prevailing reason for a positive or negative reaction to their foreign language courses was listed as their teacher. When questioned about this, students would make such statements as "He was a good Joe," "He was fair," "I don't know, we just seemed to get along," and many other such subjective indicators.

Why is it that some students and teachers seem to "hit it off?" Are there areas of compatability and/or measurable characteristics which when matched result in the kind of appraisal mentioned above?

This study will deal with the field of foreign language instruction and will concentrate on a "mix" of students and teachers and attempt to isolate some measurable characteristics which tend to result in a positive appraisal of the students' success in class (his grade).

Background of the Study

Work in the field of individual differences as it affects learning is no new endeavor. It has been going on within educational literature since the turn of the century (see Chapter II of this study).

Recently several attempts to provide data on student achievement which can be measured and applied to the educational process have developed. In Michigan alone three such attempts are receiving public attention.

In Troy, Michigan, there is a computerized program which feeds student achievement data and analysis of that data to teachers for the purpose of pinpointing curricular problems and possible altering of treatment and learning environment. This program, known as PACER, a Prescriptive Analysis for Curriculum Evaluation and Review, was not appropriate to the present study since the system is geared to analyze the product of only the student and not those described characteristics of student and teacher which can be measured.

A similar program is in operation in the Bridgeport, Michigan, schools. This project also only considers student achievement, test scores and their feedback impact upon the educational process.

The COMET (computer operated method for educational testing) Program recently funded under E.S.E.A. Title III is a computerized program giving instant data feedback to students related to progress as reflected in data banks and achievement testing within subject areas.

There is a program housed at Oakland Community College which tests students entering freshmen) and provides a computerized "cognitive style" printout of the

data from such testing which is used to match students and teachers and also match students with certain instructional procedures.

The Oakland Community College program was selected for this study because of its broad categories of testing (see definitions of terms, S, E. H), its flexibility and its attempt to implement this data into more achievement oriented structural alternatives for students and an attempt to match compatible learning styles of teachers and students.

The program at Oakland Community College has the desirable components of flexibility and personal feedback. Using the cognitive style map and subjective information gathered in private conversation with the student, a team of teachers and the student jointly developed a personalized education program which is geared to his strengths and weaknesses--a program which is his personal prescription and which is intended to give every possibility for his success. Computers are used to expedite the process.

Counselors from Oakland Community College report that most students consider this process as giving them more decision-making data and not placing them in a mold.

The student is then presented with course objectives and procedes to follow these instructional procedures jointly arrived at in the counseling session. These alternatives are:

1. Individualized Programmed Learning Lab (IPLL) where students can work on programmed material independent of the help of the instructor.

2. Carrel Arcades where students can utilize video taped materials and private study facilities.

3. Seminar where a student sits with the instructor in a small group situation to clarify difficulties.

4. Youth-tutor-youth where students work with students towards instructional objectives.

5. Lecture discussion where a more traditional approach to instruction predominates, i.e., material is presented and students are allowed to ask questions.

The process of attempting to tailor-make the student to the process and instructor has thrust Oakland Community College toward their objective of ninty per cent success in achievement of instructional goals.

This provides one of the possible theoretic basis for solution and implementations of individual differences. This approach presents a conceptual framework for education and a diagnostic procedure whereby cognitive characteristics can be identified. This stage in the process has been unavailable and is at present undergoing extensive research. If fully implemented this could bring us closer to a scientific treatment of differences for the purpose of diagnosing the relationship of these definable characteristics related to the educational process.

Through this process of accommodating individual differences, the educational institution might begin to develop the achievement potential of students. One of the accommodations mentioned which an institution can make is to attempt to relate the cognitive learning styles of students to that of the teachers.

Purpose of the Study

The purpose of this study is to determine the relationship of the cognitive characteristics of foreign language students and teachers to success in the course. This will be accomplished by mapping the profile of teachers and students in two classes of French I and comparing characteristics on a "like" and "unlike" basis to success in the course as measured by letter grades.

It is necessary for the author to assume that the letter grade is a valid measure of the teachers' estimate of success. This is the "real world" measure for students and parents and until a more valid measure is achieved (and utilized by schools) this symbol is assumed to be a valid representation of "success." The study does not have as its purpose the validation of letter grades as a measure of success.

Limitations of the Study

This study is dealing only with the relationship of isolated measurable cognitive characteristics of

student and teacher and the teachers' estimate of the student's success. It must be understood that there are many other significant elements which relate to the final learning and happiness of any one student. Motivational elements are not dealt with or many of the affective influences which are important to any learning process. The human organism cannot be totally analyzed, the only hope is to find some relationships between certain described characteristics and certain outcomes of the educational process.

The whole field of the educational sciences and the diagnosis of cognitive style is just now beginning to attract the attention of educators. The process must be approached with caution and precise attention to thorough understanding as to what it can do and what it does not claim to do. Most baiscally it will only affect those things which one can measure and relate to success and claims and implementations cannot and should not be made beyond this level.

Definition of Key Terms

Educational Sciences

A common structure within which inquiry of significance for the basic aspects of the applied field of education can be conducted.

Cognitive Style Mapping

The map of cognitive style gives a limited picture of the way a student derives meaning from his environment and personal experience based upon those discrete characteristics which can be measured. Each map, like each student, is different. A student's cognitive style is concerned with a description of the observed and measured behavior which reflects the way he takes notice of his total surroundings--how he seeks meaning--how he becomes informed. Is he a listener or a reader? Is he concerned only with his point of view or is he influenced in decision-making by his family or by his group associates?

EXAMPLE OF COGNITIVE STYLE MAP*

$$g = \frac{12}{10} \times \frac{T(AL)\ T(VL)\ Q(CET)\ Q(CEM)\ Q(CS)\ q(ck)\ q(ch)}{1} \times \frac{a(+)}{\begin{matrix} M & D \\ d & m \\ r & r \end{matrix}}$$

*Personalizing Educational Programs utilizing cognitive style mapping, Oakland Community College, Publication.

Three Cartesian Sets of Mapping

1. Symbolic Orientation refers to the ability of an individual to mediate either theoretical or qualitative symbols into meaning. For example, if the individual has a

"good to high" (50-99%) ability to read and write at a particular level of educational development, he would be accorded a "major" theoretical visual linguistic symbolic orientation, which would be written as TVL.

2. Modalities of Inference are the types, forms, or patterns of a six-step inferential process employed by an individual in the process of drawing conclusions.

3. Cultural Determinants are the meanings that man assigns to symbols in the category of "cultural influences." These cultural influences are (F) family, (I) individual, and (A) associates.

Two Types of Symbols in All of Symbolic Orientation

1. Theoretical Symbols are those symbols which present to the individual's nervous system something different from that which the symbol itself is (e.g., the word "chair" representing the object chair).

2. Qualitative Symbols are those symbols which present and then represent to the nervous system of the individual that which the symbol itself is to that individual (e.g., a particular strain of music, or the color of a given object).

Four Theoretical Symbols

1. T(AL)--Theoretical Auditory Linguistic--the sound of a word.

2. T(AQ)--Theoretical Auditory Quantitative--the sound of a number.

3. T(VL)--Theoretical Visual Linguistic--the written word.

4. T(VQ)--Theoretical Visual Quantitative--a written number.

Fifteen Qualitative Symbols

1. Q(A)--auditory--the ability to perceive meaning through the sense of hearing;

2. Q(O)--olfactory--the ability to perceive meaning through the sense of smell;

3. Q(S)--savory--the ability to perceive meaning by the sense of taste;

4. Q(T)--tactile--the ability to perceive meaning by the sense of touch;

5. Q(V)--visual--the ability to perceive meaning by the sense of sight;

6. Q(P)--proprioceptive--sometimes referred to as the sixth sense--vehicle for conveying meanings associated with "Programmatic effects;"

7. Q(CES)--code esthetic--the ability to identify with, or have a vicarious experience of, another person's feelings, ideas or volitions;

8. Q(CEM)--code-empathetic--the ability of the individual under consideration to view with enjoyment the

"beauth" and "pureness" of a resulting product, situation or idea;

9. Q(CET)--code-ethic--a commitment to a set of values, a group of moral principles, obligations, and/or duties;

10. Q(CH)--code-histrionic--staged behavior, or a deliberate exhibition of emotion or temperament to produce some particular effect on other persons;

11. Q(CK)--code-kinesics--the ability to communicate by means of non-linguistic functions such as blushing and motions of the body, such as shrugs, smiles and gestures;

12. Q(CKH)--code-kinesthetics--motor skill abilities;

13. Q(CP)--code-proxemics--the ability of an individual to judge the acceptable "critical" physical and social distance between himself and others as perceived by the other person;

14. Q(CS)--code-synnoetics--personal knowledge of oneself in all qualitative and theoretical symbolic forms in relation to one's environment;

15. Q(CT)--code-transactional--the ability to maintain a positive communicative interaction which significantly influences the goals of the persons involved in that interaction.

Four Modalities of Inference

1. (M)--Magnitude inference process is a form of "categorical thinking," and utilizes norms categorically classified, and attitudes accepted as true by the individual as the basis for acceptance or rejection of advanced hypotheses;

2. (D)--Difference deals with hypotheses of difference such as one-to-one contrasts or comparisons of selected characteristics or measurements;

3. (R)--Relationship process considers a relationship between two or more characteristics or measurements;

4. (L)--Appraisal type of inference considers, with equal weight, hypotheses of all the previous three (magnitude, difference, and relationship) in arriving at a probable conclusion.

Qualitative Predominance

Qualitative Predominance is a symbolic condition of an educational task which mainly involves qualitative symbols supplemented by occasional references expressed in theoretical symbols.

Theoretical Predominance

Theoretical Predominance is a symbolic condition of an educational task which mainly involves theoretical symbols supplemented by an occasional reference expressed in terms of qualitative symbols.

Cognition

When Hill, et al., speak of the cognitive style they are speaking of various methods and environments in which a child seeks meaning. He seeks meaning through the interpretation of many types of symbols. In many cases these symbols represent what Bloom would call "affective" meaning. Therefore, the word "cognition" in this case has meaning more in the general sense of "awareness" rather than the opposite of affective (cognitive) as defined by Bloom.

Questions to be Answered

1. Is there a relationship between the measurable cognitive characteristics of a French I teacher and student and the student's success in French I as measured by teachers' grades?

2. What are the cognitive elements within the set of symbolic orientation which tend to show a major and minor "match" between teacher to student in cases of success of foreign language courses?

3. What are the cognitive elements within the set of cultural determinants which tend to show major and minor "match" between teacher and student in cases of success of foreign language courses?

4. What are the cognitive elements within the set of modes of inference which tend to show major and minor "match" between teacher and student in cases of success of foreign language courses?

5. Does the age level of the student affect the relationship of cognitive match and success in a course?

Although the questions posed will be answered mainly on the basis of what is termed "logical, rational analysis" of information pertaining to the domains covered by the questions, in order to proceed with as much efficiency as possible, there will be certain aspects of the questions that will be answered on the basis of statistical inference. In these cases, the following six-step process will be employed toward the development of a statistical hypothesis.

1. State the null hypothesis, e.g., H_o: $M_I = M_{II}$, a two-tailed test of the "null" that there would be no significant difference between the means of the levels I and II, respectively, of the factor of "teacher."

2. Set a level of significance, e.g., $\alpha = .05$.

3. Employ the F ratio: $F = \frac{S_I^2}{S_R^2}$; and $F = \frac{S_{II}^2}{S_R^2}$; where S_I^2 and S_{II}^2 are the values of the variance ascribed to levels I and II of the factor of "teacher," and S_R^2 denotes the "residual" variance of the within cells interaction.

4. Determine the critical region of the F distribution, i.e., determine the critical value of the F ratio at the .05 level of significance, under $(N-1)_I$ and $(N-1)_{II}$ degrees of freedom, respectively. This value may be read from any table of critical values (.05 and .01 level values) of the F distribution.

5. Calculate the value of the F ratio.

6. Depending on whether the calculated value of "F" occurs in the critical region, or does not occur there, reject (in the first case), or do not reject (in the latter case) the null hypothesis: H_o: $M_I = M_{II}$. If the "null" (H_o) can be rejected by the data of the sample being employed, then its statistical alternative hypothesis (H_1), for the example that has been employed throughout this discussion, (H_1) would be: H_1: $M_I \neq M_{II}$, may be accepted. This action would indicate that it was highly probable that the operational hypothesis from which (H_1) was derived was true. Under these circumstances, the acceptance of (H_1) would lead to the acceptance of the "operational" with which (H_1) was associated, and thereby would lead to the acceptance of that aspect of the research hypothesis covered by the operational hypothesis in question.

If the "null" (H_o) cannot be rejected by the data of the sample, i.e., the value of the "calculated" F ratio does not fall in the critical region of the distribution, then its "statistical alternative" (H_1) cannot be accepted; and, in turn, the "operational" from which (H_1) was devised cannot be accepted. Under these circumstances, the aspect of the research hypothesis covered by the operational hypothesis under consideration, cannot be accepted.

A basic operational hypothesis that can be used in these cases where statistical inference is employed in the study to provide answers to the general questions posed is:

> There is a difference between group mean "grade points" (A-4.0, B-3.0, etc.) associated with the factor of grouping (like and unlike) cognitive style characteristics by set, and those associated with the factor of teacher.

The example of a statistical alternative hypothesis that could be devised from this operational would be: H_1: $M_I \neq M_{II}$; where M_I indicates the population mean grade point associated with teacher I and M_{II} denotes the population mean associated with teacher II.

The null hypothesis derived from this "alternative" would become H_o: $M_I = M_{II}$; where the notation is the same as that associated with (H_1). This "null" can be submitted to a two-tailed statistical test, and depending upon the results would be "rejected" in favor of (H_1), or "not rejected," which would mean that (H_1) could not be accepted.

Overview of Chapters

Chapter I--Introduction of the Problem

The need, background, purpose of the study, limitations, definition of key terms, description of hypotheses and questions to be answered.

Chapter II--Review of the Related Literature

Review of the related literature in terms of research in the field of individual differences.

Chapter III--Research Design

Source of data, samples employed by the study, representativeness of population, adequacy of study, data collection procedures, instruments and summary.

Chapter IV--Analysis of Results

Analysis of results--a description of analytical techniques used--tables showing the results of the analysis of data and findings related to the hypotheses.

Chapter V--Summary of the Study and Discussion

Summary, conclusion, discussion, implications for research and recommendations.

CHAPTER II

REVIEW OF RELATED RESEARCH

Literature in the field of foreign language research in the past decade has been related to methodology and audio-visual components. No research has been done to try to relate this methodology or any other instructional inputs (including teacher characteristics) to individual cognitive characteristics of students. In fact, the literature tends to reflect an attempt to do the opposite--to find a methodology and a teaching package which renders the greatest possible potential situation of success for the student. Since the present study is attempting to show the impact of the relationship of individual measurable characteristics of students and teacher to success in the classroom, the pertinent related literature lies in studies on individual differences and how they affect the learning process and the concept of cognitive style as it is interpreted in psychology and in the educational sciences. The present study is related to the individual differences of students and teachers and how they relate to success in the classroom. Concern for individual differences on the part of researchers is not new.

Individual Differences

Early in this century educators acknowledged the fact that people differ in the way they perceive their environment and, therefore, in the manner in which they learn. Earl Kelly, an early proponent of the concept of individual differences described the process by which each person perceives his or her environment and reflected on the erroneous assumption that all people see things the same way under the same circumstances.

> Our perceptions do not come simple from the objects around us, but from our past experience as functioning, purposene organisms. We take a large number of clues, none of which is reliable, add them together, and make what we can of them. All that this gives us is an estimate of our surroundings. It is never exactly right. It is never the same for different individuals.
>
> It is like a statistical average, a useful device for making a prognosis, but always wrong in any particular instance.
>
> Since the perception is the usable reality, and since no two organisms can make the same use of clues or bring the same experiential background to bear, no two of us can see alike. We have no common world. Each has his own to which he responds in his own way. Because our forecasts usually approximate correctness, we make the mistake of assuming they are perfect, and that we do have a common world.[3]

While Kelly regarded individual differences as a product of differing experiences, others have cited biological diversity as an important factor in determining

---

[3]Earl C. Kelly, Education for What is Real (New York: Harper and Row, 1947), p. 34.

the "uniqueness" of individuals. The present study effort could be considered to be related to Kelly's work in that the aspect of cognitive style pertaining to cultural determinants is another approach to "perception" as Kelly viewed it.

Hardin has supplied considerable evidence of biochemical variation among people who, on the basis of usual medical criteria were considered "normal."

Variability of "Normal" Healthy Human Beings[4]

(The factor of variation is calculated by dividing the greatest value by the least value of the figures included within a range considered normal.)

	Characteristic	Factor of Variation
1.	Phosphate concentration in blood	2
2.	Sodium concentration in blood corpuscles	3
3.	Protein-bound iodine concentration in blood	3
4.	Acetylcholine concentration in blood plasma	16
5.	Glycine concentration in plasma	7
6.	Vitamin A concentration in blood	15
7.	Arginase enzyme concentration in blood	4
8.	Thyroid glands, weight	6
9.	Gonads, adult weight	5
10.	Androgens, concentration in adult male, urine	11
11.	Alcohol, minimum intoxicating percentage in blood	8
12.	Minimum perceptible movement in peripheral vision	42
13.	Daily dietary calcium needs, adult	5
14.	Vitamin B, requirement	4

[4]Garrett Hardin, "Biology and Individual Differences," Individualizing Instruction, The Sixty-first Yearbook of the National Society for the Study of Education, Part I (Chicago: University of Chicago Press, 1962), p. 13.

In light of the above variations and other biological variations such as the tendency toward ulcers, insulin deficiency and the presence of the hemophilia gene, Hardin observes, ". . . if we think of the word 'equal' in a nonevaluative way, the evidence drives us to the conclusion that (with the exception of identical twins) all men are unequal."[5]

To the extent that cognitive style provides a means of differentiating between individuals in the process of seeking meaning, or in learning activities, the present study is indirectly related to Hardin's work.

Accounting for Individual Differences Affecting the Learning Process

As early as 1906, Thorndike stated:

> The practical consequence of the fact of individual differences is that every general law of teaching has to be applied with consideration of the particular person in question. Every stimulus must be given not to men or to children in general, but to a particular individual or group characterized by certain peculiarities.[6]

While the existence of individual differences, whether due to genetic diversity or varied past experiences, may be generally accepted by most educators, a method for identifying differences which significantly affect the

---

[5] Ibid., p. 11.

[6] Edward L. Thorndike, quoted in Morris L. Bigge and Maurice P. Hunt, Psychological Foundations of Education (New York: Harper and Row, 1968), p. 114.

learning process continues to be elusive. Noting this persistent problem, Gagne makes the following comment:

> At the present time it seems fair to say that we know considerably more about learning, its varieties and conditions, than we did ten years ago. But we do not know much more about individual differences in learning than we did thirty years ago.[7]

Some progress has been made in identifying personality traits that appear to interact with certain kinds of learning experiences.

Carpenter and Haddan's[8] study seems to indicate that students who are successful in the "information getting" stage (as distinct from the stages of "application," "analysis" and "creativity") possess a high degree of docility, suggestibility, industriousness, need for achievement and trusting. They also suggest that successful students will possess relatively little independence, flexibility, theory-orientation, aggressiveness and coubtfulness.[9]

The results of Bigelow and Egbert's[10] comparison of an independent study group and a traditional study group

---

[7]Robert M. Gagne, Learning and Individual Differences (Columbus, Ohio: Charles E. Merrill Books, Inc., 1967), p. xi.

[8]Finley Carpenter and Eugene E. Haddan, Systematic Application of Psychology (New York: Macmillan Company, 1964).

[9]Ibid., p. 105.

[10]Gordon S. Bigelow and Robert L. Egbert, "Personality Factors and Independent Study," The Journal of Educational Research, Vol. 62, No. 1 (September, 1968), 27-29.

showed no significant difference in personality traits (as measured by the California Psychological Inventory) between successful students in the two groups. However, within the independent study group, successful students scored significantly higher on Intellectual Efficiency and Responsibility than did the unsuccessful students.

Rokeach's[11] studies have suggested that person's possessing the personality trait of dogmatism or closed-mindedness tend to rely heavily on authority and direction. In support of this notion, Mouw[12] demonstrated that as learning tasks become more complex or autonomous, open-minded individuals increase in their ability to successfully complete the task. One implication of Mouw's investigation is that, ". . . the degree of dogmatism possessed by individuals should be a consideration in the education process, especially when the emphasis is on self-directed learning or problem solving skills."[13]

Hedley's[14] study showed that certain personality traits seemed to be related to scientific and mathematical

---

[11]M. Rokeach, The Open and Closed Mind (New York: Basic Books, 1960).

[12]John T. Mouw, "Effect of Dogmatism on Levels of Cognitive Processes," Journal of Educational Psychology, Vol. 60, No. 5 (1969), 365-369.

[13]Ibid., p. 368.

[14]Carolyn Neal Hedley, "The Relationship of Personality Factors to Scientific and Mathematical Ability Factors," School Science and Mathematics, Vol. 68 (1968), 265-271.

ability. It was observed that individuals with scientific ability tended to be high in anxiety, sensitivity, self-doubt, literary and musical interest.

Majer's[15] comparison of personality traits of college physics students utilizing computer assisted instruction (CAI), with those taught by lecture, demonstrated that students less mature in their "academic style," more sensitive and who were not scientifically oriented achieved at a higher rate useing the CAI method. Also, students who were more autonomous, independent thinkers with scientific interests and a scientifically oriented method of inquiry tended to have greater success when taught by the lecture method.

A five-year study by Stroup[16] indicated that Math and Verbal Scholastic Aptitude Tests correlated higher with college freshman grade-point average than did any of the eighteen scales of the California Psychological Inventory.

---

[15]Kenneth Majer, "Differential Relationships Between Personality and Performance Under Dissimilar Modes of Instruction," AV Communication Review, Vol. 18, No. 2 (Summer, 1970), 169-179.

[16]Atkee L. Stroup, "The Prediction of Academic Performance from Personality and Aptitude Variables," The Journal of Experimental Education, Vol. 38, No. 3 (Spring, 1970), 83-86.

In a study of personality traits of college probationary students, Smith and Winterbottom[17] found unrealistically optimistic expectations concerning grades, defensiveness, lack of positive motivation for academic work and dependence on parents to be characteristic of the group.

Snow[18] and his co-workers examined the relationship between individual differences and the effectiveness of instructional films. Their study suggests that college physics students characterized as active, self-assured, assertive and independent achieved at higher levels under the conditions of live presentations than did similar students using instructional films. Conversely, students characterized as passive, lacking self-confidence and dependent on others tended (although not significantly) toward higher achievement using films. The study also implied that persons with high "numerical aptitude" and/or high "verbal aptitude" tended to perform better on recall tests when they were taught by live lecture/demonstration methods.

These studies are related to present study in that investigation is somewhat similar regarding the effect of

---

[17]Charles P. Smith, Miriam T. Winterbottom, "Personality Characteristics of College Students on Academic Probation," Journal of Personality, Vol. 38, No. 3 (September, 1970), 379-391.

[18]Richard E. Snow, Joseph Tiffen and Warren F. Seibert, "Individual Differences and Instructional Film Effects," Journal of Educational Psychology, Vol. 56, No. 6 (1965), 315-326.

certain characteristics at play in the educational process but also is being conducted in foreign language as opposed to other academic areas.

Cognitive Style in Psychology

Perhaps, as suggested in Chapter I of this study, a practical method (for identifying individual differences for the purpose of matching characteristics in students and teachers which give greater chance for learning) is needed in order to discuss the application of the construct of the cognitive style.

The concept of cognitive style as it has been variantly described and defined within the field of psychology is somewhat different from the educational science of cognitive style. In the latter half of the 1930's, Allport[19] referred to "style of life" and to "modes of adaptation" as a means of identifying distinctive personality types. In the late 40's researchers became concerned with concept formation, that process which occurs between perception and response. This group became known as one that studied "cognitive processing," and as Gardner notes, they considered a response to a stimulus as,

---

[19]Gordon W. Allport, Personality, A Psychological Interpretation (New York: Henry Holt and Company, 1937), p. 47.

". . . coerced not by stimulus alone, but also by the organizational dispositions of the responding system . . . ."[20]

Klein[21] identified the organizational processes referred to by Gardner as "cognitive control principles." While Gardner[22] suggested that the term "cognitive style" should pertain only to those control principles within an individual, other recent studies have considered cognitive style in terms of an individual's response to specific stimuli.

Broverman argued that certain kinds of cognitive style as defined by Klein and Gardner appear to correspond to certain broad classes of behavior; and therefore that ". . . cognitive styles seem promising parameters on which to order a perplexing array of individual differences in human behavior."[23]

Some contemporary researchers who have considered cognitive style as a consistent form or pattern of behavior have examined types of cognitive style in relation to

---

[20]R. W. Gardner, et al., "Cognitive Control: A Study of Individual Consistencies in Cognitive Behavior," Psychological Issues, Vol. 1, No. 4, p. 3.

[21]G. S. Klein, "The Personal World through Perception," in Perception: An Approach to Personality, ed. by R. R. Blake and V. V. Ramsey (New York: Ronald Press, 1951).

[22]R. W. Gardner, "Cognitive Styles in Categorizing Behavior," Journal of Personality, Vol. 22 (1953), 214-233.

[23]D. M. Broverman, "Dimensions of Cognitive Styles," Journal of Personality, Vol. 38 (1960), 183.

certain personality factors such as dependency, anxiety and passivity.

Witkin[24] defined the concept of field-dependence independence. Individuals described as field-dependent were those observed to be relatively unsuccessful in positioning a luminous rod or themselves to a vertical plane in a room (field) after the rod and/or the field, and/or they themselves were tilted. Field-dependent types were also less successful in an embedded figures test. Persons who were relatively successful in these tests were identified as being field-independent. Witkin's studies revealed that field-dependence was associated with such personality traits as: lack of self-awareness, high anxiety, low self-esteem and general passivity. Field-independence was observed in subjects characterized by high activity, self-awareness, low anxiety and high self-esteem.

Barron[25] found that persons who had shown independence of judgment in an experimental social situation tended to prefer complexity in drawings; place a higher value on creativity, close interpersonal relations and the individual rather than the group. So called yielders in

---

[24]H. A. Witkin, "Individual Differences in Cases of Embedded Figures," Journal of Personality, Vol. 19, pp. 1-15.

[25]Frank Barron, "Some Personality Correlates of Independence of Judgment," Journal of Personality, Vol. 21 (March, 1953), 287-297.

the same experimental situation tended to be practical-minded, somewhat "physicalistic" in their thinking and group oriented.

The Educational Science of Cognitive Style

A method of exploring cognitive style, the "educational science of cognitive style," as used by Hill and others, is somewhat different from the concept as it is described in the literature of psychology. Their approach, however, is an attempt to describe a "style" or broad pattern of behavior using symbolic language.

Hill describes cognitive style in the educational sciences as: "a Cartesian product, G composed of three sets, S, E and H where S denotes the set of elements defining symbolic orientation, E indicates the set of cultural determinants of the meaning of symbols and H designates the set of modalities of inference."[26] An individual's cognitive style is considered to be, "a set g, a Cartesian product of sub-sets (s, e and h) of appropriate elements drawn from (all of the possible elements in)[27] sets S, E and H."[28]

---

[26]Joseph E. Hill, "Cognitive Style as an Educational Science" (unpublished paper, Oakland Community College, 1968), p. 2.

[27]Refer to p. 11 of this study for a description of the possible elements in each set.

[28]Ibid., p. 4.

The following explanation of this method of treating cognitive style includes all the studies which have examined this approach.

Symbolic Orientation

Symbolic orientation, as set s of an individual's cognitive style, refers to the manner in which that individual acquires knowledge and meaning through the use of symbols.

Shuert,[29] in his study of the cognitive styles of successful mathematics students, found that the following elements of symbolic orientation were unique to the successful group.

1. Major theoretical visual quantitative (TVQ);
2. Major theoretical auditory quantitative (TAQ);
3. Minor theoretical auditory linguistic (TAL).

Dehnke's[30] findings indicated that there seemed to be a pattern of symbol mediation among successful English teachers.

---

[29]Keith L. Shuert, "A Study to Determine Whether a Selected Type of Cognitive Style Predisposes One to do Well in Mathematics" (unpublished Ph.D. dissertation, Wayne State University, 1970).

[30]Ronald E. Dehnke, "An Exploration of the Possible Isomorphism of Cognitive Style and Successful Teaching of Secondary School English" (unpublished Ph.D. dissertation, Wayne State University, 1966).

Wasser[31] discovered that teachers of mathematics, language, health, social studies, science, reading and spelling tended to give higher grades to students who made use of auditory and visual theoretical symbols.

Robinson,[32] investigating the changes that occurred in the cognitive style of participants in a "Higher Opportunities Program in Education," found increases in theoretical visual and quantitative orientation. He also found that increase, or lack of increase, of theoretical visual and quantitative orientation can be related to certain qualitative codes.

Zussman[33] identified "collective" cognitive styles among groups of public-school and community-college administrators. Both groups of administrators exhibited theoretical visual and auditory orientations as well as qualitative code empathetic and kinesthetic orientations.

---

[31]Laurence Wasser, "An Investigation into Cognitive Style as a Facet of Teachers' Systems of Student Appraisal" (unpublished Ph.D. dissertation, University of Michigan, 1969).

[32]Richard L. Robinson, "A Descriptive Study of Specific Achievements and Aptitudes of the High Risk Students in Oakland University's Higher Opportunities Program in Education" (unpublished Ph.D. dissertation, Wayne State University, 1969).

[33]Steven P. Zussman, "A Pilot Study Exploration of Cognitive Style and Administrative Style as Defined in the Educational Sciences" (unpublished Ph.D. dissertation, Wayne State University, 1968).

Cultural Determinants of the Meanings of Symbols

The cultural determinants, included in set e of an individual's cognitive style, are considered to be those that comprise the educational science concerned with the main cultural influences at work on the individual throughout his life, and the ones particularly significant in his continual search for meaning by the process of symbolic mediation.

Shuert[34] observed the minor, positive associates determinants ($a_{(+)}$) to be characteristic of unsuccessful mathematics students. There were no cultural determinants unique to the successful student in his study.

Zussman[35] found major individuality and minor positive associates determinants to be common elements among both public school and community college administrators.

Cotter's[36] study demonstrated a trend in which students who possessed a major individuality (I) most frequently selected community-college curricula which stress fundamental disciplines (i.e., Science and Liberal

---

[34]Keith L. Shuert, op. cit.

[35]Stephen P. Zussman, op. cit.

[36]Jude T. Cotter, "The Affects of the Educational Science of Cultural Determinants of the Meanings of Symbols on Curricular Choice" (unpublished Ph.D. dissertation, Wayne State University, 1970).

Arts curriculum) as opposed to Applied Sciences and Arts curriculum. Cotter notes, however, that while this trend and others were indicated, the hypothesis of a significant difference between the cultural determinants of students in the two groups could not be supported.

Modalities of Inference

The modalities of inference in set H of an individual's cognitive style are defined as the form of inference processes used mainly by an individual in the process of deriving conclusions.

Rankin[37] delineated the modalities of inference in terms of models, isomorphism and hypotheses and in essence added data to support the behavioral description of the symbols attached to this (modalities of inference) set.

The model theory to which Rankin's study refers is based upon the property of "isomorphism" associated with set theory in mathematics. In mathematics, a set is considered to be a carefully defined collection of elements. If two sets are examined, and if (a) there is found to be a one-to-one correspondence between the elements included in the sets, and (b) that certain structures are preserved, then the two sets are said to be "isomorphic." If two sets are isomorphic to each other, then either set can serve as a model for the other.

---

[37]Stuart C. Rankin, "A Theory of an Isomorphism-Model-Hypothesis Method of Thought" (unpublished Ph.D. dissertation, Wayne State University, 1964).

Dehnke[38] observed isomorphism between modalities of inference and successful English teaching.

Shuert[39] found the major appraisal and major deductive inferential processes to be elements unique to successful math students.

Community college administrators in Zussman's[40] study possessed the modalities of appraisal, major difference and minor relationship. There were no modalities of inference in common among the public school administrators.

Other investigations utilizing the educational science of cognitive style includes the works' of DeLoach,[41] Fragale[42] and Wyett.[43] DeLoach found that similarity of administrator and instructor cognitive style acts as a

---

[38]Ronald E. Dehnke, op. cit.

[39]Keith L. Shuert, op. cit.

[40]Steven P. Zussman, op. cit.

[41]Joseph F. DeLoach, "An Analysis of Cognitive Style Disparity as an Antecedent of Cognitive Dissonance in Instructional Evaluation: An Exploratory Study in the 'Educational Sciences'" (unpublished Ph.D. dissertation, Wayne State University, 1969).

[42]Marvin Joseph Fragale, "A Pilot Study of Cognitive Styles of Selected Faculty Members and Students in a Community College Setting" (unpublished Ph.D. dissertation, Wayne State University, 1969).

[43]Jerry L. Wyett, "A Pilot Study to Analyze Cognitive Style and Teaching Style with Reference to Selected Strata of the Defined Educational Sciences" (unpublished Ph.D. dissertation, Wayne State University, 1969).

a significant variable in the administrator's evaluation of the instructor. He also noted that similarities of teaching style between administrators and instructors were significant to the evaluation process.

Fragale identified "collective cognitive styles" among teachers and students included in his sample.

Wyett identified a general cognitive style orientation for each teacher who participated in the "Teacher Education Experimental Project" at Wayne State University. His study also implied that certain teaching tasks are related to certain cognitive styles.

Summary

This chapter has reviewed selected research related to individual differences, cognitive style in psychology and cognitive style as explored in the educational sciences. The present study is the first to test the use of a cognitive style diagnostic process in an attempt to provide better learning situations in foreign language classes. The study attempts to determine the existence of common cognitive characteristics of students and teachers which may affect the teacher's evaluation of the student.

Since the theory of cognitive style in the educational sciences is a descriptive theoretical model, and still being tested, it seemed necessary to at least mention all available research on this model. The information presented in this chapter is intended to establish a

foundation for the design and interpretation of the findings of the present study. Therefore, a description of the symbolic explanation of "cognitive style in the educational sciences" is included in the chapter. The design of this study will be presented in Chapter III.

CHAPTER III

DESIGN OF STUDY

Source of Data

East Lansing, Michigan, is located in the south central section of the state of Michigan. It is an adjacent suburb of Lansing, the capital of the State.

The city houses Michigan State University, a state supported university. The permanent resident population consists of 18,125. The student population living off campus totals 11,786 and the student population living on campus, 21,434.[44] The average annual income is estimated at $15,000.[45]

The East Lansing Public Schools has a student population of 5,162 and a total staff (administrative, teaching and custodial) of 561. There are 261 teaching personnel. The classroom teaching staff includes one doctorate, 135 with masters, 120 with bachelor degrees and 5 with less than a bachelors.[46] Eighty per cent of the

---

[44]Based on 1970 U.S. Bureau of Census statistics projected by Michigan Planning Commission, City Hall, East Lansing.

[45]Based on 1960 U.S. Bureau of Census Statistics projected.

[46]Final Report, East Lansing Public Schools 1970-71.

students go on to college with an estimated 60 per cent completing college.

The offering of foreign language begins in grades 6 and gives the student a potential sequence of grades 6 to 12. Students may begin a foreign language at any grade level; therefore, any one student can have a continuum of from 1 to 7 years. There are 535 students taking foreign language in the high school and 286 in the two middle schools. There are 252 students taking French in the high school with 136 in the middle schools. There are 10 foreign language teachers, 3 teaching French in the high school. Each middle school has one teacher of French giving a total French teaching staff of 5. There are 58 students taking French I in the high school and 62 in the two middle schools.

There is one teacher of French I in the East Lansing High School and one each in the middle schools. For the purpose of this study, the one teacher of East Lansing High School and one from Hannah Middle School were tested with their classes. Both of these teachers have tenure. The high school teacher has taught in East Lansing for ten years and the Middle School teacher for eight years. The high school teacher has a B.A. Degree with a major in Latin. The middle school teacher has an M.A. Degree in French. Both teachers are married and permanent residents of East Lansing.

Samples Employed by the Study

Since it was impossible to employ all the persons, processes, and properties included in the defined population, the student includes one French I class in the high school and one French I class in the Hannah Middle School and a sampling procedure was used to estimate and infer about 34 selected characteristics in three sets of cognitive styles. Specifically, the population included a total of 46 students enrolled in the two French I classes. The respective teachers of these two classes were also tested in the study. Twenty-five students were tested in the high school. Their ages ranged from 15 to 18. Twenty-three students were tested in the Hannah Middle School. Their ages ranged from 11 to 13.

The main criterion employed in this study was the grade (A=4.0, B=3.0, C=2.0, etc.) point accorded a student by the teacher for the student's performance in the courses. These grade points were entered in appropriate cells of the Anova Grid shown below. For example, if a student "matched" his teacher in the high school in symbolic orientation and received an A (4.0) in the course, a 4.0 was entered in the "like" cell under S (symbolic orientation). The variables represented by the data included two teachers (I and II), I being the high school teacher, three cognitive style sets (S--Symbolic Orientation, E--Cultural Determinants, H--Mode of Inference) for each of the two

teachers and two groupings representing like (L) and unlike (U) for each of the two teachers. The letter X was used to denote the teacher's grade point estimates of success of the students in the sample. Further examples are in the Anova Grid below:

	I			II		
	S	E	H	S	E	H
	X	X	X	X	X	X
L	4.0	4.0	4.0			
	4.0	3.0	4.0			
I	3.0	1.0	4.0			
	3.0		2.0			
K	1.0		2.0			
	0.0		1.0			
E	0.0		0.0			
U	4.0	4.0 4.0	3.0			
	3.0	3.0 3.0	3.0			
N	3.0	3.0	3.0			
L	3.0	0.0 3.0	3.0			
	3.0	0.0 3.0	3.0			
I	2.0	0.0 2.0	3.0			
K	2.0	2.0	0.0			
	0.0		0.0			
E						

In the above hypothetical example in a class of 15 students of teacher I, two students were "like" the teacher in symbolic orientation and received a grade of A (4.0), two "like" received B (3.0), one "like" received a D (1.0) and two "like" received an E (0.0). In the same class 8 students were "unlike" the teacher in symbolic

orientation: one received an A (4.0), four received a B, two received a C, and one received an E. This process was then continued for the stypes E (Cultural Determinants), and H (Modes of Inferences). The same procedure was carried out for teacher II (middle school). The data were then analyzed through the use of the statistical technique described in Chapter IV called Analysis of Variance.

Then, in an attempt to break down sets into discrete characteristics and to isolate significant effects of measurable characteristics of cognitive styles regardless of teacher, the Kolmogorov-Smirnov two sample test (Like and Unlike Groupings) was used. The two samples' cumulative distribution of relative frequencies of occurrence over the "categories" of A, B, C, D, E, were analyzed by the process described in Hill and Kerber.[47]

Kolmogorov-Smirnov

Symbolic Orientation (S)
Regardless of Teacher

	A=4	B=3	C=2	D=1	E=0
Like					
Unlike					

i.e., T(VL), T(AL), T(VQ), of Teacher was "matched" by students whose "grades" were distributed over A, B, C, D, E, categories.

Repeat for Cultural Determinants i.e., T, F, A.

Repeat for Mode of Inference i.e., M. R. D.

---

[47]Joseph E. Hill and August Kerber, Models, Methods, and Analytical Procedures in Educational Resources (Detroit: Wayne State University Press, 1967), pp. 154-155.

It should be noted that the sample is made up of a collection of those cognitive characteristics which are measurable in the symbolic set alone, and does not employ the total cognitive style of the student, i.e., a cartesian product of the three sets S, E, H; or G=S x E x H. See Appendix.

Representativeness of Population

Since the sample employed in the study was drawn from the defined population (two French I classes) to fit the Anova Grid, and since the sampling involved all students in the population when each category of the Grid was considered, and since both teachers (the total number of that aspect of the defined population), the sample was considered to be highly representative of the defined population), the sample was considered to be highly representative of the defined population from which it was drawn.

Adequacy of Study

Since the study was designed to examine the data at a pilot study level of consideration, it was agreed that small-sample theory could be employed appropriately. Under these circumstances, a sample of 25 or more could be considered adequate.

Data Collection

The aspect of the study dealing with data collection is described in two parts (A) the instruments and techniques and (B) the procedures which were followed during data collection activities.

Instruments

The tests used compose a battery designed at Oakland Community College to determine cognitive style. The battery is divided into two parts. The first part is a selection of 12 theoretical tests requiring 2 1/2 hours to complete, the first six of which represent aptitude testing. All of the tests have item validity. The second six tests of the first part are inventories which give both qualitative and theoretical information about a student. The second section of the test is a qualitative non-written test requiring 90 minutes to complete. This section is composed of performance tests of sensory accuity. A complete test battery can be found in the appendix. The characteristics described by particular instruments are:

Theoretical Test:

Test #1: Verbal Reasoning--TUL

Test #2: Listening--TAL (Recording)

Test #3: Numerical Reasoning--TUQ

Test #4: Reading--TUL (Gates)

Test #5: Numerical Listening--TAW (Tape)

Test #6: Grammar--TUL

Inventory #9 and #10: Cultural Determinants--IAF

Inventory #11: Modalities of Inference--MDRL

Inventory #12: Personal Code Inventory

Qualitative--Non Written:

Test #1: Qualitative Auditory

Test #2: Qualitative Olfactory

This battery is a descriptive bettery at the present time and as gives such descriptive information about the student being tested. Items are taken from a variety of instruments, such as the Iowa tests of Educational Development, the Gates Reading Tests, the Vineland Social Maturity Scale and the Science Research Associates Batteries. Attitudes, interests and values are measured by inventories and check-lists employed to provide information about specific vocational interests, social activities and such broad fields of interest as mechanical, electronic or computational devices.

Procedures of Data Collection

During the summer, a contact was made with the Director of Instructional Services of the East Lansing Public Schools, Dr. Robert Docking. The idea was presented regarding the use of two French I classes in East Lansing Public Schools for the purpose of this study. A description of the process of cognitive style was presented to Dr. Docking. The application of this diagnostic technique was explained in relation to current problems in foreign

language education with an attempt to relate this to some possible findings which could benefit Dr. Docking in his work with foreign language students and teachers in the East Lansing Schools. Dr. Docking accepted this explanation and proceeded to stipulate the obligations which this study would have to the administration, teaching staff and students. The following data collection procedures were agreed upon:

1. An interview was set up with the principal of East Lansing High School and the principal of Hannah Middle School to explain the purpose of the testing and the advantages to the school system. Both principals agreed to cooperate and make students available for testing.

2. An interview was set up with the two teachers involved to explain the testing procedure and the value to them and their students. A particular emphasis was placed upon the type of testing used. It was very necessary that the students understand that no evaluation was being made of them in order to prevent any feelings of intimidation which might affect the validity of the data. Both teachers were anxious to cooperate.

3. A letter was sent to parents explaining the testing procedure along with purposes and benefits. A copy of the letter is included in the appendix. None of the parents objected to their children being tested.

4. An agreement was made with the assistant superintendent to give feed-back to the parents, students and administrators concerning the final data and its implied implications to benefits to the school system.

5. An interview was then set up with Dr. Joseph E. Hill, President of Oakland Community College, to facilitate testing procedures. Dates were verified for the convenience of both OCC and East Lansing Schools.

6. Students in the East Lansing Hannah Middle School were given the cognitive style test battery (described above) on the morning of November 3, 1970, by a mobile testing unit provided for that purpose by Oakland Community College (administrative offices located in Bloomfield Hills, Michigan).

7. On the same day (November 3) in the afternoon, the same battery (completion time 2 1/2 hours) was given to the East Lansing High School French I class. The students were released from their classes for this purpose. The teachers of both the high school and middle school were tested at the same time. The data were then provided at Oakland Community College on a series of print-outs giving a computer based description of student and teacher characteristics.

8. The mobile unit of Oakland Community College returned to the East Lansing High School and Hannah Middle School on January 3, 1971, to test the two classes for

qualitative data. Those data provided printouts similar to those provided from the theoretical data. Samples of the two descriptions can be found in Appendix A.

Summary

French I classes in East Lansing High School and Hannah Middle School were used as the population which provided data for the study. The students were tested by a battery made available by a mobile testing unit from Oakland Community College in Bloomfield Hills, Michigan. The data were then entered on an Anova Grid for further analysis. Individual characteristics of students were entered upon the Kolmogorov-Smirnov Grid.

The study is considered representative as it related to the defined population from which it was drawn and it is considered adequate under the definition of a pilot study.

The feed-back on the findings of the study was promised to the East Lansing schools after completion of the study.

CHAPTER IV

ANALYSIS OF DATA AND FINDINGS

The first three chapters of the study treated the background, purpose, need, related literature, and design. The purposes of the present chapter are:

1. to consider the analytical techniques employed in the study; and
2. to present the findings (not the conclusions) resulting from the analysis.

Analytical Techniques

In addition to analyzing information provided by conversations with school administrators, teachers and students, two statistical techniques were employed to analyze grade point data and "grouped" cognitive style elements respectively. These techniques, the analysis of variance, and the Kolmogorov-Smirnov, the two independent techniques, are described below.

Analysis of Variance

The analysis of variance (anova) technique, or testing, is described by Rosander[48] as:

---

[48] A. C. Rosander, Elementary Principles of Statistics (New York: D. Van Nostrand, 1951).

> . . . In its broader aspects, analysis of variance means the analysis of the total variation of a given set of observations into its components. These components are factors or categories which are of major importance in interpreting the data. If one of these components constitutes the random or residual variation after the variation due to the principal causes or factors has been eliminated, then this variance can be used as the basis of z or F tests of the significance of the other components. In terms of specific statistical operations, analysis of variance requires the cross-classification of the data by categories or factors, a tabulation which is a definite counterpart of reflection of the initial design of the statistical inquiry. In terms of calculations it requires the following magnitudes which are usually arranged in a compact tabular form: the number of degrees of freedom for each of the components, the sum of squares of deviations about the mean for each of these components, the estimated variance or mean square, and a z or F value for each test that is made.
>
> Analysis of variance can be of considerable practical value in analyzing a complex set of data, even though all four conditions for the z or F test are not met, especially if the sampling is random and the categories are independent, that is, if the first two conditions are met. The reason is that the procedure of analysis of variance is a way of making maximum use of all the data, and considerable value may be derived from such an analysis even though no z or F test seems to be justified . . . .

Statistical Tables Using Analysis of Variance

The following approach was used to employ this technique (analysis of variance) through the use of the anova grid. I and II represent teacher I and teacher II. Teacher I is from the high school; teacher II is from the middle school. S, E and H represent the three sets of cognitive style. S means symbolic orientation; E means

cultural determinants; H means modes of inference. Student groupings are represented by L and U, or like and unlike.

Kolmogorov-Smirnov Statistical Test Model is described by Hill and Kerber as

> . . . The two-sample test is concerned with the degree of agreement between the two cumulative distributions of the relative frequencies observed in the respective samples. If the two samples have actually been drawn from the same population, or populations having the same distribution, the cumulative distributions of both samples should be reasonably close to each other over the range of values involved. If the two-sample cumulative distributions evidence too much divergence at any point, there is a given probability that the samples might come from different populations. If the deviation between the two cumulative distributions at any point is so great that it would occur, according to the appropriate Kolmogorov-Smirnov probability distribution, less than 5 per cent, or 1 per cent of the time, due to chance factors alone, the null hypothesis (no difference between the respective cumulative distributions) is rejected in favor of the statistical alternative hypothesis (H_1).

An analysis of how this technique was employed in the study is shown below.

To determine if there was a statistically significant difference between like and unlike groups where group membership was established on the basis of whether the student matched or did not match the teacher in terms of the binomial element of [T(AL) - Q(CES)] in the symbolic set of cognitive style the following grid was used to apply the above statistical model.

TAL - QCES

	4	3	2	1	0
L					
U					

In similar fashion this approach was employed on the sets relating to cultural determinants and modes of inference. Findings resulted from these analyses are reported later in this chapter.

Restatement of Hypotheses

Operational Hypothesis

> There is a difference between group mean "grade points" (A=4.0, B=3.0, etc.) associated with the factor of grouping (like and unlike) cognitive style characteristics by set, and those associated with the factor of teacher.

Statistical Alternative

H_1: $M_1 \neq M_{11}$.

Null Hypothesis

H_o: $M_1 = M_{11}$

Tables Showing Analysis of Data and Findings

The purpose of Table 1 is to locate the total sum of squares. This procedure is used whan a simple two column variance cannot be employed. In this case, this was

TABLE 1.--Sum of squares.

Student Grouping	Teacher I			Teacher II		
	Cog. St. Set			Cog. St. Set		
	S	E	H	S	E	H
	Gr. Ptc.			Gr. Ptc.		
	$\tilde{X}$	$\tilde{X}$	$\tilde{X}$	$\tilde{X}$	$\tilde{X}$	$\tilde{X}$
L	$\Sigma X = 55$ (N = 21) $\Sigma X^2 = 163$	$\Sigma X = 42$ (N = 18) $\Sigma X^2 = 112$	$\Sigma X = 51$ (N = 20) $\Sigma X^2 = 147$	$\Sigma X = 27$ (N = 9) $\Sigma X^2 = 85$	$\Sigma X = 31$ (N = 9) $\Sigma X^2 = 111$	$\Sigma X = 42$ (N = 13) $\Sigma X^2 = 142$
U	$\Sigma X = 4$ (N = 2) $\Sigma X^2 = 8$	$\Sigma X = 17$ (N = 5) $\Sigma X^2 = 59$	$\Sigma X = 8$ (N = 3) $\Sigma X^2 = 24$	$\Sigma X = 45$ (N = 14) $\Sigma X^2 = 151$	$\Sigma X = 27$ (N = 9) $\Sigma X^2 = 85$	$\Sigma X = 7$ (N = 2) $\Sigma X^2 = 25$

the result of an unequal number of entries in each cell. As indicated by Table 1, it will be noted that the total sum of squares equals 1034.2, which is represented by A. The total sum of squares is found by computing within each square the sum of X, which is the total arrived at by computing the sum of all grade points using A=4, B=3, C=2, D-1, and E=0. Therefore, in the first cell, the sum of the squares equals 55, the number of entries are 21 and the cell is represented by $\frac{(55)^2}{21}$. The procedure used to arrive at the sum of squares is explained in Hill and Kerber.[49] It must be kept in mind that the study is seeking to show the interaction effect of sources of variation upon the hypothesis (H_o). The statistical formula for analysis of variance = $S^2 = \frac{(X-\bar{X})^2}{N-1}$. Table 1 represents the factors and their levels (e.g., teacher, 2 levels, I and II) associated with "grade points" derived from the letter grades assigned to students by the teachers.

The variance table (Table 2) represents the analysis of sources of variation in terms of interactions and main effects; i.e., teacher, cognitive style set, and student grouping. The "work tables" showing the actual analyses of the data can be found in the appendix.

---

[49]Hill and Kerber, op. cit.

TABLE 2.--Variance.

Source of Variation	df	Sum of Squares	Mean Square	F-Ratio	Decision
Error (within cells)	113	1,301.71	11.52	--	
Groupings x Style x Teacher	2	179.54	89.77	$\frac{89.77}{11.52} = 7.79$	Reject H_o at .01 level
Teacher x Style	2	173.19	86.595	$\frac{86.595}{11.52} = 7.52$	"
Style x Grouping	2	170.02	85.015	$\frac{85.015}{11.52} = 7.38$	"
Teacher x Grouping	1	86.55	86.55	$\frac{86.55}{11.52} = 7.51$	"
Grouping	1	84.95	84.95	$\frac{84.95}{11.52} = 7.39$	
Style	2	169.01	84.505	$\frac{84.505}{11.52} = 7.34$	"
Teacher	1	86.54	86.54	$\frac{86.54}{11.52} = 7.51$	"
TOTAL	124	2,251.52			

Consulting Table 2, it is interesting to note that:

1. There is a significant difference between groupings "like" and "unlike" when groupings were determined on basis of single set matches; i.e. (S matches S) or (E matches E), not on total Cartesian Product of Sets. The mean score of the "unlike" groups were found in certain cases to be significantly higher than those of the "like" groups.[50] It is interesting to note that this is the first study with this finding. Heretofore "like" groups classified on the basis of the total style of the individuals involved have always shown higher group mean scores than the "unlike" groups.

2. There is a significant difference in the level of grading of the two teachers. Teacher II (middle school) graded considerably higher on the average than did Teacher I (high school). (For actual teacher means, see Table 7, in the Appendix). For teacher II the average grade point was found to be 3.2 (B+). Teacher I was found to be 2.5 (C+).

3. Since all the group mean scores of main effects were found to be significantly different between levels and since all interactions proved to be statistically significant, the findings required interpretation in each factor. (See work tables in the Appendix).

The Kolmogorov-Smirnov Grid (Table 3) represents one example of a discrete characteristic, in this case

---

[50] See Table 2.

TABLE 3.--[T(VQ)-Q(CET)].

		4	3	2	1	0	Total
$S_1(X)$	L	$^{6}\frac{126}{525}$	$^{9}\frac{315}{525}$	$^{8}\frac{483}{525}$	$^{1}\frac{504}{525}$	$^{1}\frac{525}{525}$	(21)(25) = 525
$S_2(X)$	U	$^{5}\frac{125}{525}$	$^{10}\frac{375}{525}$	$^{6}\frac{525}{525}$	$^{0}\frac{525}{525}$	$^{0}\frac{525}{525}$	(21)(25) = 525
$D=[S_1(X)-S_2(X)]$		$\frac{1}{525}$	(MAX) $\frac{60}{525}$	$\frac{42}{525}$	$\frac{21}{525}$	0	

T(VQ)-Q(CET) or theoretical visual quantitative-qualitative code ethic, as applied to the statistical test described earlier.

Applying the necessary X^2 formula with two degrees of freedom, e.e., 2df:

$$X^2 = 4D^2 \left[\frac{n_1 n_2}{n_1 + n_2}\right]$$

$$X^2 = 4 \left[\frac{60}{525}\right] \left[\frac{(25)(21)}{46}\right] + .6$$

Since the value of $X^2 = .6$ is not significant; i.e., it does not exceed the critical value of $X^2 = 5.991$, the null hypothesis cannot be rejected, and its alternative (that the two groups are different in terms of the element [T(VQ)-Q(CET)] cannot be accepted.

The remainder of these types of working tables can be found in the Appendix. It should be noted that in each case of analysis, the null hypothesis could not be rejected and, therefore, its corresponding "alternative" could not be accepted.

Summary

Table 1 shows the techniques used to manipulate the data in the variance, Table 2. The purpose of this table was to locate the sum of squares. This procedure is used when there are an unequal number of entries in each cell.

It should be noted that by breaking down the entries into S, E and H, or cognitive style sets, any one student could have both "like" and "unlike" sets to the teacher.

The variance table (Table 2) carries the summary data of the Anova-Grid since all the group mean scores and mean affects were found to be significantly different between levels and since all interactions proved to be statistically different, the findings required interpretation in each factor. Each factor also called for the rejection of the null hypothesis and the acceptance of the alternate hypothesis. In other words, there is a relationship between the variables of cognitive style teachers and groupings of "like" and "unlike."

It was impossible to break down to the most basic binomial elements to show any significant effect to "like" and "unlike" "matches." Therefore, it was impossible to find any discrete characteristics which had a significant relationship upon the teacher's mean score.

CHAPTER V

SUMMARY AND CONCLUSIONS

Foreign languages in the past twelve years have gone through major methodological changes. Teachers, parents and students were dissatisfied with the visual approach (heavy emphasis on reading, writing and grammar) which is now termed the "traditional" approach.

Most were unhappy that students could not speak a foreign language and our federal government viewed this lack as hurting our international intellectual stature. Therefore a new approach called "audio-lingual" was developed and large sums of federal monies (National Defense Education Act 1958) went into providing materials, equipment and inservice education to receptive school systems.

The new audio-lingual approach to foreign language education proposed to correct all omission in the process of producing fluent speakers of a foreign language. The new doctrine of introduction of the four skills in the proper order, listening, speaking, reading and writing. Dialogues were memorized, pattern drills repeated, language laboratories purchased and hope for a new age in language learning prevailed.

For several years the profession has indicated a general dissatisfaction with the audio-lingual approach. Perhaps too much was expected of it but little change seems to have occurred in drop-out rates from foreign language courses. Students are not instantaneously fluent speakers. However, it must be noted that colleges are saying that the students they get are better prepared. Enrollments not only have not increased, but are going down. We still have not found a way to interest a large majority of students in foreign language.

Foreign language teachers are being bombarded by eager critics anxious to lay much of education's--and indeed society's--omissions at their feet.

Many prestigious institutions such as Yale, Stanford, Brown and Wesleyan are now dropping their undergraduate foreign language requirements.

And in the high school, for these and other reasons, school administrators and students across the nation are showing a disinterest in either offering or learning foreign languages. Enrollments are dropping and the place of foreign language instruction in the curriculum is being challenged.

While this situation has stemmed in part from a changing society, a realignment of social and educational priorities and the "cannonization of relevancy," such circumstances alone would not be sufficient to produce the current attacks.

It is generally agreed that all children do not learn alike. The literature reviewed in this study indicates that little is known about the structure of learning. The study deals with those cognitive characteristics which are measurable and, in doing so, sheds more light on student learning.

The diagnostic procedure utilized at Oakland Community College in Bloomfield Hills, Michigan, was used with two classes in French I at two schools, East Lansing High School and Hannah Middle School (also at East Lansing, Michigan). Measurable cognitive elements were provided for each student and both teachers.

The data were analyzed by use of the analysis of variance technique to show interaction of cognitive sets or categories of cognitive elements on the hypotheses. In order to further search for significant elements or characteristics, the data were further broken down by use of the Kolmogorov-Smirnov Statistical Test Model.

The findings emanating from the Anova Techniques appear to reject the null hypotheses and call for the acceptance of the "alternate" hypothesis. (The null hypothesis stated that there is no difference between the mean grade point associated with teacher I and teacher II. It is rejected.) There is a difference between the mean grade point associated with teacher I and teacher II. In other words, there is a relationship between the variables

of cognitive style groupings and both teachers and the evaluation both teachers made of their students.

When component sets of cognitive style were broken down into discrete characteristics, it was impossible to show any "like" or "unlike" group relationship of student and teacher characteristics. However, this was the first study which attempts to analyze "like" and "unlike" groupings in terms of individual sets as opposed to the Cartesian product of three sets which indicate the cognitive style of an individual. The studies cited in the related literature compared the total cognitive styles of the students and teachers in making "like" and "unlike" comparisons. The present study sought to determine the influence of one component of a characteristic (for example, [T(AL)-Q(CEM)]]. It is also possible that the issue involved may be less "like/unlike the teacher's style" than a matter of "like/unlike the instructional experience style." This could indicate the possibility of another variable somewhat compatible to methodology and teacher style.

Therefore, conclusions from the related literature may still be valid. Furthermore, we have another dimension which has been added to the evaluation process of foreign language instruction.

Conclusions

1. In answer to the question: Is there a relationship between the measurable cognitive styles of a French I teacher and student and the student's success in French I? The response can be given on the basis of the rejection of the null hypothesis in the analysis of variance by saying:

> Due to the observed "F-ratio" being greater in value than that of the critical values of the "F-ratio," there is a significant difference between "like" and "unlike" group mean scores associated with the individual sets comprising the Cartesian product denoting the cognitive style of an individual, i.e., there is a significant difference between "like" and "unlike" group mean scores according to symbolic orientation, cultural determinants and modes of inference, respectively. The fact that the mean scores, in some cases, favored the "unlike" group, while in others favored the "like" group, at a significant level, would indicate that the total cognitive style should be used to "predict" which group, "like" or "unlike," the teacher's evaluation (letter grade) might favor. A relationship does exist between the students' and teachers' styles, but analyzing the relationship in terms of the individual sets

comprising "style" instead of analyzing it in terms of the total cognitive style yields an "unpredictability" factor that otherwise does not seem to exist. For example, this finding, and conclusion, is not supported by Lawrence Wasser's[51] study which clearly showed that, employing total cognitive style to determine "like" and "unlike" groupings, teachers tended to mark groups with "like" styles significantly higher than the group of students with styles "unlike" those of the teacher.

In other words, since the total cognitive style was broken down into the three component sets when the characteristics of the student and teacher were matched, they were matched on the basis of independent sets. This could mean, for example, that one student could be "like" the teacher in one set and "unlike" in the other two sets. If the total cognitive profile had been taken into account, that one student could have been entered as a total "like" or "unlike" characteristic within the profile. This seems to indicate that scores function differently when treated in smaller component parts in an attempt to relate it to an upper tier which is made up of those three parts.

---

[51]Wasser, op. cit., p. 27.

2. In answer to the question: What are the cognitive elements within the set of symbolic orientation which tend to show a major or minor "match" between teacher and student in cases of student success in foreign language courses?

According to the data analyzed by the Kolmogorov-Smirnov Statistical Test no significant findings were yielded through the analyses which involved the characteristics being broken down this minutely, and when used in isolation from the total cognitive style. Again, the "whole picture," so to speak, is needed.

3. In answer to the questions: What are the cognitive elements within the set of cultural determinants which tend to show major and minor "match" between teacher and student in cases of success of foreign language courses? and

4. What are the cognitive elements within the set of modes of inference which tend to show major and minor "match" between teacher and student in cases of success of foreign language courses?

The conclusions also arrived at for question 2 are appropriate for the sets of cultural determinants and modes of inference.

5. In answer to the question: Does the age level of the student affect the relationship of cognitive match and success in a course?

The findings indicate that the two teachers did not have the same grading procedure. It may be that the different age levels of the two groups, high school and middle school, affected the grade mean of the two teachers (teacher II graded significantly higher than teacher I). This was probably only one factor responsible for this finding. Another factor may be that there is a different philosophy of grading operating at each school.

Discussion

This study appears to have created more questions than answers. Many of these questions need to be pursued. The specific direction of those questions is discussed in some detail in the section of "Implications for Future Research." At the conclusion of the study the implications for curriculum tend to follow in two general categories. The first of these, "Individual Differences," is based upon the statistical findings. The second implication is related to the whole question of the validity of grades and are more observations than findings.

Individual Differences

The most significant statistical finding of the study is the discovery that it is impossible to isolate a discrete characteristic which has a significant impact on the hypothesis. Applying the present findings to the concept of individual differences, one finds that there is considerable objective support in the present data for the need to view the individual child as a whole rather than as a set of isolated emotional-social-cognitive characteristics. Even with supportive data which implies the importance of complete profile data, there is still an incomplete picture of the learner. Indications are that reading level alone or any other standardized test measurement cannot and should not play as significant a role in school as it presently does. A study of the total cognitive style can become a contribution when it is utilized for the purpose of providing appropriate learning situations for the child as this gives to educators a much more complete picture of the student.

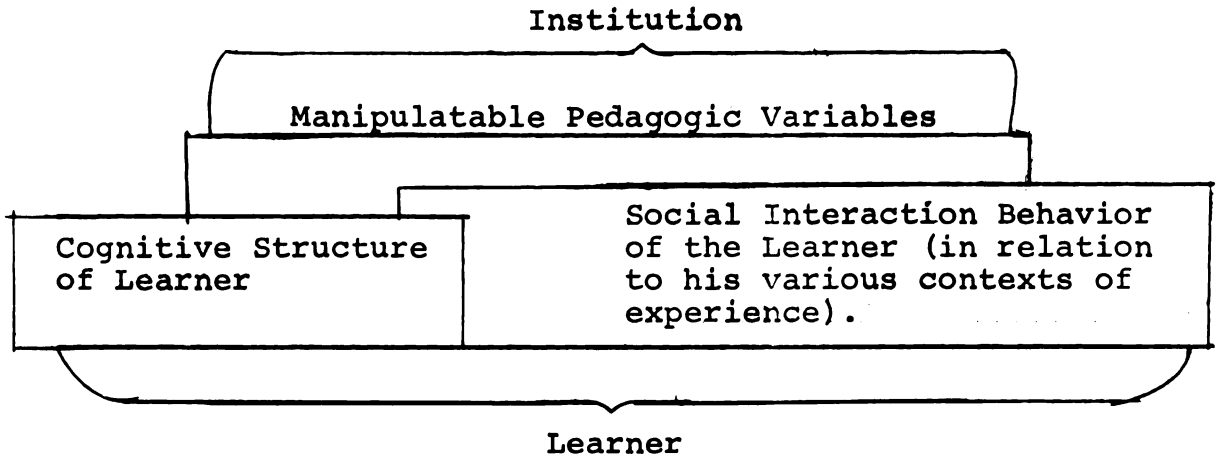
This becomes particularly significant in foreign language instruction. Four skills have been defined as a part of the total ability to speak another language. Comprehension, speaking, reading and writing are necessary for effective communication; however, in most schools there is one grade given to represent performance in all of these skills. Furthermore, one methodology is provided

to accommodate all students pursuing proficiency in foreign language usage. If, indeed, students are different, why must they be guided through the educational process with limited data being used for decisions regarding learning and why must he be placed in a learning environment which gives the impression all students learn alike? It must be noted that the relationship of specific profiles to certain curricular environments was not a part of this study and must remain for future action research.

In summation, various descriptive tests and inventories can give feedback information provided by the child about himself and, in turn, could be used as a way of guiding him through a more introspective experience in education whether it be the choice of a teacher or an alternative learning environment.

Educational theorists constantly are reminding us to look at the whole child, yet practitioners on a daily basis are making decisions concerning children by use of very isolated and rigid testing data.

Perhaps the true picture would look something like this:



Here we see the institution dealing with available manipulatible pedagogic variables which affect the learner in both his structured learning and his social experiences. The institution should and must continue to research better ways to interact with the learner within this area; however, one must always keep in mind that there are aspects of both cognitive structure and of social interaction behavior which lie outside the domain of manipulatable pedagogic variables.

Grades

None of the findings either directly support or repute the use of grades; however, there were observations made throughout the study which are worthy of mention.

The question of validity of grades was approached at the beginning of the study. The grade was never intended to serve as a valid representation of proficiency or a

symbol of success. It represented merely the teacher's judgmental, real-world evaluation.

After this study, less confidence is expressed in the present grading system to measure success in foreign language. In fact, there is a possibility that the tendency of the second teacher to grade high may have resulted in the matching of "unlike" characteristics to success in the class.

The middle school teacher expressed an unwillingness to assign grades to the students. She said that students who were failing dropped out so she gave no D's and E's and did give mostly A's and B's. Her approach to success in the class was much broader and less based upon test grades and stylized performance. She expressed a lack of confidence in grades and supported the Hannah Middle School practice which does not provide for their use. In other words, her evaluation of the student included more input than the performance of the student in foreign languages. As mentioned before, this probably threw off the data, but as it affects grading procedures it become evident that many subjective influences effect "grades." Parents and students usually assume that grades represent performance whereas in reality they represent, as in this study, many variables, i.e., teacher philosophy, school philosophy, test grades, behavior, etc.

Implications for Future Research

1. The existing study should be replicated by using a valid statement for measuring proficiency in foreign languages.

2. Once accurate assessment is made of proficiency, a comparison could be made of the total cognitive styles of teachers and students as they relate to a more efficient measure of proficiency.

3. Two teaching techniques could be provided, one audio-lingual and one traditional, and they could be related to cognitive style to determine tolerance to different curricular environments.

4. The present studies could also be replicated in other cognitive areas to assess the same types of data.

5. It would be interesting to compare high school test behavior under the same general condition in a different socio-economic-strata high school.

Recommendations

The recommendation, therefore, is to strive for understanding and cautious attention to future research.

1. Cognitive style diagnosis is very new and offers much promise for future research. The possibilities are great, but much care must be taken in utilizing these kinds of data.

The impact of cognitive style diagnosis curriculum could be significant or damaging. Both its limitations and possibilities must be observed by professional educators.

To blindly accept this procedure as another educational panacea would be disastrous; to categorically dismiss it and hope it will go away is foolhardy. Researchers should examine findings carefully before rushing forward to implement innovations based on them.

2. Courses in cognitive style mapping, diagnosis and use of data should be examined for inclusion in the programs of major teacher training institutions.

3. Inservice courses should be held in secondary schools to familiarize teachers with the theory and terminology of this approach to cognitive style. This is only one approach to the theory of cognition. It is assumed that other theories of cognition and cognitive development have valid methods of measurement.

4. Further instruments and techniques to give feedback to students concerning progress should be developed and researched as an alternative to the rigid and, in this study, ineffective teacher grade to measure success in the class.

5. Foreign language teachers having extensive profile data on students should do some action research to

try to assess the tolerance of certain profiles to certain curricular environments.

BIBLIOGRAPHY

BIBLIOGRAPHY

Allport, Gordon W. Personality, A Psychological Interpretation. New York: Henry Holt and Company, 1937.

Barron, Frank. "Some Personality Correlates of Independence of Judgment." Journal of Personality, Vol. 21 (March, 1953), 287-297.

Bigelow, Gordon S. and Robert L. Egbert. "Personality Factors and Independent Study." The Journal of Educational Research, Vol. 62, No. 1 (September, 1968), 27-29.

Broverman, D. M. "Dimensions of Cognitive Styles." Journal of Personality, Vol. 28 (1960), 183.

Carpenter, Finley, and Hadden, Eugene E. Systematic Application of Psychology. New York: Macmillan Company, 1964.

Cotter, Jude T. "The Affects of the Educational Science of Cultural Determinants of the Meanings of Symbols on Curricular Choice." Unpublished Ph.D. dissertation, Wayne State University, 1970.

Dehnke, Ronald E. "An Exploration of the Possible Isomorphism of Cognitive Style and Successful Teaching of Secondary School English." Unpublished Ph.D. dissertation, Wayne State University, 1966.

DeLoach, Joseph F. "An Analysis of Cognitive Style Disparity as an Antecedent of Cognitive Dissonance in Instructional Evaluation: An Exploratory Study in the 'Educational Sciences.'" Unpublished Ph.D. dissertation, Wayne State University, 1969.

Fragale, Marvin Joseph. "A Pilot Study of Cognitive Styles of Selected Faculty Members and Students in a Community College Setting." Unpublished Ph.D. dissertation, Wayne State University, 1969.

Gagne, Robert M. Learning and Individual Differences. Columbus, Ohio: Charles E. Merrill Books, Inc., 1967.

Gardner, R. W., et al. "Cognitive Control: A Study of Individual Consistencies in Cognitive Behavior." Psychological Issues, Vol. 1, No. 4, 3.

Hardin, Garrett. "Biology and Individual Differences." Individualizing Instruction. The Sixty-first Yearbook of the National Society for the Study of Education, Part I. Chicago: University of Chicago Press (1962), 13.

Hedley, Carolyn Neal. "The Relationship of Personality Factors to Scientific and Mathematical Ability Factors." School Science and Mathematics, Vol. 68 (1968), 265-271.

Hill, Joseph E. "Cognitive Style as an Educational Science." Unpublished paper, Oakland Community College, 1968.

Hill, Joseph E., and Kerber, August. Models, Methods, and Analytical Procedures in Educational Resources. Detroit: Wayne State University Press, 1967.

Keating, R. F. A Study of the Effectiveness of Language Laboratories. New York: Columbia University, Institute of Administrative Research, Teachers College, 1963.

Kelly, Earl C. Education for What is Real. New York: Harper and Row, 1947.

Klein, G. S. "The Personal World through Perception." Perception: An Approach to Personality. Edited by R. R. Blake, and V. V. Ramsey. New York: Ronald Press, 1951.

Majer, Kenneth. "Differential Relationships Between Personality and Performance Under Dissimilar Modes of Instruction." AV Communication Review, Vol. 18, No. 2 (Summer, 1970), 169-179.

Mouw, John T. "Effect of Dogmatism on Levels of Cognitive Processes." Journal of Educational Psychology, Vol. 60, No. 5 (1969).

Rankin, Stuart C. "A Theory of an Isomorphism-Model-Hypothesis Method of Thought." Unpublished Ph.D. dissertation, Wayne State University, 1964.

Robinson, Richard L. "A Descriptive Study of Specific Achievements and Aptitudes of the High Risk Students in Oakland University's Higher Opportunities Program in Education." Unpublished Ph.D. dissertation, Wayne State University, 1969.

Rokeach, M. The Open and Closed Mind. New York: Basic Books, 1960.

Rosander, A. C. Elementary Principles of Statistics. New York: D. Van Nostrand, 1951.

Shuert, Keith L. "A Study to Determine Whether a Selected Type of Cognitive Style Predisposes One to do Well in Mathematics." Unpublished Ph.D. dissertation, Wayne State University, 1970.

Smith, Charles P., and Winterbottom, Miriam T. "Personality Characteristics of College Students on Academic Probation." Journal of Personality, Vol. 38, No. 3 (September, 1970), 379-399.

Smith, Philip D., Jr., and Baranyi, Helmut A. A Comparison Study of the Effectiveness of the Traditional and Audiolingual Approaches to Foreign Language Instruction Utilizing Laboratory Equipment. Washington, D.C.: U.S. Department of Health, Education and Welfare, Office of Education, 1968.

Snow, Richard E., Tiffen, Joseph, and Seibert, Warren F. "Individual Differences and Instructional Film Effects." Journal of Educational Psychology, Vol. 56, No. 6 (1965), 315-326.

Stroup, Atkee L. "The Prediction of Academic Performance from Personality and Aptitude Variables." The Journal of Experimental Education, Vol. 38, No. 3 (Spring, 1970), 83-86.

Thorndike, Edward L., quoted in Morris L. Bigge and Maurice P. Hunt. Psychological Foundations of Education. New York: Harper and Row, 1968.

Wasser, Laurence. "An Investigation into Cognitive Style as a Facet of Teachers' Systems of Student Appraisal." Unpublished Ph.D. dissertation, University of Michigan, 1969.

Witkin, H. A. "Individual Differences in Cases of Embedded Figures." Journal of Personality, Vol. 19, pp. 1-15.

Wyett, Jerry L. "A Pilot Study to Analyze Cognitive Style and Teaching Style with Reference to Selected Strata of the Defined Educational Sciences." Unpublished Ph.D. dissertation, Wayne State University, 1969.

Zussman, Steven P. "A Pilot Study Exploration of Cognitive Style and Administrative Style as Defined in the Educational Sciences." Unpublished Ph.D. dissertation, Wayne State University, 1968.

APPENDICES

APPENDIX A

Instruments included here are presented by the initial pages of each test given. They may be found in their entirity in the library of the Testing Center of Oakland Community College. For further information contact Dr. Virginia Spagr, Oakland Community College, Bloomfield Hills, Michigan.

TEST I

DIRECTIONS

ANSWERS ARE TO BE MARKED ON I B M CARDS ONLY

Choose the pair of words so that the sentence will be true and sensible.

The first word of the pair you choose goes in the blank space at the beginning of the sentence; the second word of the pair goes in the blank at the end of the sentence.

When you have picked the pair to fill in the blanks, fill in the letter for that pair on the I. B. M. card.

Example X: ..... is to water as eat is to .....

A. continue.....drive
B. foot.....enemy
C. drink.....food
D. girl.....industry
E. drink.....enemy

ANSWER CARD:

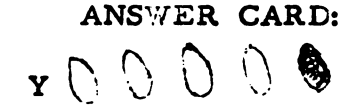
The answer is C. The words drink and food complete the sentence so it is true and sensible.

Now look at the next example:

Example Y ..... is to night as breakfast is to .....

A. supper.....corner
B. gentle.....morning
C. door..... corner
D. flow.....enjoy
E. supper ...morning

ANSWER CARD:



The answer is E. If your answer is incorrect, reread example X.

1. Turn the page
2. Read the directions
3. You have 15 minutes for this test.

TEST III

DIRECTIONS

This test consists of 20 numerical problems. Next to each problem there are five answers.

You are to pick out the correct answer and fill in its letter on the answer card. If you do not find a correct answer among the first four choices, fill in the "E" as your answer.

Choice E for every problem is "none of these" which means that a correct answer is not among the first four choices.

Only one answer should be marked for each problem.

Do your figuring on the scratch paper you have been given, and reduce fractions to lowest terms. For example, if two choices are 1 1/2 and 1 2/4, only the 1 1/2 is correct.

The following are examples of problems in the test:

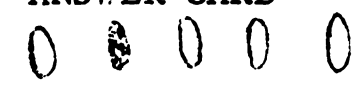
Example X

ADD
13
12

Answers

A. 14
B. 25
C. 16
D. 59
E. None of these

ANSWER CARD

X 

In Example X, 25 is the correct answer, so the letter B has been filled in.

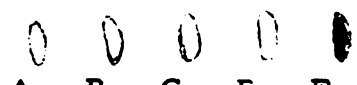
Example Y

SUBTRACT
30
20

Answers

A. 15
B. 26
C. 16
D. 8
E. None of these

ANSWER CARD

Y 

In example Y, the correct answer has not been given, so the letter E has been filled in.

PLEASE DO NOT TURN THE PAGE.

TEST IV

Directions to Students

A. **Do not turn this page of the test booklet until directed to do so.**

B. **There are eight selections in this part of the test. Read a selection through completely; then answer the questions. When you have completed one selection, go immediately to the next. Keep working until you have completed all the selections or until you are told to stop. To answer a question, you may, if you wish, look back at the material you have read. But do not puzzle too long over any one question. After a reasonable effort, go on to the next question.**

C. **You will have 20 minutes to work this part of the test. When the examiner tells you to begin, turn this page and start immediately to read Unit I.**

D. **Wait for the signal to turn this page.**

MAKE NO MARKS ON THIS TEST BOOKLET

FORM II

TEST I

TEST I

DIRECTIONS

Each of the 25 sentences in this test has the first word and the last word left out. You are to pick out words which will fill the blanks so that the sentence will be true and sensible.

For each sentence you are to choose from among five pairs of words to fill the blanks. The first word of the pair you choose goes in the blank space at the beginning of the sentence; the second word of the pair goes in the blank at the end of the sentence. When you have picked the pair to fill in the blanks, fill in the letter of that pair.

Example X. .....is to water as eat is to.....

A. continue.....drive
B. foot.....enemy
C. drink.....food
D. girl.....industry
E. drink.....enemy

DRINK is to water as eat is to FOOD. DRINK is the first word of pair C and FOOD is the second word of pair C, so the C has been filled in.

ANSWER CARD:

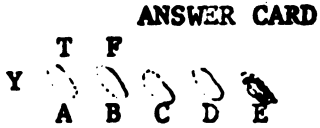
Now look at the next example.

Example Y. ..... is to night as breakfast is to .....

A. supper.....corner
B. gentle.....morning
C. door.....corner
D. flow.....enjoy
E. supper.....morning

SUPPER is to night as breakfast is to MORNING. Pair E has both SUPPER and MORNING; SUPPER fits in the blank at the beginning of the sentence and MORNING fits in the blank at the end. the E has been filled in.

ANSWER CARD:



You will have 15 minutes for this test. Work as rapidly and as accurately as you can. If you are not sure of an answer, mark the choice which is your best guess. Mark all of your answers on the answer card provided. Be sure to put the correct answer by the correct number.

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.

DIRECTIONS

This test consists of 20 numerical problems. Next to each problem there are five answers. You are to pick out the correct answer and fill in its letter on the answer card. If you do not find a correct answer among the first four choices, fill in the E as your answer. Choice E for every problem is "none of these" which means that a correct answer is not among the first four choices. Only one answer should be marked for each problem. Do your figuring on the scratch paper you have been given, and reduce fractions to lowest terms.

The following are examples of problems in the test.

Example X.

ADD 13
12

A 14
B 25
C 16
D 59
E none of these

ANSWER CARD:

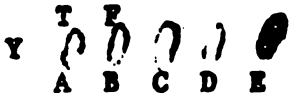
In Example X, 25 is the correct answer, so the letter B -- has been filled in.

Example Y.

SUBTRACT 30
20

A 15
B 26
C 16
D 8
E none of these

ANSWER CARD:



In Example Y, the correct answer has not been given, so the letter ---E--- has been filled in.

Remember, each answer must be reduced to its simplest terms. For example, if two choices are 1 1/2 and 1 2/4, only the 1 1/2 is correct.

DO ALL YOUR FIGURING ON THE SCRATCH PAPER, NOT IN YOUR BOOKLET.

You will have 15 minutes for this test. Work as rapidly and as accurately as you can. Do not spend a long time on any one problem. If you are not sure of an answer, mark the choice which is your best guess.

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.

FORM II

TEST [redacted] TEST [redacted]

DIRECTIONS

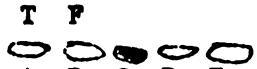
Read these paragraphs. Draw a mark in the circle which has the letter of the best answer to the question or completes the sentence. Draw a mark in one circle only. Do the exercises as rapidly as you can without making errors. This is a timed test.

SAMPLE: All night long the truck driver sat at the wheel of the huge trailer truck. He drove the twisting highways until dawn. How did he feel then?

A. rested B. amused C. tired D. fresh

ANSWER CARD:

T F

1. 

A B C D E

On the next pages are more paragraphs similar to this sample. When your teacher tells you to turn the page, read the paragraphs and draw a mark in the proper circle which best answers the question or completes the sentence. Be sure to do the paragraphs in order 1, 2, 3, etc., in which they are numbered.

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO BEGIN.

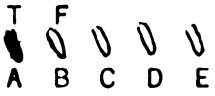
DIRECTIONS

This test consists of a series of sentences, each divided into four parts lettered A, B, C, D and E. You are to look at each sentence and decide which part has an error in grammar, punctuation or spelling. When you have decided which part is wrong fill in the space next to the letter on your answer card.

Some sentences have no error in any part. If there is no error in a sentence, fill in the space next to the letter E.

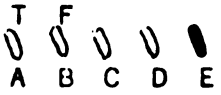
Example X: Ain't we/ going to/ the office/ next week?
A B C D E

ANSWER CARD:



Example Y: I went/ to a ball/ game with/ Jimmy.
A B C D E

ANSWER CARD:



In Example X, "ain't" is wrong, so the A has been marked. There is no error in Example Y, so the E has been marked.

There is no more than one wrong part in any sentence. When you find a part with an error, fill in the space next to its letter. Some of the sentences are entirely correct. If no part has an error, fill in the space next to the E.

You will have 13 minutes for this test. Work as rapidly and as accurately as you can. If you are not sure of an answer, mark the choice which is your best guess. Do all your work on your answer card.

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO

DIRECTIONS

The following test is untimed. However, work quickly and give the first answer that comes to you. Do not spend a lot of time on any one question. Your first impression is important. Mark your answers on the answer card.

There are 32 items and you are to rate each one with regard to how it is like you. Fill in the space, on your answer card, under the proper letter. (A = usually; B = sometimes; C = seldom; D = never)

EXAMPLE:

I would make a good football player.

A. usually B. sometimes C. seldom D. never

In this case you believe you would "usually" be good as a football player.

Rate all 32 items and put your answers in the proper place on your answer card.

DO NOT TURN THE PAGE UNTIL TOLD TO DO SO

DIRECTIONS

Following are some stories or incidents that might happen to people in which they must make a choice as to how to respond or react.

We want to know how you would respond, according to what you would do in real life, if you were required to choose among the possible reactions the one that was "most like you" and the one that was "least like you".

In the following examples there are three choices. You MUST make two choices in each example and leave one blank. Make the appropriate mark on your answer card according to your choice. In each question you must make a choice of what is "most like you" (A - MOST) and what is "least like you" (B - LEAST) and leave one choice blank.

EXAMPLE

A. Sue Bryant is planning to buy a new set of clothes for a long vacation trip. She should:

1. Consult her parents and sisters on what to buy.

   A). MOST B). LEAST

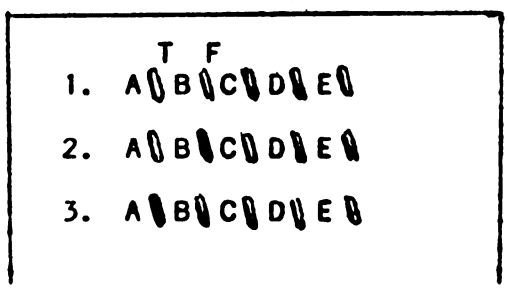
2. Make her own decision.

   A). MOST B). LEAST

3. Ask the advice of her girlfriends.

   A). MOST B). LEAST

SAMPLE ANSWER CARD



In the above example it would be most like you to ask the advice of your friends and least like you to make a decision alone on what to buy.

Remember, you MUST make a choice of what is "most like you" (MOST) and what is "least like you" (LEAST), and leave one BLANK.

DO YOUR WORK ON THE ANSWER CARD PROVIDED

TEST X DIRECTIONS TEST X

In this test there are ten (10) situations in which you are asked to imagine yourself. Each situation has four (4) alternative responses. You are to decide which response you would "most likely" make as the first or best solution, then the second best, the third best, and the fourth best.

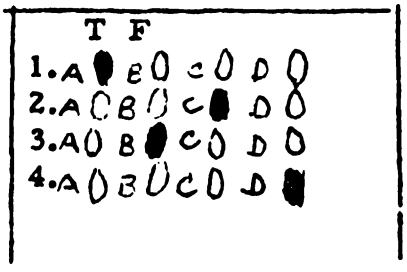
Remember YOU MUST RANK ALL FOUR RESPONSES for each situation.

READ ALL FOUR (4) RESPONSES BEFORE YOU MAKE YOUR SELECTIONS.

EXAMPLE

If you had to organize a baseball team, you would:

1. Pick from previously established teams.
   A. first choice
   B. second choice
   C. third choice
   D. fourth choice
2. Get all new untried players.
   A. first choice
   B. second choice
   C. third choice
   D. fourth choice
3. Bring older experienced players from retirement.
   A. first choice
   B. second choice
   C. third choice
   D. fourth choice
4. Compare each choice to an established star.
   A. first choice
   B. second choice
   C. third choice
   D. fourth choice



SAMPLE ANSWER CARD

In this example #1 would be your first choice, #2 would be your third choice, #3 would be your second choice, and #4 would be your fourth choice.

TEST VIII

TEST VIII

DIRECTIONS

The following test is untimed.

Work quickly and give the first answer that comes to you.

Your first impression is important.

Do not spend a lot of time on any one question.

There are 40 items.

Fill in the space on the IBM card under the proper letter.

A = usually
B = sometimes
C = seldom
D = never

EXAMPLE:

I would make a good football player.
A. usually B. sometimes C. seldom D. never

1. A● B○ C○ D○ E○

In this case you believe you would "usually" be good as a football player.

DO NOT MARK IN TEST BOOKLET

TEST IX

DIRECTIONS

Following are some stories or incidents that might happen to people. Three possible responses are given. You are required to choose which of these is "most like you" and which is "least like you". You will leave one choice blank. Read the example.

EXAMPLE

A. Sue Bryant is planning to buy a new set of clothes for a long vacation trip. She should:

1. Consult her parents and sisters on what to buy.
A. MOST B. LEAST

2. Make her own decision.
A. MOST B. LEAST

3. Ask the advice of her girlfriends.
A. MOST B. LEAST

1. A○ B○ C○ D○ E○
2. A○ B● C○ D○ E○
3. A● B○ C○ D○ E○

In the above example it would be "most like you" to ask the advice of your friends and "least like you" to make a decision alone on what to buy, and you left one choice (1) blank.

TEST VII

DIRECTIONS

The following test is untimed.

Work quickly and give the first answer that comes to you.

Your first impression is important.

Do not spend a lot of time on any one question.

There are 40 items.

Fill in the space on the IBM card under the proper letter.

A = usually
B = sometimes
C = seldom
D = never

EXAMPLE:

I would make a good football player.
A. usually B. sometimes C. seldom D. never

1. A● B○ C○ D○ E○

In this case you believe you would "usually" be good as a football player.

DO NOT MARK IN TEST BOOKLET

APPENDIX B

WORK TABLES

ANOVA GRID

Table 1 represents the effect of teacher and style upon the H_1. Since there are two groups being acted upon, the formula must be weighted by 1/2.

WORK TABLE 1.

Teacher I			Teacher II		
Cognitive Style Set			Cognitive Style Set		
S	E	H	S	E	H
$\frac{\Sigma}{9}\tilde{X}$ Grade Pte.	$\frac{\Sigma}{9}\tilde{X}$	$\frac{\Sigma}{9}\tilde{X}$	$\frac{\Sigma}{9}\tilde{X}$ Grade Pte.	$\frac{\Sigma}{9}\tilde{X}$	$\frac{\Sigma}{9}\tilde{X}$
$\Sigma\Sigma_9X=59$	$\Sigma\Sigma_9X=59$	$\Sigma\Sigma_9X=59$	$\Sigma\Sigma_9X=72$	$\Sigma\Sigma_9X=58$	$\Sigma\Sigma_9X=49$
(N=23)	(N=23)	(N=23)	(N=23)	(N=18)	N=15)

Total Sum of Squares:

$$\frac{1}{2}\left[\frac{(59)^2}{23}+\frac{(59)^2}{23}+\frac{(59)^2}{23}+\frac{(72)^2}{23}+\frac{(58)^2}{18}+\frac{(49)^2}{15}\right]$$

$$=\frac{1026.45}{2}=513.225=B$$

Table 2 represents the effect of style and groupings upon the H_1. Since there are two teachers being acted upon, the formula must be weighted by 1/2.

WORK TABLE 2.

Student Groupings	Cognitive Style Sets S	E	H
	Grade Point 2^X	2^X	2^X
L	$\Sigma\Sigma_t X=82$ (N=30)	$\Sigma\Sigma_t X=73$ (N=29)	$\Sigma\Sigma_t X=93$ (N=33)
U	$\Sigma\Sigma_t X=49$ (N=16)	$\Sigma\Sigma_t X=44$ (N=14)	$\Sigma\Sigma_t X=15$ (N=5)

Total Sum of Squares:

$$\frac{1}{2}\left[\frac{(82)^2}{30}+\frac{(73)^2}{27}+\frac{(93)^2}{33}+\frac{(49)^2}{16}+\frac{(44)^2}{14}+\frac{(15)^2}{5}\right]$$

$$=\frac{1016.96}{2}=508.48=B_2$$

Table 3 represents the effect of teacher and groupings upon each one. Since there are three styles being acted upon the formula is weighted by 1/3.

WORK TABLE 3.

Grouping	Teacher I	Teacher II
	Grade Point $\frac{\Sigma X}{3}$	$\frac{\Sigma X}{3}$
L	$\Sigma\Sigma_3 X = 148$ (N=59)	$\Sigma\Sigma_3 X = 100$ (N=31)
U	$\Sigma\Sigma_3 X = 29$ (N=10)	$\Sigma\Sigma_3 X = 79$ (N=25)

Total Sum of Squares

$$\frac{1}{3}\left[\frac{(148)^2}{59} + \frac{(100)^2}{31} + \frac{(29)^2}{10} + \frac{(79)^2}{25}\right] = \frac{1027.59}{3} = 342.53 = B_3$$

$$\frac{1}{3}\ [371.25 + 322.60 + 84.10 + 249.64]$$

Table 4 represents the effect of groupings upon the H_1. Since the teachers and styles are being acted upon the formula is weighted by 1/6.

WORK TABLE 4.

Groupings	Grade Point $\frac{\Sigma\Sigma\ 6}{X}$
L	$\Sigma\Sigma X = 248$ (N = 90)
U	$\Sigma\Sigma X = 108$ (N = 35)

Total Sum of Squares:

$$\frac{1}{6}\left[\frac{(248)^2}{90} + \frac{(108)^2}{35}\right] = \frac{1016.64}{6} = 169.44 = C_1$$

Table 5 represents the effect of style upon the H_1. Since the teachers and the groups are being acted upon, the formula is weighted by 1/4.

WORK TABLE 5.

Cognitive Style Sets		
S	E	H
Grade Point		
$\frac{\Sigma\Sigma X}{4}$	$\frac{\Sigma\Sigma X}{4}$	$\frac{\Sigma\Sigma X}{4}$
$\Sigma\Sigma X = 131$ (N=46)	$\Sigma\Sigma X = 117$ (N=41)	$\Sigma\Sigma X = 108$ (N=38)

Total Sum of Squares:

$$\frac{1}{4}\left[\frac{(131)^2}{46} + \frac{(117)^2}{41} + \frac{(108)^2}{38}\right] = \frac{1,014.00}{4} = 253.50 = C_2$$

Table 6 represents the effect of teacher as a main effect factor upon the H_1. Since the students and groupings are being acted upon, the formula is weighted by 1/6.

WORK TABLE 6.

Teacher I	Teacher II
Grade Point	Grade Point
$\frac{\Sigma\Sigma X}{6}$	$\frac{\Sigma\Sigma X}{6}$
$\Sigma\Sigma X = 177$ (N = 69)	$\Sigma\Sigma X = 179$ (N = 56)

Total Sum of Squares:

$$\frac{1}{6}\left[\frac{(177)^2}{69} + \frac{(179)^2}{56}\right] = \frac{1026.20}{6} = 171.03 = C_3$$

Table 7 represents the effect of a grade point mean upon the H_1. Since the groupings, students and teachers are being acted upon, the formula is weighted by 1/12.

WORK TABLE 7.

Grade Point $\frac{\Sigma\Sigma\Sigma X}{12}$
$\Sigma\Sigma\Sigma X = 356 \quad (N = 125)$

Total Sum of Squares:

$$\frac{1}{12}\left[\frac{(356)^2}{125} = \frac{1013.9}{12}\right] = 84.49 = D$$

WORK TABLE 8.--Summary table of sums of squares equations.

Sources of Variation	Equations
Interaction:	
1. Groupings x Style x Teacher	$A - \sum_{i=1}^{3} B_i + \sum_{i=1}^{3} C_i - D$
2. Teacher x Style	$B_1 - (C_2 + C_3) + D$
3. Style x Grouping	$B_2 - (C_1 + C_2) + D$
4. Teacher x Grouping	$B_3 - (C_1 + C_3) + D$
Main Effects:	
5. Grouping	$C_1 - D$
6. Style	$C_2 - D$
7. Teacher	$C_3 - D$

Actual Summations Of:

Interaction 1:

1034.20-(513.225+508.48+342.53) + (169.44+253.50+171.03) -84.49 = 1,628.27 - 1,448.73 = 179.54

Interaction 2:

513.225-(253.50+171.03) + 84.49 = 597.72 - 424.53 = 173.19

Interaction 3:

508.48-(169.44+253.50) + 84.49 = 592.97 - 422.94 = 170.03

Interaction 4:

342.53-(169.44+171.03) + 84.49 = 427.02 - 340.47 = 86.55.

Main Effects 5: 169.44 - 84.49 = 84.95

Main Effects 6: 253.50 - 84.49 = 169.01

Main Effects 7: 171.03 - 84.49 = 86.54

APPENDIX C

KOLMOGOROV-SMIRNOV STATISTICAL TEST MODEL

KOLMOGOROV-SMIRNOV STATISTICAL TEST MODEL

T(VQ) - Q(CET)

	4	3	2	1	0
L	6	9	8	1	1
U	5	10	6		

T(VQ) - Q(CP)

	4	3	2	1	0
L	6	11	9	1	1
U	5	8	5		

T(AQ) - Q(CEM)

	4	3	2	1	0
L	10	15	11	1	1
U	1	4	3		

T(VQ) - Q(CKH)

	4	3	2	1	0
L	3	8	5	1	1
U	8	11	9		

T(AQ) - Q(CK)

	4	3	2	1	0
L	8	13	9	1	1
U	3	6	5		

T(AQ) - Q(CES)

	4	3	2	1	0
L	7	10	9	1	1
U	4	17	5		

T(AQ) - Q(CT)

	4	3	2	1	0
L	8	11	10	1	1
U	3	6	4		

T(AQ) - Q(CP)

	4	3	2	1	0
L	8	14	11	1	1
U	3	5	3		

T(AQ) - Q(CET)

	4	3	2	1	0
L	8	13	12	1	1
U	3	6	2		

T(VQ) - Q(CH)

	4	3	2	1	0
L	5	10	8	1	1
U	6	9	6		

T(VQ) - Q(CS)

	4	3	2	1	0
L	5	11	8	1	1
U	6	8	6		

T(AQ) - Q(CH)

	4	3	2	1	0
L	8	15	11	1	1
U	3	4	3		

T(AQ) - Q(CS)

	4	3	2	1	0
L	9	14	11	1	1
U	2	5	3		

T(AQ) - Q(CKH)

	4	3	2	1	0
L	7	11	9	1	1
U	4	8	5		

T(AL) - Q(CEM)

	4	3	2	1	0
L	8	12	10	1	1
U	3	7	4		

T(AL) - Q(CK)

	4	3	2	1	0
L	6	8	7	1	0
U	5	11	7		

T(AL) - Q(CT)

	4	3	2	1	0
L	6	8	8	1	1
U	5	11	6		

T(AL) - Q(CET)

	4	3	2	1	0
L	6	9	10	1	1
U	5	10	4		

T(AL) - Q(CES)

	4	3	2	1	0
L	4	7	7	1	1
U	7	12	7		

T(AL) - Q(CP)

	4	3	2	1	0
L	7	11	9	1	1
U	4	8	5		

T(AL) - Q(CKH)

	4	3	2	1	0
L	2	6	6	1	1
U	9	3	8		

T(AL) - Q(CH)

	4	3	2	1	0
L	6	11	9	1	1
U	5	8	5		

T(AL) - Q(CS)

	4	3	2	1	0
L	6	12	9	1	1
U	5	7	5		

T(VQ) - Q(CEM)

	4	3	2	1	0
L	8	12	9	1	1
U	3	7	5		

T(VQ) - Q(CK)

	4	3	2	1	0
L	5	7	8	1	1
U	6	2	6		

T(VQ) - Q(CT)

	4	3	2	1	0
L	5	8	6	1	1
U	6	11	8		

Cultural Determinants

	4	3	2	1	0
L	5	3	3		
U	5	17	11	1	1

Modes of Inference

	4	3	2	1	0
L	1	9	4	1	
U	9	11	10	1	