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DISSERTATION

Presented in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy in the Graduate School of the Ohio State University

By
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The Ohio State University

1977

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>ii</td>
</tr>
<tr>
<td>VITA</td>
<td>iii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>ix</td>
</tr>
<tr>
<td><strong>Chapter</strong></td>
<td></td>
</tr>
<tr>
<td>I. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>The Problem</td>
<td>5</td>
</tr>
<tr>
<td>Educational Cognitive Style Mapping</td>
<td>6</td>
</tr>
<tr>
<td>Design of the Study</td>
<td>9</td>
</tr>
<tr>
<td>Hypotheses</td>
<td>12</td>
</tr>
<tr>
<td>Significance of the Study</td>
<td>13</td>
</tr>
<tr>
<td>Definition of Terms</td>
<td>13</td>
</tr>
<tr>
<td>Organization of the Study</td>
<td>15</td>
</tr>
<tr>
<td>Chapter I Notes</td>
<td>17</td>
</tr>
<tr>
<td>II. REVIEW OF THE LITERATURE</td>
<td>19</td>
</tr>
<tr>
<td>Introduction</td>
<td>19</td>
</tr>
<tr>
<td>Tests of Perception and Cognitive Functioning</td>
<td>20</td>
</tr>
<tr>
<td>Observation Procedures</td>
<td>28</td>
</tr>
<tr>
<td>Self-Reporting Procedures</td>
<td>29</td>
</tr>
<tr>
<td>Educational Cognitive Style Mapping</td>
<td>32</td>
</tr>
<tr>
<td>Related Research</td>
<td>44</td>
</tr>
<tr>
<td>Chapter II Notes</td>
<td>54</td>
</tr>
<tr>
<td>III. PROCEDURES</td>
<td>62</td>
</tr>
<tr>
<td>Participating Teachers</td>
<td>63</td>
</tr>
<tr>
<td>Sampling Procedure</td>
<td>64</td>
</tr>
<tr>
<td>Instrumentation</td>
<td>67</td>
</tr>
<tr>
<td>Data Collection Procedures</td>
<td>70</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>73</td>
</tr>
<tr>
<td>Chapter III Notes</td>
<td>77</td>
</tr>
<tr>
<td>Chapter</td>
<td>Page</td>
</tr>
<tr>
<td>---------</td>
<td>------</td>
</tr>
<tr>
<td>IV. RESULTS .....................................</td>
<td>78</td>
</tr>
<tr>
<td>Analysis of Cognitive Style Inventory Data</td>
<td>78</td>
</tr>
<tr>
<td>Analysis of Teacher Assessment Data</td>
<td>82</td>
</tr>
<tr>
<td>Analysis of Correlations by Instructional Level, Grade Level, and Sex</td>
<td>84</td>
</tr>
<tr>
<td>Analysis of Individual Subject Correlations</td>
<td>89</td>
</tr>
<tr>
<td>Total Sample Correlations</td>
<td>92</td>
</tr>
<tr>
<td>Chapter IV Notes</td>
<td>99</td>
</tr>
<tr>
<td>V. SUMMARY, DISCUSSION, CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH</td>
<td>100</td>
</tr>
<tr>
<td>Summary</td>
<td>100</td>
</tr>
<tr>
<td>Discussion</td>
<td>101</td>
</tr>
<tr>
<td>Conclusions</td>
<td>117</td>
</tr>
<tr>
<td>Limitations</td>
<td>120</td>
</tr>
<tr>
<td>Recommendations for Further Research</td>
<td>121</td>
</tr>
<tr>
<td>Chapter V Notes</td>
<td>123</td>
</tr>
</tbody>
</table>

APPENDIX

| A COGNITIVE STYLE INVENTORY | 124 |
| B COGNITIVE STYLE INVENTORY: ITEMS GROUPED BY COGNITIVE STYLE ELEMENT | 136 |
| C TEACHER ASSESSMENT INSTRUMENT | 151 |

LIST OF REFERENCES | 154 |
<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Breakdown of Study Sample by Instructional Level, Grade Level, and Sex</td>
<td>66</td>
</tr>
<tr>
<td>2. Means and Standard Deviations of Cognitive Style Inventory Scores by Instructional Level</td>
<td>79</td>
</tr>
<tr>
<td>3. Multivariate Analysis of Variance of Cognitive Style Inventory Scores by Instructional Level</td>
<td>81</td>
</tr>
<tr>
<td>4. Means and Standard Deviations of Teacher Assessment Scores by Instructional Level</td>
<td>83</td>
</tr>
<tr>
<td>5. Correlations Between Cognitive Style Inventory Scores and Teacher Assessment Scores by Instructional Level</td>
<td>85</td>
</tr>
<tr>
<td>6. Correlations Between Cognitive Style Inventory Scores and Teacher Assessment Scores by Grade Level</td>
<td>87</td>
</tr>
<tr>
<td>7. Correlations Between Cognitive Style Inventory Scores and Teacher Assessment Scores by Sex</td>
<td>88</td>
</tr>
<tr>
<td>8. Minimum, Maximum, and Median Values of Coefficients of Correlation Between Individual Subjects' Cognitive Style Inventory Scores and Teacher Assessment Scores by Instructional Level</td>
<td>90</td>
</tr>
<tr>
<td>9. Mann-Whitney U Test for Coefficients of Correlation Between Individual Subjects' Cognitive Style Inventory Scores and Teacher Assessment Scores</td>
<td>90</td>
</tr>
<tr>
<td>10. Correlations Between Cognitive Style Inventory Scores and Teacher Assessment Scores for Total Sample ($N = 99$)</td>
<td>93</td>
</tr>
<tr>
<td>11. 95 Percent Confidence Intervals for Correlations Between Inventory Scores and Teacher Assessment Scores</td>
<td>95</td>
</tr>
<tr>
<td>Table</td>
<td>Page</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>12. Proportions of Explained and Residual Variance</td>
<td>97</td>
</tr>
<tr>
<td>In Inventory and Teacher Assessment Measures by Cognitive Style Element</td>
<td></td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Form Used to Plot a Cognitive Style Map</td>
<td>7</td>
</tr>
<tr>
<td>2. Design of the Study</td>
<td>11</td>
</tr>
<tr>
<td>3. Computer-Processed Cognitive Style Map</td>
<td>72</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

For many years the foreign language education profession was concerned — one might almost say obsessed — with a search for one "right" method of teaching the target language. Various periods in our professional history were dominated by one method or another: the Natural Method, the Direct Method, the Eclectic Method, the Reading Method, the Army Method, the Grammar-Translation Method, and the Audiolingual Method all had their day.

Our preoccupation with methodology has often led to acrimonious controversy over one method as against another. The debate in the 1960s, between the proponents of the Audiolingual Method and the so-called traditionalists who favored grammar and translation, was particularly divisive. During that time much of the research in foreign language education attempted to demonstrate the superiority of the audiolingual approach — with little success. In fact, the conclusion, if any, to be drawn from the preponderance of this research is one that is consistent with the results of many studies in education comparing one method with another: Given randomly selected groups of students, there is no significant difference in the effectiveness of any of the many different ways of teaching students.¹
Fortunately, in recent years dwindling enrollments and high attrition rates have compelled our professional attention in other directions. As Lafayette has stated,

We have spent an inordinate amount of time seeking one correct approach to teaching foreign languages with the result that every ten or fifteen years a new approach is introduced and immediately placed at odds against the old...Hopefully, the current enrollment and retention problems will suggest to all of us that the past is not to be emulated. Rather than pursuing the search for the one true faith, we should gather all that is good from various past methods and entertain the posibility of using different approaches with different students.\(^2\)

Lafayette's view is supported by Grittner and LaLeike, who observe that

After years of working with students who were learning a foreign language under conditions of individualized instruction, we have become convinced that there is no "best" method to teach any of the so-called foreign language skills that applies to all students. Clearly, different students can learn the same things in a great variety of ways, and many students will function much better if they are given a broad range of choices concerning how (authors' emphasis) they will learn.\(^3\)

Today we are beginning to realize that one reason for our students' failure to attain proficiency in the target language may be our failure to take their unique, individual characteristics as learners into account. Naiman underscores the importance of this insight:

We may be labeling far too many of our students as poor language learners because their personality traits or learning styles do not match the language programs in which they have been placed...Indeed, if we wish to ensure that students do not incorrectly become identified as poor language learners, we must become more sensitive to individual differences both in the goals of our students, and in their learning styles and personality characteristics.\(^4\)

Such a shift in emphasis requires a radical change in perspective.

In the past the teacher was the central focus of everything that took
place in the classroom. Today it is the student. Hosenfeld has aptly summed up the situation:

A fundamental change is occurring in the educational process: Every encounter between teacher and learner involves an exchange of information; formerly the teacher initiated the exchange and now it is initiated by the student...In the past a teacher communicated a message -- often the same message -- to all students who were subsequently evaluated on their ability to understand the message and were often ranked according to the various approximations or "match" they could provide to the initial message. Presently, however, students are providing the first input into the teaching-learning situation -- in the form of individual differences -- and the teacher must interpret the information and provide differentiated environments to "match" those differences.5

The notion of adapting instruction to individual differences is far from new. Over the years it has been continually emphasized in educational literature. Hosenfeld6 cites arguments from Montaigne and Locke in its favor. She also points out, in the context of foreign language education, that even in the heyday of audiolingualism many teachers departed from "orthodox" classroom procedures to respond to perceived needs of individual students.

Unfortunately, as Cronbach suggests, adapting to individual differences has usually meant altering administrative arrangements rather than instructional techniques.7 This has frequently been the case in so-called "individualized" foreign language programs. Many such programs are built around the same goals, content, methods, materials, and learning activities; all students are expected to master the same content and skills, follow the same instructional approach, and work with the same materials. The only thing that is "individualized" is the time factor: students are able to proceed through the program more or less at their own pace.
Self-pacing, however, has generated its own problems. Leamon notes that there are relatively few programs where the students are really pacing themselves and where there is shared responsibility for learning. In most cases (1) the teacher is pacing the students, (2) the students are pacing the teacher, (3) no one is pacing anyone, or (4) the "system" is pacing everyone. Moreover, not all students respond equally well to self-pacing. Many are unable to take the necessary degree of responsibility for their own learning, establish goals and timelines for themselves, interact effectively with their peers in designated small-group activities, and seek help from their peers or from the teacher when they need it. In fact, for those students who need a high degree of structure in their learning environment and who constantly look to the teacher for guidance, direction and reinforcement, self-paced instruction can be a highly frustrating experience. As Grittner points out, "not all students want to be individualized, and students do not develop self-discipline merely because a program based upon it has been implemented."  

The lesson to be learned from all of this experience is that no single instructional approach -- including self-paced instruction -- works equally well with all students. Indeed, what is instrumental to one student's success at language learning may well be a decisive factor in another's failure. It seems obvious, then, that if each of our students has his own unique learning style, instruction that is truly individualized is that which provides for each student the learning environment and instructional strategies most compatible with his style.
The Problem

How does one identify students' individual learning styles? Some teachers appear to do it intuitively, and individualize instruction by adapting materials, instructional strategies and classroom activities to the needs of different students on an ad hoc, day-to-day basis. For others who do not possess this ability, as well as those who are perhaps more systematic, various kinds of checklists of student learning behaviors observable in the classroom have been developed. Both of these approaches, however, require that the teacher know his students well, that he be thoroughly familiar with, and have the opportunity to observe, the individual behavior in different kinds of learning situations. This, in turn, requires time — generally as much as a full semester or more. Moreover, diagnosis of this sort is usually effected on a trial-and-error basis: the teacher is obliged to try a variety of approaches with all students before he begins to get a clear idea of what works best with whom.

It would appear that much time and effort might be saved if the teacher had at his disposal a means of diagnosing students' learning styles at the outset of a foreign language course, rather than midway or later in the course as is usually the case. But can students' learning styles be diagnosed without observing their behavior in a variety of situations? And how accurate is such diagnosis? Is it, for example, as accurate, within reasonable limits, as the teacher would be able to effect on the basis of observation? These are the basic questions to which the present study was addressed.
Educational Cognitive Style Mapping

The diagnostic procedure selected for the study was educational cognitive style mapping. It is essentially a technique for identifying and representing graphically ("mapping") the ways in which an individual seeks and acquires meaning from his environment. Educational cognitive style mapping is based on the theoretical construct of the Educational Sciences and the model of cognitive style developed by Joseph E. Hill, former dean of the College of Education of Wayne State University, and currently president of Oakland Community College in Bloomfield Hills, Michigan. Hill's theory and its related cognitive style mapping procedures are discussed in detail in Chapter II. The following is a brief overview.

A cognitive style map provides a picture or profile of various ways in which an individual acquires meaning. Is the individual a listener or a reader? Is he concerned primarily with his own viewpoint, or is he influenced by authority or peers? Does he reason according to rules and definitions, or does he look for relationships? These are but a few of the factors included in a student's educational cognitive style and which can be identified by means of the cognitive style map.

A cognitive style map can be derived "empirically," that is, on the basis of observation and interviews. It can also be derived from the results of a test or "interest inventory" whose basic form was developed by Hill and his associates. The map is represented schematically in the form of three sets of cognitive style traits or "elements" which are designated by code letters (see Figure 1). The first set, Symbolic Orientations, indicates the individual's tendency to use
**Figure 1.** Form Used to Plot a Cognitive Style Map.
certain kinds of symbols. More precisely, it indicates the degree of his ability to acquire meaning through words, numbers, and sensory impressions, as well as the extent of his sensitivity or responsiveness to cultural norms and expectations. The second set, Cultural Determinants, indicates influences which the individual brings to bear in deriving meaning from symbols. The influences are effected mainly in terms of his own individuality, his peer associates' perceptions, and those of his family and other authority figures. The third set, Modalities of Inference, indicates the manner in which the individual reasons or infers: whether he thinks in terms of categories, definitions and rules; differences; multiple relationships, analysis and synthesis; uses all three of these modalities; or reasons logically and deductively.

On the map the individual's degree of strength in each element is designated in terms of a major, minor, or negligible orientation. A major orientation is indicated by the code letters themselves with no modification. For example, a major strength in the element T(AL), or ability to derive meaning from the spoken word, is indicated by the absence of any modification. A prime ('') mark is used to indicate a minor strength: T'(AL). A negligible orientation is designated by a line drawn through the code letters: T(̲AL).

One major advantage of the map is that it presents a profile or graphic representation of the individual's cognitive style -- one in which all of the elements can be viewed simultaneously. This gives the "reader" of the map an immediate, overall view of the individual's cognitive style in terms of his areas of strength and weakness. It is
also important from the point of view of Hill's theory which emphasizes that all three sets are functions of one another and must be considered together rather than separately if an accurate determination of the individual's cognitive style is to be made.

A certain amount of training is necessary for the teacher to be able to interpret a student's cognitive style map and prescribe appropriate instructional strategies for him on the basis of it. To the untrained teacher the definitions and underlying meanings of the various cognitive style elements, as well as the elaborate coding system, may appear complex and intimidating. In reality, the system is no more difficult to learn than, for instance, interaction analysis. Certainly it should be no more complex or intimidating to the foreign language teacher than the grammar of the target language which he expects his students to learn.

Design of the Study

The study was essentially exploratory rather than experimental in nature. Its purpose was to determine whether the cognitive style inventory, administered at the beginning of the school year, could, within reasonable limits, yield as accurate information about foreign language students' cognitive styles as teachers' informal assessments of those students' cognitive styles later in the year, based on observation of the classroom behavior in a variety of instructional situations and activities.

The investigator was fortunate in being able to secure the cooperation of an Ohio school district where a program of individualized
instruction based on educational cognitive style mapping is being implemented. All high school students had been mapped at the beginning of the school year 1976-77 with a form of the cognitive style inventory adapted for local use at the secondary level. Results, in the form of maps and numerical scores for each of the 27 cognitive style elements were on file in the high school guidance office. A further favorable condition presented itself in the fact that the foreign language teachers had not referred to their students' maps and would thus not be influenced in their assessments by prior knowledge of inventory-based data regarding students' cognitive styles.

Figure 2 is a schematic representation of the study design. Fifty French I students and fifty French II students were randomly selected. The two participating teachers, both of whom had been trained in educational cognitive style theory and mapping procedures, made informal assessments of subjects' cognitive styles, using a special instrument designed for the purpose. The assessment instrument focused on 22 selected elements of the 27 elements measured by the inventory; five elements were eliminated as being either largely irrelevant to foreign language learning or impossible for the teachers to assess adequately on the basis of their experience with the subjects. (These had to do with orientation toward written and spoken numerical data and to olfactory, savory, and tactile sensory impressions.)
Figure 2. Design of the Study.
Hypotheses

1. French I students will differ significantly from French II students with respect to the overall effects of cognitive style inventory measures of the 22 selected measures of educational cognitive style.

2. French I students will differ significantly from French II students with respect to informal teacher assessment measures of the 22 selected elements of educational cognitive style.

3. French I students will differ significantly from French II students with respect to obtained coefficients of correlation between cognitive style inventory measures and informal teacher assessment measures of the 22 selected elements of educational cognitive style.

4. Ninth grade French I and French II students will differ significantly from tenth grade French I and French II students with respect to obtained coefficients of correlation between cognitive style inventory measures and informal teacher assessment measures of the 22 selected elements of educational cognitive style.

5. Male French I and French II students will differ significantly from female French I and French II students with respect to obtained coefficients of correlation between cognitive style inventory measures and informal teacher assessment measures of the 22 selected elements of educational cognitive style.

6. French I students will differ significantly from French II students with respect to degree of overall agreement/discrepancy between cognitive style inventory scores and teacher assessment scores.

7. For each of the 22 selected elements of educational cognitive style, the correlation between the formal cognitive style inventory measure
and the informal teacher measure will be greater than zero in the population.

**Significance of the Study**

It was felt that correlations of .70 or higher between the formal inventory measure and the informal teacher assessment measure would constitute strong evidence in favor of the inventory as a means of diagnosing foreign language students' cognitive styles. Given correlations of that magnitude, a major implication would be the desirability of administering the inventory at the beginning of the school year. The results could then be used by the foreign language teacher to adapt instruction to students' individual cognitive style differences from the outset of the course, with reasonable assurance that the information constituted at least as accurate a diagnosis as he or she might be able to effect on a trial-and-error basis by observing students' learning behavior in a variety of situations over several months. An important corollary would be some degree of justification for the time, effort, and expense involved in mapping students, as well as that necessary to train teachers in educational cognitive style theory, mapping procedures, interpretation, and adaptation of instruction.

**Definition of Terms**

*Cognitive style.* The term has been defined in various ways. In general, each definition is related to a particular theory, construct, or model of cognitive style. Shouksmith defines it broadly as "the adoption by an individual of a certain strategy or group of strategies in his approach to problem situations." Ausubel offers the following explanation:
"Cognitive style" refers to self-consistent and enduring individual differences in cognitive organization and functioning. The term refers both to individual differences in general principles of cognitive organization (simplification and consistency trends), and to various self-consistent idiosyncratic tendencies (intolerance for ambiguity; memory for particular kinds of experience) that are not reflective of human cognitive functioning in general. It reflects differences in personality organization as well as in genetically and experientially determined differences in cognitive capacity and functioning; and in a very real sense, it mediates between motivation and emotion, on the one hand, and cognition, on the other...Many cognitive style variables reflect self-consistent individual differences with respect to certain general properties or attributes of cognitive organization and functioning that characterize human beings as information-storing and processing mechanisms. These tendencies occur in the same direction and apply to all individuals and all age levels but are consistently more or less accentuated in particular persons.12

The term cognitive style is found most frequently, though not exclusively, in the literature of psychology. By and large, educators seem to prefer the term learning style. The difference is largely one of focus rather than substantive meaning; presumably, educators are more interested in "individual differences in cognitive organization and functioning" as they pertain to classroom teaching and learning. In addition, learning style may include affective factors, as well as preferences for certain kinds of learning environments, sensory modalities, and interactive modes.

In the present study the terms cognitive style and learning style appear as they do in any references cited; that is, where an author has used one term or the other, that term is used consistently in discussing his writings. In the context of the statistical study itself, the term cognitive style is used interchangeably with educational cognitive style.
Educational cognitive style. Hill and his associates define the term as "the way an individual seeks meaning from the formalized structures of knowledge,"13 either "through formal instruction with the help of some other person, or in an informal sense employing his own self-initiated and self-directed approach."14

Cognitive style element. A discrete component, trait, or aspect of an individual's educational cognitive style. These are classified into three sets. For a full explanation of each set and its related elements, the reader is referred to Chapter II, pages 32-44.

Cognitive style map. A profile or graphic representation of an individual's educational cognitive style.

Cognitive style inventory. A self-reporting-type instrument designed to measure the relative strength of 27 elements of educational cognitive style. The 216-item inventory used in the study appears in Appendix A.

Teacher assessment. Teachers' ratings, on a 1-5 scale, of subjects' relative strength in each of 22 selected elements of educational cognitive style, based on their knowledge and observation of subjects in foreign language classes throughout the year.

Organization of the Study

The study is divided into five chapters. Chapter I has presented a brief rationale, a statement of the problem, an overview of educational cognitive style mapping and the study design, research hypotheses, significance of the study, and definitions of terms used throughout the text. Chapter II reviews selected literature
pertaining to the measurement of cognitive or learning style and discusses the theoretical construct of educational cognitive style and related research. Chapter III describes the population and sample, the participating teachers and the instruments, as well as the procedures used in collecting and analyzing the data. Chapter IV presents the results of the data analysis. Chapter V summarizes the study, discusses the results, and presents conclusions, limitations, and recommendations for further research.


6. ibid.


10. The investigator attended a five-day workshop on cognitive style mapping, conducted at Kent State University in August 1976. The forty workshop participants included classroom teachers of virtually every subject offered in the standard high school curriculum, as well as several guidance counselors. All participants attained a level of competency judged to be adequate for the purpose of mapping their students and adapting instruction accordingly. One foreign language teacher mapped her students in September
1976 and, during the following year, made substantial progress toward matching instructional strategies with students' cognitive styles.


CHAPTER II

REVIEW OF THE LITERATURE

Introduction

Although educators' interest in learning styles and the implications these have for instruction is of fairly recent date, the concept of cognitive or learning style is far from new. According to Coop and Sigel, the term "cognitive style" has appeared and reappeared in the literature of psychology, possibly as far back as the turn of the century. Most frequently it has been used to designate consistencies in individual modes of functioning in various behavioral situations. In the late 1930s, Allport used the term "style" to describe consistencies and patterns of behavior evidenced by individuals in their day-to-day activities. Since that time, numerous psychologists, each with his own set of constructs, have used the term cognitive style to denote a wide variety of individual differences in modes of cognitive functioning in children and adults. Ausubel lists no fewer than eighteen distinct aspects of cognitive style which have been identified and studied; his listing is far from complete.

The lay consumer of the literature is thus confronted with a vast body of research, consisting of several hundred studies related to a wide array of cognitive style theories and variables. His problem is
compounded by the fact that some investigators have used the same term to designate quite different cognitive processes, while others have used different labels to denote essentially the same construct. To further confuse the issue, a variety of tests have been employed to identify the same cognitive style, and often there is little correlation between these criterion measures.

Since the present study is essentially concerned with the measurement of cognitive style, the review of literature will focus primarily on instruments and procedures used to identify cognitive style variables. In general, these fall into three categories: tests of perception and cognitive functioning, observation techniques, and self-reporting procedures. Each of these types will be selectively reviewed in an effort to present an overview of cognitive style measurement. The chapter will conclude with a detailed examination of educational cognitive style mapping and related research.

Tests of Perception and Cognitive Functioning

Much of the work psychologists have done in the area of cognitive styles is an outgrowth of research on human perception. In the early 1950s, Witkin and his associates identified a perceptual trait, field-dependence/independence, which is explained as follows:

In a field-dependent mode of perceiving, perception is dominated by the overall organization of the field; there is relative inability to perceive parts of a field as discrete. This global quality is indicative of limited differentiation. Conversely, a field-independent style of perceiving, in which parts of a field are experienced as discrete from organized background, rather than fused with it, is a relatively differentiated way of perceiving.
Subsequent studies firmly established the field-dependent/independent construct as a consistent personality configuration, as well as a global/analytic continuum of cognitive functioning, and even social behavior, which is relatively stable from childhood into maturity.²

In the literature of foreign language education, Chastain¹⁰ briefly explores several implications of field-dependence/independence for individualized instruction. Naiman et al.¹¹ believe that field-independence is an important trait of the "good" language learner and propose to use Witkin's Embedded Figures Test to measure this dimension of the student's cognitive style. Ramirez et al.¹² discuss field-independence and field-dependence (field-sensitivity), pointing out that, largely due to native-culture influences, Mexican-American children tend to score in the direction of field-sensitivity on tests of cognitive style. Their manual is one of a series designed for use in bilingual/bicultural education programs. Meyer¹³ contends that students of lower socioeconomic class in general tend to be field sensitive. This places them at a disadvantage in school environments and in relation to upper-class peers, both of which tend toward field-independence. She proposes a number of ways in which foreign language teachers can facilitate target language learning for the field-sensitive student.

Several different perceptual-type instruments have been designed by Witkin and others to measure degree of field-dependence/independence. Most of these require sophisticated apparatus and involve somewhat complex scoring procedures. The Embedded Figures Test (EFT), on the other hand, is relatively simple to administer and to score. The test
consists of 24 pairs of simple and complex geometric figures, some in black-and-white, some in color. For each pair, the subject is first shown the simple figure, then the complex figure in which the simple one is "embedded." His score for each pair is the amount of time required for him to locate the embedded simple figure. The overall test score, which is the mean of the individual pair scores, furnishes an index of the subject's degree of field-dependence/independence. 14

Witkin maintains that the EFT assesses the strength of a mode of cognitive functioning while being relatively free of the general level of intellectual ability (although subjects sometimes react to it as if it were a test of intelligence). 15 Moreover, it correlates highly with his other, more elaborate measures. 16 However, he acknowledges the presence of a practice effect which limits the instrument's usefulness for longitudinal studies. 17

Kagan 18 observed that some individuals formulate and report hypotheses with seemingly minimal consideration for their probable accuracy, while others of equal intelligence take more time to decide about the validity of their solutions to problems. From these observations he derived the construct of reflection/impulsivity, which he calls "conceptual tempo." While reflection tends to increase with age, Kagan notes that "the tendency to be reflective or impulsive shows intra-individual stability over time and across situations involving visual recognition or matching problems." 19

While considerable value can be attached to various kinds of spontaneous behavior, impulsive selection and/or reporting of hypotheses has been shown to be strongly associated with inaccurate
performance on learning tasks. In foreign language education, Brown reports a study in which reflective students of English as a second language were found to be slower but more accurate readers than impulsive students.  

There is some evidence, however, that reflective teachers can influence impulsive students to become more reflective and thus more accurate in their learning performance. In fact, Meredith found that merely imposing a 20-second delay on the responses of second-year high school Spanish students to an oral proficiency test significantly improved the performance of impulsive subjects and tended to improve the performance of reflective, "fast-accurate," and "slow-inaccurate" subjects as well.

To assess the extent to which the individual is reflective or impulsive, Kagan has developed the Matching Familiar Figures Test (MFPT). In this test the subject is shown a single picture of a familiar object (the standard) and a number of similar variants, only one of which is identical to the standard. His task is to select the variant which is identical to the standard. Scoring is based on the amount of time the subject takes to give his first answer to each item, and the total number of errors across the 12 items of the test. According to Kagan, impulsive children in Grades 1–4 have a mean response time of 4 to 10 seconds and make 15 to 20 errors; reflective children have a mean response time of 30 to 40 seconds and make between 2 and 6 errors.

Another instrument designed by Kagan to measure reflection/impulsivity is the Haptic Visual Matching Test (HVMT). In this test the subject explores with his fingers a wooden figure which he cannot see.
He is then presented with five wooden figures he can see and asked to select the one that corresponds to the figure he explored with his fingers. As with the MFFT, scoring is based on response time and number of errors.²⁴

As noted above, Kagan considers reflection/impulsivity to be a "conceptual tempo" rather than a cognitive style. Kagan, Moss, and Sigel,²⁵ however, have formulated a construct they characterize as a cognitive style and which they define as "stable individual preferences in the mode of perceptual organization and conceptual categorization of the external environment."²⁶ It includes three basic categories: descriptive, relational-contextual, and inferential-categorical. The descriptive (analytical) individual tends to split his environment into parts, attending to environmental stimuli as discrete units. The relational-contextual person prefers to characterize objects in the environment on the basis of some functional relationship they may have. The inferential-categorical individual groups environmental stimuli into categories on the basis of inferences he makes about them.²⁷

Two tests have been designed to assess cognitive style on these three dimensions, both of which require scoring by trained raters. Kagan, Moss, and Sigel's Conceptual Style Test (CST) consists of 30 sets of picture triads depicting people, animals, plants, and familiar objects. The subject is told that there are no right or wrong answers. He is then instructed to group two of the three pictures in some way and to give a reason for his grouping. In an alternate form the subject is presented with multiple-choice possibilities which are based on actual responses elementary school children have given to the
free-response form. On the basis of his groupings and his reasons for them, the subject is classified as predominantly descriptive, relational-contextual, or inferential-categorical.²⁸

The Sigel Cognitive Style Test (SCST) is modeled on the CST. It consists of 35 picture triads which can be presented to a group of subjects by means of 35mm slide projection accompanied by tape-recorded instructions. Subjects are allowed 90 seconds to view each of the first two items and 75 seconds for each succeeding item. Each response is scored as Descriptive Part-Whole, Descriptive Global, Relational-Contextual, or Categorical-Inferential.²⁹

Bruner's notion of cognitive style is essentially oriented toward strategies of concept selection. The procedure he has devised to identify selection strategies utilizes a set of 81 cards, each varying in the number of figure shapes represented (3), number of figures (3), color of figures (3), and number of borders (3). The experimenter explains to the subject what is meant by a "conjunctive concept": a set of the cards that share a given set of attributes (e.g., "all red cards" or "all cards containing red squares and two borders"). After a practice run, the subject is then told that the experimenter has a concept in mind, that certain of the cards exemplify the concept, and that he is to determine what the concept is. He is shown one card that exemplifies the concept. He must then choose one card at a time for testing. He may offer only one hypothesis after each choice of a card, or if he does not wish to offer a hypothesis, he need not do so. After each choice he is told whether the card is a positive or a negative instance of the concept.³⁰
By means of this procedure a trained experimenter is able to determine which of four selection strategies an individual employs in arriving at the correct concept. In conservative focusing the individual uses an example of the concept as a focus and changes one attribute of the example at a time to find those attributes that are essential. In focus gambling he uses a focus example but changes more than one attribute at a time. In successive scanning, the least efficient of the four strategies, the individual tests a single hypothesis at a time until he arrives at the correct concept. In simultaneous scanning, the most demanding strategy, he formulates several hypotheses and gradually eliminates the less tenable until he deduces the correct concept.

Coop and Sigel make several observations concerning the foregoing approaches to the measurement of cognitive style. They point out that in the tests devised by Witkin and by Kagan, Moss, and Sigel, each item can be responded to as an individual and separate problem, whereas Bruner's procedure requires the subject to utilize his particular strategy from one instance to another and approach each new presentation as being essentially related to the previous ones. Secondly, both Bruner's test and Witkin's require subjects to produce correct answers, while the Kagan, Moss, and Sigel instruments do not. Lastly, the Witkin test demands a particular type of perceptual ability, and the Bruner procedure requires the subject to employ a particular cognitive strategy, whereas the Kagan, Moss and Sigel instruments elicit the subject's preferences and do not assess either cognitive abilities or strategies per se.
As a means of identifying students' individual differences for the purpose of individualizing foreign language instruction, Niedzielski has utilized the Illinois Test of Psycholinguistic Abilities (ITPA), modified for high school students. While not, strictly speaking, a cognitive style instrument, it nevertheless contains 19 measures of value to the foreign language teacher. These include auditory and visual perception; esthetic, semantic, and grammatical imagination; medium and long-term memory in auditory, visual, sensorimotor, semantic, and grammatical dimensions; and manual and verbal sensorimotor aptitudes.

Reinert has developed a unique instrument for identifying students' learning styles. The procedure, called ELSIE (Edmonds Reaming Style Identification Exercise), is based on research regarding the predominant functions of the right and left hemispheres of the brain. A test consisting of 50 common English words is administered by means of audio tape. On a response sheet the student indicates whether his initial reaction to each word has been in terms of (1) a mental image of the object or action suggested by the word, (2) a mental image of the word spelled out, (3) an understanding of the word alone with no visualization, or (4) a kinesthetic reaction, either emotional or physical. Tabulation of the results yields a profile showing the strength of the student's orientation toward, and need for, visual stimuli, the written word, auditory stimuli, and/or various kinds of physical activity in the learning process. In addition to a profile for each student, a collective profile can be derived for an entire class, so that even conventional instruction can be adapted to a predominant group pattern of learning preference. The procedure has reportedly been
tested and refined with more than 1000 subjects.

**Observation Procedures**

Wood\(^3\) has observed that "learning style is a frequently used term, but its meaning is often vague and seldom related to observable behaviors." The criticism can scarcely be applied to the work of Papalia\(^3\) who bases his approach to the diagnosis of learning styles on observation of student behavior. His 41-item Student Behavior Inventory is designed primarily for teacher use. The items are grouped into seven categories: Cognitive Styles,\(^3\) Sensory Modes, Interaction Learning Modes, Work Habits, Personal Characteristics, Intellectual Dependence, and Intellectual Independence/Originality. Each item is scored on a 1-to-5 scale. Effective use of the inventory requires that the teacher implement different modes of instruction in the classroom in order to observe the behaviors outlined.

Papalia\(^4\) has conducted a study using the Student Behaviors Inventory (called "Learning Modalities Inventory" in the study) as a means of diagnosing the learning styles of high school students. Ten Spanish teachers in a large urban school system and ten suburban teachers were trained in the use of the inventory, which they then used to identify their students' learning styles. A total of 540 students were diagnosed. Both urban and suburban students showed a preference for target language examples related to their concrete and personal experiences, tended to employ a deductive rather than an inductive reasoning approach, learned best by using all senses, and preferred one-to-one situations with the teacher. Suburban students exhibited more
tolerance for tasks they disliked, more persistence at difficult tasks, and greater tendency to turn in assignments on time. Urban students were more restless, more inclined to blame difficulties on external circumstances, and more reliant on the teacher. As a result of the experience, teachers gained in their perception of students' individual differences; many expressed intentions to make regular provision for small-group and individual work in their heterogeneous classes.

Self-Reporting Procedures

Self-reporting procedures are those which directly or indirectly elicit information from the student regarding his learning style preferences. Interviews, questionnaires, and inventories of various kinds fall into this category.

On the simplest level, the student can be questioned directly. Harper found this to be an effective means of determining college-level French students' learning styles for the purpose of matching them with compatible instructional modes. Papalia asked students which of 24 different vocabulary-learning strategies they preferred in order to derive an indication of their learning styles. Hosenfeld asked students to "think aloud" as they proceeded through foreign language exercises, a technique which yielded significant insights into their individual learning strategies.

On a more complex level, Dun and Dunn have developed an elaborate 226-item questionnaire to elicit students' preferences and needs regarding the following:
Environment: sound, light, temperature, design
Emotional: motivation, persistence, responsibility, structure
Sociological: peers, self, pair, team, adult, varied
Physical: perceptual, intake, time, mobility

Students respond to all items on a true-false basis. There is a different scoring procedure for each of the 18 sections.

Most psychologists have found cognitive style to be relatively stable over time and across task variables. Hunt, however, views the student's learning style not as a fixed, unchanging characteristic, but rather a stage in a developmental process from relatively high dependence and conceptual simplicity to a relatively high independence and conceptual complexity. His Conceptual Level Matching Model describes the types of learning environments necessary to meet students' immediate learning needs as well as their long-range developmental growth needs. The higher a student's conceptual level and degree of independence, the less structure he requires in his learning environment.

As a means of assessing conceptual levels, Hunt has devised a semi-projective self-reporting instrument, the Paragraph Completion Instrument. The test requires the student to write a short paragraph of at least three sentences on each of six open-ended topics eliciting his ideas, opinions, and feelings (e.g., "What I think about rules..." and "When I'm not sure...”). Each paragraph is scored on a 0-3 scale, preferably by a trained rater. A student's highest three scores are then combined to produce a conceptual level score as an index of the amount of structure the student needs in his learning environment. Once this has been determined, appropriate classroom
activities can be designed to optimize his learning and, in the case of
the student at a low or intermediate conceptual level, foster his de-
velopmental growth toward more complex conceptualization and greater
independence.45

Zampogna et al.46 conducted a study to determine whether there is
a significant relationship between students' conceptual level, as meas­
ured by Hunt's Paragraph Completion Instrument, and their preference
and/or perceived need for an individualized (low-structure) or tradi­
tional (high-structure) learning environment. A total of 154 Level II
Spanish and Level III French students experienced both learning en­
vironments for one semester each in a design which counterbalanced the
order of treatments. Subjects with a high conceptual level indicated a
preference and need for an individualized environment, while those with
a low conceptual level indicated a preference and need for a tradition­
al environment. Additionally, high conceptual level students showed
more reading skill gains in the traditional environment, while low con­
ceptual level students achieved more reading skill in the individual­
ized mode. Conversely, high conceptual level students showed greater
speaking skill achievement gains in the individualized environment,
while low conceptual level students achieved more speaking skill in the
traditional mode.

The foregoing discussion has attempted to present a brief, selec­
tive overview of cognitive or learning styles as a context for educa­
tional cognitive style mapping. The concluding section which follows
will examine educational cognitive style and related research in some­
what greater depth.
Educational Cognitive Style Mapping

Educational cognitive style mapping is an outgrowth of Hill's theoretical construct of the Educational Sciences. According to Hill, "fundamental disciplines are bodies of knowledge generated by communities of scholars that produce pure and distinct forms of information about the phenomena which they study." Complementing the fundamental disciplines are applied or derivative fields of knowledge, composed of terms and methods borrowed from the fundamental disciplines. These bodies of knowledge are generated by practitioners who are not concerned with producing pure and distinct forms of information, but rather deal with practical aspects of their respective fields.

Articulation between the fundamental disciplines and the applied fields has resulted in progress in most areas of inquiry and endeavor. Engineering, law, medicine, nursing, and pharmacy, for example, have all developed conceptual frameworks and related "languages" which, although they are less precise than those of the fundamental disciplines, nevertheless enable practitioners to communicate reasonably well and to pursue generally agreed-upon courses of inquiry. Education, however, while it has drawn concepts and definitions from many fundamental disciplines and applied fields, presently lacks a conceptual framework and related precise, common language. At best, the information available in the field of education can be characterized as a loosely knit collection of methods, materials, and techniques.

Hill states that four assumptions are essential to the conceptual framework for education which he calls the Educational Sciences.
1. Education is the process of searching for meaning.
2. Thought is different from language.
3. Man is a social creature with a unique capacity for deriving meaning from his environment and personal experiences through the creation and use of symbols.
4. Not content with biological satisfactions alone, man continually seeks meaning. He maintains that "These "sciences approach a level of precision that is found in such other derivative fields as medicine, pharmacy, engineering, and law. With the development of the Educational Sciences, the solution of problems and explanations of phenomena are facilitated, and educational problems accruing to inadequate communication, misinterpretation of information, and fragmentation of effort are alleviated."

As formulated by Hill, there are seven Educational Sciences, each of which includes its own body of facts, concepts, generalizations, and principles:
1. Symbols and their meanings (Symbologosics)
2. Cultural determinants of the meanings of symbols (Determinants)
3. Modalities of inference (Inferensics)
4. Biochemical and electrophysiological aspects of memory concern.
5. Cognitive styles of individuals
6. Teaching styles, administrative styles, and counseling styles
7. Systemic analysis decision-making

The fifth educational science, cognitive styles of individuals, combines information included in the first four sciences to produce a profile or graphic representation of the ways in which an individual seeks meaning from his environment and personal experiences. At
present, however, instruments and procedures are available to measure only elements of the first three sets (i.e., symbols and their meanings, cultural determinants, and modalities of inference). Although elements of the fourth set, memory concern, have been delineated, appropriate tests have yet to be developed.

The following is a brief explanation of the first three sets of elements which comprise an individual's educational cognitive style.

Set S: Symbols and Their Meanings (Symbolologics).

Man is seen by Hill as a symbolizing creature. Individuals create and use two types of symbols to acquire knowledge and derive meaning from their environments and personal experiences. Theoretical symbols (T) include words and numbers. These present to the individual's awareness something different from that which the symbol itself is. The printed word "flag" is different from an actual flag or the image of a flag which is brought to one's awareness by the printed symbol.

Qualitative symbols (Q) include sensory messages, programmatic cues (e.g., psychomotor skills), and cultural codes (e.g., feelings, values, and commitments). The qualitative symbol first presents then represents to the individual's awareness that which the symbol is to the individual. Thus, the sight of a flag presents a symbol, then represents the particular message it intends to convey: truce, patriotism, or other meaning. According to Mullally, the theoretical symbols are associated with the functioning of the left hemisphere of the brain (verbal, numerical, linear, analytic, and rational functioning). Qualitative symbols are associated with the functioning of the right brain hemisphere (sensory, spatial, perceptual, intuitive, imaginative and
and metaphoric functioning).

In the "T" subset, there are two types of theoretical symbols, auditory and visual, which in turn are subdivided into linguistic (verbal) and quantitative (numerical) elements. On the individual's cognitive style map each appears as a coded three-letter abbreviation representing the individual's predisposition to utilize that particular type of symbol in seeking meaning.

T(AL) - Theoretical Auditory Linguistic - refers to the sound of words and the individual's ability to acquire and communicate meaning through spoken words.

T(AQ) - Theoretical Auditory Quantitative - refers to the sound of numbers and the individual's ability to acquire and communicate meaning through numerical symbols, relationships, and measurements that are spoken.

T(VL) - Theoretical Visual Linguistic - refers to the written or printed word and the individual's ability to acquire and communicate meaning by means of it.

T(VQ) - Theoretical Visual Quantitative - refers to written or printed numbers and the individual's ability to acquire and communicate meaning by means of them.

In the "Q" subset, Hill proposes that meanings of qualitative symbols are derived from three basic sources: (1) sensory stimuli, (2) programmatic elements, and (3) cultural codes. There are five qualitative symbols associated with sensory stimuli.

Q(A) - Qualitative Auditory - ability to perceive meaning through the sense of hearing (other than hearing verbal and numerical
symbols). A strong orientation in this area indicates the ability to distinguish between sounds, tones of music, and other purely sonic sensations.

**Q(0)** - **Qualitative Olfactory** - ability to perceive meaning through the sense of smell.

**Q(S)** - **Qualitative Savory** - ability to perceive meaning through the sense of taste. Chefs should have highly developed Q(0) and Q(S) abilities.

**Q(T)** - **Qualitative Tactile** - ability to perceive meaning through touch, temperature, and pain.

**Q(V)** - **Qualitative Visual** - ability to perceive meaning through the sense of sight (other than seeing words and numbers). Artists and photographers usually have a highly developed Q(V).

Hill delineates ten distinct qualitative symbols characterized as "programmatic" in nature. These are concerned primarily with physical activity involving fine and gross muscular control, predominant right- and left-handedness, and sense of timing. The following global programmatic element, however, is the one most frequently measured in relation to classroom instruction.

**Q(P)** - **Qualitative Proprioceptive** - ability to coordinate a number of behaviors simultaneously in order to perform a complex physical task. The obvious examples here are one's seemingly automatic motor responses in such activities as playing a musical instrument, driving a car, or working with an electronic calculator. However, Q(P) ability may be evidenced not only in performance of a complex physical activity, but also in certain types of
theoretical mediation. As Hill suggests, "the synthesis of a number of symbolic mediations is evident when an individual, upon seeing a sign of smoke, immediately interprets it as evidence of fire and experiences an interplay of many sensations including smell of smoke, taste of smoke, and sensation of heat. In this case, a network of previous experiences and related associations produces the theoretical mediation of fire along with other qualitative aspects." A high Q(P) ability might also include the ability to watch a demonstration and then perform a task. It has been used to indicate someone who uses imitation and intuition (the "sixth sense").

The remaining ten qualitative symbols are associated with cultural codes. They are largely conditioned by the individual's cultural environment.

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

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

**Q(CET) - Qualitative Code Ethic** - commitment to a set of values, principles, obligations, and/or duties.

**Q(CH) - Qualitative Code Histrionic** - ability to exhibit a deliberate behavior or play a role to affect others. This type of person knows how to fulfill role expectations. He also enjoys
role-playing and simulation activities.

Q(CK) - Qualitative Code Kinesics - ability to understand and communicate by non-verbal language, such as facial expressions, gestures, and body motions.

Q(CKH) - Qualitative Code Kinesthetic - ability to perform motor skills according to recommended or acceptable form. An individual possessing this element is usually willing to practice motor skills to perfection.

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

Q(CS) - Qualitative Code Synnoetics - personal knowledge of oneself, of one's capacities and limitations.

Q(CT) - Qualitative Code Transactional - ability to maintain a positive communication interaction in order to influence others. Persons in leadership positions should possess this ability to a high degree.

Q(CTM) - Qualitative Code Temporal - ability to respond or behave according to time expectations.

Set E: Cultural Determinants (Determantics).

Hill views culture as the matrix which largely determines the ways in which the individual mediates both theoretical and qualitative symbols. The major influences here are one's family, one's associates or peers, and one's own individuality. These three key relationships or determinants not only define the social roles one will play, but also constitute the basis for others' expectations about these roles, since they grow out of the rules and norms of society. In this sense, they
are primary factors in the evolution of one's world view and cognitive style.

The three cultural determinants appear on the individual's map as follows:

F - Family - predisposition toward authority, security, and tradition.
An individual with a strong "F" orientation tends to seek guidance, direction, and structure from his family members, as well as from superiors and other authority figures.

A - Associates - predisposition toward peer-group influence. A person with a strong "A" orientation looks to friends and associates for guidance, solicits ideas and advice from peers before making decisions, and enjoys working in groups.

I - Individuality - preference for one's own interpretation or way of doing things. The person with a strong "I" generally prefers to work independently and make his own decisions relatively free of the influence of others.

Hill acknowledges the fact that the relative strength of each of these three cultural determinants varies with the age of the individual and with the specific nature of the task, educational or other, he may be engaged in. He emphasizes, however, that the continuous interplay of all three determinants contributes to the molding of the individual's perception and cognition.

Set H: Modalities of Inference (Inferensics).

In this set Hill is concerned with the modes or patterns of reasoning which an individual employs to arrive at meanings. He proceeds from the traditional assumption that persons employ two different types
of reasoning: the inductive process which draws generalizations from particulars, and the deductive process which derives specifics from generalizations deemed to be indisputable. Inductive processes yield probability conclusions, while deductive processes terminate in conclusions which are the logical consequences of axiomatic premises.

Hill feels that the deductive mode of inference is largely restricted to mathematics and other pure sciences, and is only infrequently required or employed in daily living. As a consequence, he is primarily concerned with the inductive processes which individuals regularly apply in the course of their daily living. He identifies four such modalities:

M - **Magnitude** - a form of categorical reasoning which utilizes norms or categorical classifications. Defining or categorizing things in order to understand them is a reflection of this modality.

D - **Difference** - a tendency to reason in terms of one-to-one contrasts or comparisons of certain characteristics. Artists, creative writers, and musicians often exhibit this modality.

R - **Relationship** - ability to find similarities or to synthesize a number of dimensions, characteristics, or incidents into a unified whole -- or conversely, to analyze a situation in an effort to discover its component parts.

L - **Appraisal** - use of all three modalities -- M, D, and R -- with equal weight given to each in the reasoning process. Individuals who employ this modality tend to analyze, question, and thoroughly "appraise" all aspects of whatever is under consideration in the process of coming to a conclusion.
Hill identifies only one deductive process:

K - Deduction - the inferential process which relies upon logical proofs, such as those used in geometry or syllogistic reasoning.

A student's cognitive style map can be derived in several ways. Early approaches primarily involved observation and interviewing procedures (called "empirical" mapping). Recently, however, a series of tests has been developed and validated. The most widely used of these is a 216-item self-reporting-type instrument, or "interest inventory," designed to measure 27 cognitive style elements. There are eight items for each of the 27 elements ($8 \times 27 = 216$). All items are distributed randomly throughout the instrument. (The inventory used in the present study appears in Appendix A. It was adapted from Hill's adult form for use with secondary students, Grades 9-12, in the Stow City Schools.)

The student responds to the inventory by indicating the extent to which each statement is true in his case. His choices are Usually, Sometimes, and Rarely. For scoring purposes the choices are assigned values of 5, 3, and 1, respectively. Tabulation of the scores then yields a total score for each element. A total score falling in the 50th to 99th percentile range indicates a major orientation in that particular element. A score between the 25th percentile and the 49th percentile indicates a minor orientation. Scores falling below the 25th percentile are considered indications of negligible orientation, or weakness, in a given element.

Although the process is somewhat more cumbersome and time-consuming, inventory items can also be administered by means of a Q-sort procedure. In a large-scale adult education project in Niagara Falls, New
York, each item was both printed and recorded on a Language Master card. Subjects either read each item or, if their reading skills were deficient, played it as many times as necessary for understanding before placing it in one of three boxes labeled "Most of the Time," "Some of the Time," and "Hardly Ever." A five-way Q-sort procedure is used in the Fredonia (New York) Central School District.

The final step is to prepare a cognitive style map for each student. A pre-printed form is often used for this purpose. On the map a major orientation in a given area (e.g., Theoretical Visual Linguistic) appears as T(VL); that is, no modification of the printed map symbol is made. A minor orientation is indicated with a "prime" mark ('), thusly: T'(VL). A negligible orientation is indicated by drawing a horizontal or slanted line through the map symbol: ~T(VL) or H(VL).

Hill emphasizes that an individual's cognitive style, as represented by his map, is a "Cartesian product of the three sets: symbols and their meanings (Set S), cultural determinants (Set E), and modalities of inference (Set H). This means, simply, that all three sets must be considered together rather than separately, since they are functions of each other. Thus, each set modifies and qualifies the other sets, and it is only by viewing the three sets as a totality that an accurate determination of the individual's cognitive style can be made. Moreover, all the elements within a given set should be considered together in order to assess their functional relationships. It is particularly important for the interpreter not to focus on any one element as an isolated strength or weakness and to characterize the student on that basis. On the other hand, certain elements that are
essentially unrelated to a given instructional situation can at times be largely ignored. A high school teacher of home economics, for example, would find it indispensable to know the extent of a student's olfactory and savory, and perhaps tactile, development, whereas a teacher of English or social studies would undoubtedly place far less emphasis, if any, on these elements.

The major purpose of mapping a student's cognitive style is, of course, to identify his individual learning strengths and weaknesses so that appropriate instructional strategies and activities may be designed for him. Hill and his associates maintain that with the right kind of match between cognitive styles and learning environments, it should be possible for 90% of the students to achieve at the 90% level 90% of the time. Thus Nunney sees the "normal" curve of student achievement as one skewed sharply to the right, rather than the conventional bell-shaped curve familiar to psychologists and educators. Major efforts at Oakland Community College in Michigan are currently being directed toward the attainment of this goal. Of particular importance in this connection is a recent publication by DeNike and Strother which delineates the cognitive style elements most compatible with 25 different types of instructional media.

Hill also emphasizes that the student's cognitive style is not fixed and unchangeable, but rather is susceptible to modification through activities designed to augment his areas of weakness. He defines the "ideal" map as one diagnosing a person who is able to "derive meaning in all possible ways with the widest possible cultural determinations and a complete range of inferential patterns." He states
that the cognitive style map not only delineates the educational capacities of the student, but points to what kind of person he might become, in terms of both how he seeks meaning as well as his social and personality traits. However, Nunney points out that the amount of time needed for augmentation depends on the element to be augmented, the student's level of educational development and degree of motivation, and the extent to which realistic performance goals can be established.

Hill acknowledges that qualitative symbolic forms do not lend themselves well to measurement by means of pencil-and-paper tests. However, they can be assessed by observation of students' behavior, although interrater reliability is sometimes difficult to achieve.

Related Research

According to Nunney, there have been approximately 150 doctoral dissertations and other research studies related to educational cognitive style and its applicability to various aspects of education.

Bass validated a series of videotaped performance-type tests which he developed as alternative measures of five qualitative cognitive style elements. Cotter found that the cultural determinants set, when isolated from the first and third sets of cognitive style elements, does not serve as a reliable predictor of students' curricular choice. His finding tends to reinforce Hill's contention that the cognitive style map must be viewed as a totality, rather than in terms of isolated elements or sets of elements.
Heun et al.\textsuperscript{67} established strong "edumetric" (criterion-referenced) reliability and validity evidence for the cognitive style interest inventory in relation to college-level speech communication and world civilization courses. Skeen\textsuperscript{68} however, found that, while the inventory items appeared to have good face validity, some items were more effective than others in measuring a given element, and some items tapped another element than that for which they were intended. Furthermore, a factorial analysis revealed that, at best, only 18 of 26 factors were being measured; 13 factors accounted for 68\% of the variance, and 2 factors accounted for 27\% of the variance.

In the area of teacher education, Wyett\textsuperscript{69} established evidence for the validity of educational cognitive style for purposes of predicting and analyzing teaching styles. Bowman\textsuperscript{70} found that feedback about students' cognitive styles significantly increased the range and variety of teachers' classroom behavior; the effect was substantially enhanced by the addition of Flanders' interaction analysis feedback. In a study conducted by Dehnke\textsuperscript{71} student teachers who registered the major elements $T(VL)$ and $L$ were the most successful teachers as evaluated by their college supervisors.

A considerable proportion of the research on educational cognitive style has been directed to the following questions:

1. What are the effects when there is a similarity, or dissimilarity, between the cognitive style of the teacher and that of the student?
2. Do certain cognitive style elements, or combinations of elements, predispose the learner to do well in a given subject area?
3. Can a distinct cognitive style be identified for students who respond well to a particular instructional mode, such as programmed instruction?

Studies by Wasser, Schroeder, Ort, Lipson, McAdam, and Lange are related to the first question. In Wasser's investigation, sixth grade teachers tended to give higher letter grades in mathematics, language, health, social studies, science, reading, and spelling to students with cognitive styles similar to theirs than to those with dissimilar styles. Schroeder found that a high school English teacher gave significantly higher grades to students whose cognitive styles were like hers. Ort's study revealed that French I students whose overall cognitive styles closely approximated the teachers' styles obtained significantly higher course grades than those whose styles were unlike the teachers'. However, when component sets of cognitive style elements were broken down and analyzed by discrete characteristics, it was impossible to show any similar or dissimilar group relationship between teacher and student characteristics. This finding was proposed as evidence that the total cognitive style profile (i.e., the Cartesian product of the three sets), rather than isolated characteristics, should be utilized.

Presenting contrary evidence, Lipson's investigation of grading practices in a junior high school showed that, if anything, teachers tended to give unfavorable grades to students whose cognitive styles and preferred teaching styles were similar to theirs. The exception was in the case of students performing at the "C" or "D" level who received the higher grades if they had a major degree of match with the
teacher in terms of cognitive style and preferred teaching style.

Schroeder's study cited above also focused on students' ratings of their teacher. He found that students having cognitive styles similar to that of the teacher evaluated her as being more effective than did those students having cognitive styles different from the teacher's. In McAdam's investigation, college-level communications students whose cognitive styles approximated the teacher's style expressed a positive attitude about the instructional experience and activities, whereas those with styles substantially different from the teacher's style expressed a lack of high interest in the activities of the class.

Lange matched both the cognitive style and the preferred teaching style of nursing education students with the cognitive and predominant teaching styles of their instructors. Results of her study indicated that matched students achieved significantly higher mean scores in final grades and perceived their instructors more positively than did non-matched students. Analysis of the data also showed that the greater the number of major cognitive style elements the student had in his profile, the higher his course grade tended to be.

Several studies have yielded evidence that certain cognitive style elements may predispose the student to do well in specific subject areas and that cognitive style profiles can serve as predictors of student success or failure. Fragale established a relationship between high achievement in community college industrial technology courses and students whose cognitive style profiles contained the major elements T(VL), T(AL), Q(V), Q(CEM), Q(CS), A, L, D, and M. Schuert found that the following elements were unique to students who were successful
in mathematics courses: major $T(VQ)$, major $T(AQ)$, minor $T(AL)$, minor $Q(CT)$, major $L$, and major $K$. Henderson's findings revealed that college-level students with a major $R$ orientation performed significantly better on an inferential-type reading comprehension test than did students with a major $M$ orientation. In London's investigation, non-academically related quantitative elements, especially $Q(CEP)$, $Q(CES)$, $Q(CF)$, $Q(CT)$, and $Q(CH)$, proved to be better predictors of the academic potential and preferences of lower socio-economic class students than were the theoretical elements, which are normally associated with academic success.

Grasser compared aptitude and achievement scores of elementary college algebra students with their cognitive style profiles. The results of his study showed highly significant mean score differences between successful and unsuccessful students. Cognitive style element scores also correlated highly with aptitude scores. Rundio established a relationship between cognitive style profiles of ninth grade biology students and the letter grades the students received in the course. Smithers found that rural-isolated Canadian high school students had individual and collective cognitive style profiles more conducive to defined academic success than did urban students. While Hoogasian failed to demonstrate that cognitive style profiles could be used to predict definite letter grades for students in college English courses, his findings nevertheless indicated that students' profiles could serve as gross predictors of success or failure.

With regard to possible relationships between cognitive styles and specific modes of instruction, an investigation by Blanzy...
revealed that when programmed instructional materials were used in a college mathematics course, students whose cognitive styles included the major elements T(VL) and I registered significantly greater achievement gains than did those who did not possess both or either of these elements. His findings suggest that the higher achievement gains may have been due to students' ability to derive meaning from the printed word, together with their indicated preference for working independently.

In another study, Warner analyzed students' cognitive styles in relation to two different instructional approaches in a college life science course. The major element L was identified as unique to the collective style of students who successfully attained the terminal objectives of the self-instructional multi-media approach. Students who were successful in the lecture-discussion instructional mode evidenced a major orientation in T(VL) and Q(CES). Hauser verified the existence of a cognitive style containing the major Q(V) element for high achievers who were taught an environmental science concept by means of an audio-tutorial package. Those who successfully learned the concept via a print self-instructional package registered the elements minor Q(0), minor Q(CS), minor Q(CT), major D, and major L. Collective cognitive styles of low achievers in the audio-tutorial group contained the major elements T(VL), Q(CH), and Q(CT).

DeNike conducted an exploratory study to determine whether any cognitive style elements are related to fifth grade students' learning from simulation games. The group achieving the greatest pretest-posttest score gains exhibited a collective cognitive style containing
the elements major T(Al), major Q(A), major Q(CEM), major A, minor I, and minor M. This suggested that those who derive maximum cognitive knowledge from simulation game activities are likely to be those who speak and listen well, acquire meaning from other sounds, empathize, are influenced by their peers, can but usually do not assert their individuality, and can but usually do not reason categorically. The collective profile for the non-achievement group contained the elements minor T(Vl), minor T(Al), minor Q(CEM), minor Q(CKH), minor A and major I, suggesting that those who derive the least cognitive knowledge from simulation games are those who derive relatively little meaning from either the printed or the spoken word, empathize relatively little, are physically well-coordinated, assert their individuality strongly, and are influenced by their peers in only a minor way.

In another investigation conducted by Strother, senior education students were pretested on the content of an instructional film, viewed the film, and were then post-tested to measure the amount of their learning gain. Those whose cognitive style profiles showed a major orientation to the spoken word - T(Al) - obtained significantly higher gain scores than those whose profiles showed a major T(Vl) orientation to the printed word.

Donahue compared three different methods of matching introductory psychology students in learning cells for paired-partner work in relation to the students' achievement in the course. He found that cognitive style similarity was no better a criterion than self-selection or random assignment in terms of either achievement or rating of the learning cell experience by the subjects. Hand matched
programmed instruction materials and different instructional settings with the cognitive styles of freshman students in a college science course, but found no significant differences, below the .10 level of confidence, between cumulative relative frequencies of gain scores across groups. Frever,\textsuperscript{93} on the other hand, found that when college-level social science students were matched on the basis of cognitive style with instructional activities designed to facilitate their successful acquisition of the course content, there was a 26\% increase in the proportion of students receiving "C" or better grades as compared with previous years. Additionally, the percentage of students receiving "A" grades more than doubled during the project years, as compared with prior years. Davidoff\textsuperscript{94} reports that previously low-achieving high school students substantially improved their performance in mathematics when matched with instructional strategies consistent with their cognitive styles, and expressed highly positive attitudes regarding the experience.

Of particular significance for the field of foreign language education is the investigation conducted by Lepke.\textsuperscript{95} Her study compared the cognitive styles and achievement levels of college beginning German students in two different instructional formats: conventional teacher-centered, "lock-step" classes, and self-paced individualized classes. Collective cognitive style profiles of students achieving the highest course grades in the conventional classes contained the major elements T(VL), Q(CES), Q(CS), F, R, and L. This suggested that members of this group 1) responded well to the written word as presented in the textbook and on the blackboard, 2) related positively to esthetic qualities
of the target language, which was more frequently spoken in the conventional classes than in the individualized setting, 3) were able to establish daily goals and complete assigned tasks for themselves, 4) related well to the teacher-dominated learning environment, and 5) had their needs for relationship- and appraisal-type reasoning satisfied by the conventional teaching approach which emphasized classifications, rules, definitions, differences, and similarities.

Students obtaining the highest grades in the individualized classes registered the major elements T(VL), I, and A. This finding suggested that their preference for the printed word was effectively met by means of learning activity packets, and that the frequent opportunities they had to work independently at their own pace and to interact with their peers met their needs in these dimensions.

Profiles of students receiving low grades in both conventional and individualized classes revealed clusters of cognitive style elements which would probably have been more satisfactorially accommodated by instructional strategies other than those available to them in the classes they elected. Non-achievers in the conventional approach registered the major elements Q(CEM), I, and A, which would seem to indicate a need for independent work and small-group or one-to-one interaction. Non-achievers in individualized classes exhibited a major F. orientation, which might have been better satisfied in the conventional teacher-dominated classroom, and a major Q(V), which suggests a need for visual stimuli, such as transparencies, pictures, realia, etc., not used in the individualized program.
While final conclusions cannot be drawn from this exploratory study with a relatively small sample, the results do provide statistical evidence of a significant relationship between cognitive style and foreign language achievement.

As the foregoing review of literature demonstrates, there is some lack of agreement among researchers as to what constitutes cognitive or learning style. Nevertheless, several viable models have been proposed and investigated. For the most part, the available research tends to confirm that cognitive or learning style is a phenomenon which is susceptible to measurement. It also lends considerable support to the contention that the quality of learning can be enhanced--often dramatically so--when learners' individual differences, in terms of their unique cognitive or learning styles, are taken into account in the instructional process.


14. Witkin et al., op. cit., p. 146.


17. Witkin et al., op. cit., p. 146.


19. ibid., p. 17.


26. ibid., p. 74.


36. Papalia's "cognitive styles" category is limited to five items which assess the student's predisposition toward inductive and deductive reasoning, abstract and concrete thinking, and incremental or step-by-step learning.


53. Lee J. Mullally. Personal communication. (Notes from a workshop on Educational Cognitive Style Mapping, August 9-13, 1976, Kent State University.)


64. Derek N. Nunney. Personal communication. (Notes from a workshop on Educational Cognitive Style Mapping, Joint Meeting of the Central States Conference on the Teaching of Foreign Languages and the Ohio Modern Language Teachers Association, Columbus, Ohio, April 15, 1977.)


CHAPTER III
PROCEDURES

The study was conducted with the cooperation of the Stow City Schools. The school district, serving the communities of Stow and Munroe Falls with a combined population of approximately 25,000, is located in northeastern Ohio between Akron and Kent. While there are several small industrial establishments within the district, the area can be considered essentially a "bedroom" community not untypical of many throughout the state.

Stow High School, with a total enrollment of 2267 students in Grades 9 through 12 at the beginning of the school year 1976-77, offers a relatively broad foreign language program, consisting of four levels each of French, Latin, and Spanish, together with two levels of German. Over the past several years approximately 30% of the total school population has been enrolled in foreign language courses, as compared with the statewide average of roughly 25% for Grades 9-12.

For several years the school system has been involved in a program aimed at individualization of instruction on the basis of students' cognitive styles. The program will eventually embrace all subject areas and include all grade levels, elementary through high school. To date, most teachers have received extensive inservice training in educational cognitive style theory and procedures. In addition, all high
school students were mapped at the beginning of the 1976-77 school year.

In the fall of 1976, the investigator contacted the school district's director of secondary education and several members of the foreign language staff regarding the possibility of conducting a study related to foreign language education and educational cognitive style mapping. Considerable interest was shown in such a project, and eventually two French teachers agreed to participate. Permission to utilize existing data regarding students' cognitive styles was subsequently granted by the school superintendent. The only stipulation was that students were in no way to be identified in the study, since both state law and local school district policy place strict controls on access to information contained in student files.

Participating Teachers

Both foreign language teachers who agreed to participate in the study are highly competent professionals. Teacher A received the Bachelor of Arts degree from the University of Akron and the Master of Arts in Foreign Language Education from The Ohio State University. She completed additional course work as a participant in a graduate program in Chambéry, France, sponsored jointly by Bowling Green State University and Ohio University. With seven years of teaching experience, all at Stow High School, she is currently head of the foreign language department.

Teacher B is a graduate of Ohio University with a double major in social studies and French. In addition, he completed graduate work in
France at a summer institute sponsored by the University of Northern Iowa. He is presently working toward a Master of Education degree in guidance counseling at Kent State University. His ten years of teaching have all been at Stow High School.

Both participating teachers are thoroughly trained in cognitive style mapping procedures. Through the school's inservice program each has received approximately 20 hours of instruction and practical work in the areas of design and administration of cognitive style measures, prescription of instruction based on cognitive style strengths, and augmentation of cognitive style weaknesses. Both have served as consultants at cognitive style workshops for other teachers in the district.

Conferences with participating teachers and observation of their classes confirmed that both had implemented a wide variety of large-group, small-group, and individual instructional activities throughout the year. They had thus acquired a broad range of experience and observation of students in different kinds of learning situations as a basis for their assessment of students' cognitive styles.

It is important to emphasize, for the purpose of the study, that during the year neither teacher had referred to the available cognitive style maps for his/her French I or French II students.

**Sampling Procedure**

The population of the study was ninth and tenth grade students enrolled in French I and French II courses at a large suburban, midwestern high school. From the population, two groups of subjects were
randomly selected: 50 of Teacher A's French I students and 50 of Teacher B's French II students.

This arrangement was dictated by circumstances. Originally the investigator had envisioned a sample consisting of both French I and French II students for each participating teacher. However, Teacher A had five first-year classes and only one second-year class, while Teacher B had four second-year classes, together with French III and French IV assignments. Consequently, in order to include both teachers in the study, it was necessary to proceed on the basis of the two-group sample as described above.

A simple procedure was employed to obtain the two random samples. The teachers were instructed to xerocopy the names of all their French I or French II students from their grade books, cut the copies into individual name slips, tumble the slips thoroughly together in a container, and draw 50 names each.

In order to assure subjects' anonymity, each was assigned an identification number. Teacher A's French I students were numbered 1 through 50, while Teacher B's French II students were numbered 51 through 100. Thus subjects' identities were known only to the participating teachers. They were identified to the investigator solely by number.

Table 1 shows the sample breakdown by instructional level (French I and French II), grade level (Grade 9 and Grade 10), and sex. The figures in parentheses are subtotals and totals for grade level. The first two figures in each offset triad at the right of the table are subtotals for sex; the third figure in each triad is the subtotal for
<table>
<thead>
<tr>
<th></th>
<th>Grade 9</th>
<th>Grade 10</th>
<th>Male</th>
<th>Female</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>French I</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>14</td>
<td>8</td>
<td>22</td>
<td></td>
<td></td>
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<td>Female</td>
<td>18</td>
<td>9</td>
<td>27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subtotals</td>
<td>(32)</td>
<td>(17)</td>
<td>49</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>French II</strong></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Male</td>
<td>--</td>
<td>16</td>
<td>16</td>
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<td></td>
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<tr>
<td>Female</td>
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<td>34</td>
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<td></td>
</tr>
<tr>
<td>Subtotals</td>
<td>(--</td>
<td>(50)</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>(32)</td>
<td>(67)</td>
<td>38</td>
<td>61</td>
<td>99</td>
</tr>
</tbody>
</table>
instructional level.

The sampling procedure provided for two instructional level groups of equal size \( (n = 50) \). Subsequent examination of the collected data revealed incomplete data for one French I subject. The subject was therefore dropped from the study, reducing the number of French I subjects to 49.

A distribution in a proportion of roughly 1:2 emerged for both sex and grade level groupings. The subgroupings by sex in the French II group and by grade level in the French I group were also found to be distributed in a proportion closely approximating 1:2. The French II group consisted entirely of tenth grade subjects.

Instrumentation

Two instruments were used to collect comparative data regarding subjects' cognitive styles: an "interest" or "preference" inventory, and a student behavior inventory.

The Cognitive Style Inventory.

The basic or adult form of the interest inventory was developed by Hill and his associates at Oakland Community College. It consists of 216 items: specifically, eight items designed to measure each of 27 different cognitive style elements \( (8 \times 27 = 216) \). Each item is a statement about the respondent's possible behavior relative to a given cognitive style element. For example, the statement, "When given a job to do, I prefer to work on it by myself," is intended as a measure of the I, or Individuality element. The statement, "I avoid saying things that hurt the feelings of others" is related to the Q(CEM), or
Qualitative Code Empathic element.

Hill recommends that the adult form of the inventory be adapted for use with different types of clientele by modifying the item statements to correspond to subjects' level of vocabulary and range of experience. The inventory from which data were collected for the present study was adapted for high school students, Grades 9-12, in the Stow City School District. A representative group of teachers from different curriculum areas, all trained in educational cognitive style mapping, participated in developing the present form of the instrument. (The complete Stow inventory appears in Appendix A.)

The Teacher Assessment Instrument.

The instrument used for informal assessment of subjects' cognitive styles was designed by the investigator. It consists of 22 descriptive designations of the 22 cognitive style elements selected for the study. Beneath each element designation are listed four to six behaviors characteristic of that element. The following example is the designation and list of behaviors for the Q(CT), or Qualitative Code Transactional element:

14) Ability to relate positively to others so as to influence their actions
   - Is a good group leader or organizer of extra-class activities
   - Can be counted on to get group activities started and keep them moving smoothly
   - Attempts to reconcile differences between others, especially friends
   - When in groups, attempts to move others to a mutually agreeable course of action

(For the complete teacher assessment form, see Appendix C.)
The teacher assessment form was derived from several sources and evolved over a period of time. The idea came initially from Papalia's 41-item inventory, which is designed for teacher diagnosis of students' learning styles based on observation of their classroom behavior in various kinds of learning situations. A number of the behaviors related to specific cognitive style elements were adapted from materials the investigator received at a cognitive style mapping workshop. Behaviors related to foreign language learning were added by the investigator. Descriptive designations of cognitive style elements, rather than the conventional map symbols, were used in a deliberate effort to help the participating teachers focus their attention on the substantive meaning of each element.

Prior to the study the instrument was submitted to two judges expert in educational cognitive style mapping. The two generally agreed that the instrument appeared to constitute a reasonable means of assessing cognitive style if used by a person trained in educational cognitive style theory and mapping procedures. Several suggestions made were incorporated into the instrument's final form. Subsequent analysis of the collected data revealed that the two teachers did not differ significantly with respect to the relative degree of agreement between their assessments of subjects' cognitive styles and the inventory measure. The results of this analysis are presented in Chapter IV.
Data Collection Procedures

The cognitive style interest inventory was first administered to all Stow High School students in the spring of 1976. When certain procedural complications emerged, it was given again in the fall of 1976 under slightly different conditions.

The second inventory administration took place in homerooms under the supervision of teachers trained in cognitive style mapping. Students were told that the inventory was not a test, that there were no right or wrong answers, and were urged to respond to each item as honestly as possible. Printed directions instructed each student to indicate the extent to which each item statement was true in his personal case. The choices were Usually, Sometimes, and Rarely. Students recorded their responses on mark-sense answer sheets. Most students took approximately one hour to complete the inventory.

Students' response forms were processed at the Kent State University computer center by means of a specially designed program. Responses were assigned the following values: Usually - 5; Sometimes - 3; Rarely - 1. Tabulation of the discrete item scores yielded a total score ranging from 8 to 40 for each of the 27 cognitive style elements. For each student a cognitive style map was then printed, together with his raw scores for the various elements. The map depicts the student's major, minor, or negligible orientation in each of the elements, based on the following score ranges:

<table>
<thead>
<tr>
<th>Category</th>
<th>Score Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major</td>
<td>27 - 40</td>
</tr>
<tr>
<td>Minor</td>
<td>18 - 26</td>
</tr>
<tr>
<td>Negligible</td>
<td>8 - 17</td>
</tr>
</tbody>
</table>
Figure 3 is a reproduction of a typical cognitive style map generated by the Kent State University computer. A major orientation in a given element appears as the abbreviated map symbol for that element with no modification: e.g., T(VL). A minor orientation appears as the map symbol modified by a single set of quotation marks: e.g., T"(AI)". A negligible orientation is indicated by a series of dashes printed through the map symbol: e.g., Q(CEH).

Observation-based data regarding subjects' cognitive styles was collected in late May and early June of 1977. The assessment instrument was explained to the two participating teachers, who were given an opportunity to make practice cognitive style assessments of several students not included in the study and to clarify any aspects of the assessment procedure they did not fully understand. They were then asked to make an informal assessment of each of the subjects they had randomly selected. They were instructed to assign a numerical value of 1 to 5 to each of the 22 cognitive style elements contained in the assessment instrument, based on their knowledge of the subject and their observations of his classroom behavior throughout the year. Ratings were to reflect the extent to which the subject exhibited behaviors characteristic of the various cognitive style elements in accordance with the following scale: Never - 1; Rarely - 2; Occasionally - 3; Often - 4; Most or All of the Time - 5.

The teachers were told that they could assess subjects' cognitive styles in any order they wished. It was suggested that they start with the subjects they were most sure of and gradually move to the more difficult cases. When they had completed an assessment for every subject,
**FIGURE 3. Computer-Processed Cognitive Style Map**
they were asked to verify the results by reviewing their ratings for all subjects by cognitive style element (i.e., all ratings on the first element, all ratings on the second element, etc.). They were instructed to change any original rating they felt did not accurately reflect the subject's degree of orientation in a given element, but to do so only after careful consideration.

The teachers were also told that they could discuss any aspect of the assessment procedure with each other as much as they wished or felt necessary. However, they were explicitly instructed not to confer about any subject's cognitive style until they had both completed the assessment process and were ready to turn in the data forms.

When the assessment process had been completed, subjects' cognitive style maps were pulled from the guidance office files. Maps were folded so as to conceal the subjects' names, then xerocopied. Subjects' assigned identification numbers were written on the copies so as to permit matching of inventory scores with teachers' ratings.

Both teachers gave assurance that at no time before or during the assessment process did they have any knowledge of inventory-based data regarding the subjects' cognitive styles.

Data Analysis

1. Means and standard deviations of cognitive style inventory scores were computed for both the French I group and the French II group on each of the 22 selected elements of cognitive style. A multivariate analysis of variance was then performed as a means of determining whether the two sample groups differed significantly with respect to the combined effects of the 22 inventory measures.
of cognitive style.

2. Means and standard deviations of teacher assessment scores were computed and analyzed for significant between-groups differences by means of t-tests.

3. For each of the 22 cognitive style elements, Pearson product-moment correlations were computed by instructional level (French I and French II), by grade level (Grade 9 and Grade 10), and by sex. These correlations were analyzed by means of z-tests.

4. A Pearson product-moment correlation coefficient was computed for each subject, using the subject's 22 cognitive style inventory scores and the corresponding 22 teacher assessment scores as correlates. This yielded an overall index of agreement/discrepancy between each subject's inventory scores and the corresponding assessment ratings assigned to him by his teacher. The Mann-Whitney U Test was used to test this data nonparametrically for significant difference between the two sample groups.

5. A Pearson product-moment coefficient of correlation between inventory scores and teacher assessment scores was computed for each cognitive style element, based on the total sample of 99 subjects. For each obtained correlation coefficient, a 95% confidence interval was calculated, together with proportions of explained and residual variance.

The bulk of the data analysis was performed at the Ohio State University Instruction and Research Computer Center on an IBM System 360 computer. The MANOVA subprogram of the Statistical Analysis System (SAS) was used for the multivariate analysis of variance.
Other computer-based statistical analyses were performed, by means of the FREQUENCIES, T-TEST, and PEARSON CORR subprograms of the Statistical Package for the Social Sciences (SPSS).

The following null hypotheses were tested:

$H_{01}$: There is no significant group difference between French I subjects and French II subjects with respect to the combined effects of cognitive style inventory measures of the 22 selected elements of educational cognitive style.

$H_{02}$: There is no significant group mean difference between French I students and French II students with respect to teacher assessment measures of the 22 selected elements of educational cognitive style.

$H_{03}$: There is no significant difference between French I students and French II students with respect to obtained coefficients of correlation between cognitive style inventory measures and teacher assessment measures on any of the 22 selected elements of educational cognitive style.

$H_{04}$: There is no significant difference between ninth grade subjects and tenth grade subjects with respect to coefficients of correlation between inventory measures and teacher assessment measures on any of the 22 selected elements of educational cognitive style.

$H_{05}$: There is no significant difference between male subjects and female subjects with respect to coefficients of correlation between inventory measures and teacher assessment measures of any of the 22 selected elements of educational cognitive style.
\( H_0^6 \): There is no significant group difference between French I subjects and French II subjects with respect to degree of agreement/discrepancy between the overall cognitive style inventory measure and the overall teacher measure of educational cognitive style.

\( H_0^7 \): For each of the 22 selected elements of cognitive style, the correlation between cognitive style inventory measures and teacher assessment measures is zero in the population from which the sample was selected.
CHAPTER III NOTES

1. The following elements are measured by the inventory: $T(\text{AL}), T(\text{AQ}), T(\text{VL}), T(\text{VQ}), Q(A), Q(O), Q(S), Q(T), Q(P), Q(\text{CEM}), Q(\text{CES}), Q(\text{CET}), Q(\text{CH}), Q(\text{CK}), Q(\text{CKH}), Q(\text{CF}), Q(\text{CS}), Q(\text{CT}), I, A, F, M, D, R, L, \text{and } K$.

2. Lee J. Mullally. Personal communication. (Notes and materials from a workshop on cognitive style mapping, Kent State University, August 1976.)


4. Lee J. Mullally. Personal communication. (Workshop notes and materials.)

5. Conventionally, a prime mark (') is used to designate a minor orientation.

6. The 1-5 scale is identical to the one proposed by Papalia for his observation-type instrument (see Note 3 above).
CHAPTER IV
RESULTS

Analysis of Cognitive Style Inventory Data

In approaching the analysis of the collected data, the investigator's first concern was whether the two randomly selected sample groups had been drawn from different populations or from the same population. It was reasoned that a finding of no significant difference between groups with respect to the inventory measure would warrant a conclusion that the two groups had in fact been drawn from the same population. That, in turn, would justify computing correlations on the basis of the total sample of 99 subjects, as well as for each group separately.

Table 2 shows mean and standard deviations of cognitive style inventory scores for the two groups for the 22 selected elements of cognitive style. The investigator had expected that for some elements there would be substantial between-groups mean differences, while for other elements the differences would be only slight. The extent to which the means approximated each other, in some cases differing by only a few hundredths of a point, was unanticipated.

A multivariate analysis of variance was selected as the most appropriate means of determining whether the groups differed with respect to the inventory measure as a whole. In order to ensure that
### TABLE 2

MEANS AND STANDARD DEVIATIONS OF COGNITIVE STYLE INVENTORY SCORES

BY INSTRUCTIONAL LEVEL

<table>
<thead>
<tr>
<th>Cognitive Style Element</th>
<th>French I (N = 49)</th>
<th>French II (N = 50)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S.D.</td>
</tr>
<tr>
<td>T(AL)</td>
<td>25.78</td>
<td>4.73</td>
</tr>
<tr>
<td>T(VL)</td>
<td>30.20</td>
<td>4.53</td>
</tr>
<tr>
<td>Q(A)</td>
<td>32.98</td>
<td>3.30</td>
</tr>
<tr>
<td>Q(V)</td>
<td>28.08</td>
<td>4.93</td>
</tr>
<tr>
<td>Q(P)</td>
<td>29.14</td>
<td>4.56</td>
</tr>
<tr>
<td>Q(CEM)</td>
<td>30.94</td>
<td>4.87</td>
</tr>
<tr>
<td>Q(CES)</td>
<td>32.18</td>
<td>5.86</td>
</tr>
<tr>
<td>Q(CEI)</td>
<td>32.31</td>
<td>4.80</td>
</tr>
<tr>
<td>Q(CH)</td>
<td>27.39</td>
<td>4.50</td>
</tr>
<tr>
<td>Q(CR)</td>
<td>27.80</td>
<td>5.62</td>
</tr>
<tr>
<td>Q(CKH)</td>
<td>28.24</td>
<td>5.50</td>
</tr>
<tr>
<td>Q(CP)</td>
<td>26.65</td>
<td>3.38</td>
</tr>
<tr>
<td>Q(CS)</td>
<td>33.96</td>
<td>4.25</td>
</tr>
<tr>
<td>Q(CT)</td>
<td>26.41</td>
<td>5.37</td>
</tr>
<tr>
<td>I</td>
<td>30.04</td>
<td>4.01</td>
</tr>
<tr>
<td>A</td>
<td>27.96</td>
<td>4.84</td>
</tr>
<tr>
<td>F</td>
<td>26.90</td>
<td>6.93</td>
</tr>
<tr>
<td>M</td>
<td>29.84</td>
<td>4.18</td>
</tr>
<tr>
<td>D</td>
<td>30.41</td>
<td>4.43</td>
</tr>
<tr>
<td>R</td>
<td>29.71</td>
<td>4.76</td>
</tr>
<tr>
<td>L</td>
<td>30.18</td>
<td>5.11</td>
</tr>
<tr>
<td>K</td>
<td>29.06</td>
<td>4.50</td>
</tr>
</tbody>
</table>

* p < .05 per MANOVA
the assumptions of the analysis of variance procedure had been met, a test for homogeneity of variance was performed for each of the 22 cognitive style elements, relative to a hypothesis of no significant difference in variance between groups. For all 22 elements the null hypothesis was retained, leading to the conclusion that variances were homogeneous for all variables. Since computer-generated histograms showed the inventory scores to be distributed in rough approximations of the normal curve, it was assumed that the data was normally distributed in the population. The assumption regarding randomness of sampling was judged to have been met by virtue of the procedure employed in selecting the subjects.

The inventory score data was then subjected to a Clyde One-Way Multivariate Analysis of Variance. The SAS procedure for this analysis tests for significant differences between levels of an independent variable in relation to the combined effect of \( n \) dependent variables. In this instance, the two sample groups (instructional level) constituted the independent variable. The dependent variables were the 22 cognitive style inventory measures.

Among other summary test criteria, the SAS MANOVA subprogram yields a Hotelling-Lawley Trace value, together with an F-ratio approximation and its related probability value.

\[ H_0 : \text{There is no significant group difference between French I subjects and French II subjects with respect to the combined effects of cognitive style inventory measures of the 22 selected elements of educational cognitive style.} \]

Table 3 summarizes the results of the MANOVA analysis. No significant difference was discerned between
the two groups with respect to the combined dependent variable effects (Hotelling-Lawley Trace = .325, F-approximation = 1.12, p > .05). The null hypothesis was retained.

TABLE 3
MULTIVARIATE ANALYSIS OF VARIANCE OF COGNITIVE STYLE INVENTORY SCORES BY INSTRUCTIONAL LEVEL

<table>
<thead>
<tr>
<th>df (Source)</th>
<th>df (Error)</th>
<th>Hotelling-Lawley Trace</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>76</td>
<td>.325</td>
<td>1.12</td>
<td>.34</td>
</tr>
</tbody>
</table>

The MANOVA subprogram also subjects each dependent variable to a univariate analysis of variance. An examination of these discrete analyses revealed significant between-group differences on two cognitive style variables: Q(CEm) (F = 4.65, p = .05) and A (F = 8.43, p = .005). However, when considered in relation to the finding of no significant difference from the multivariate analysis, and in view of the high probability value associated with the summary F-ratio approximation (p = .34), this effect can be attributed to chance. The null hypothesis was accordingly accepted with some degree of confidence.
Analysis of Teacher Assessment Data

It was assumed, and hypothesized, that Teacher A's assessments of French I subjects would differ from Teacher B's assessments of French II subjects. Accordingly, means and standard deviations for both groups were computed for each of the 22 cognitive style elements. A series of t-tests was then performed in order to determine whether the mean differences were significant. Since the alternate hypothesis was nondirectional, a two-tailed test procedure was employed.

H₀: There is no significant group mean difference between French I students and French II students with respect to teacher assessment measures of the 22 selected elements of educational cognitive style. Table 4 shows means, standard deviations, and t-test results for the two sample groups. For the following elements the null hypothesis was rejected: Q(CEM) \((t = -3.14, p = .002)\); Q(CP) \((t = 2.82, p = .006)\); Q(CS) \((t = 2.36, p = .02)\); A \((t = -3.70, p < .001)\); and M \((t = -3.31, p = .001)\). For all other elements the null hypothesis was retained.

Here again, the results were surprising, especially in view of the fact that each teacher had independently made assessments of a different group of subjects. However, in all cases where the null hypothesis was retained, the t-values and concomitant probability levels were such as to leave little doubt that there were indeed no significant differences between the groups with respect to the variables in question.
# Table 4

## Means and Standard Deviations of Teacher Assessment Scores by Instructional Level

<table>
<thead>
<tr>
<th>Cognitive Style Element</th>
<th>French I (N = 49)</th>
<th></th>
<th>French II (N = 50)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
<td>S.D.</td>
</tr>
<tr>
<td>T(AL)</td>
<td>3.69</td>
<td>.55</td>
<td>3.66</td>
<td>.59</td>
</tr>
<tr>
<td>T(VL)</td>
<td>4.41</td>
<td>.67</td>
<td>4.30</td>
<td>.76</td>
</tr>
<tr>
<td>Q(A)</td>
<td>4.12</td>
<td>.56</td>
<td>4.34</td>
<td>.63</td>
</tr>
<tr>
<td>Q(V)</td>
<td>4.06</td>
<td>.59</td>
<td>4.10</td>
<td>.54</td>
</tr>
<tr>
<td>Q(P)</td>
<td>4.06</td>
<td>.59</td>
<td>4.26</td>
<td>.69</td>
</tr>
<tr>
<td>Q(CEM)</td>
<td>3.98</td>
<td>.66</td>
<td>4.42</td>
<td>.73*</td>
</tr>
<tr>
<td>Q(CES)</td>
<td>4.18</td>
<td>.67</td>
<td>4.42</td>
<td>.67</td>
</tr>
<tr>
<td>Q(CEI)</td>
<td>4.61</td>
<td>.57</td>
<td>4.40</td>
<td>.70</td>
</tr>
<tr>
<td>Q(CH)</td>
<td>3.88</td>
<td>.81</td>
<td>4.08</td>
<td>.70</td>
</tr>
<tr>
<td>Q(CK)</td>
<td>3.78</td>
<td>.77</td>
<td>4.02</td>
<td>.77</td>
</tr>
<tr>
<td>Q(CKH)</td>
<td>4.20</td>
<td>.57</td>
<td>3.94</td>
<td>.82</td>
</tr>
<tr>
<td>Q(CP)</td>
<td>4.47</td>
<td>.54</td>
<td>4.08</td>
<td>.80*</td>
</tr>
<tr>
<td>Q(CS)</td>
<td>4.61</td>
<td>.57</td>
<td>4.30</td>
<td>.74*</td>
</tr>
<tr>
<td>Q(CT)</td>
<td>3.76</td>
<td>.78</td>
<td>3.70</td>
<td>.74</td>
</tr>
<tr>
<td>I</td>
<td>4.27</td>
<td>.73</td>
<td>3.98</td>
<td>.69</td>
</tr>
<tr>
<td>A</td>
<td>3.69</td>
<td>.51</td>
<td>4.18</td>
<td>.77*</td>
</tr>
<tr>
<td>F</td>
<td>4.10</td>
<td>.68</td>
<td>4.14</td>
<td>.67</td>
</tr>
<tr>
<td>M</td>
<td>3.96</td>
<td>.50</td>
<td>4.36</td>
<td>.69*</td>
</tr>
<tr>
<td>D</td>
<td>4.10</td>
<td>.59</td>
<td>4.04</td>
<td>.67</td>
</tr>
<tr>
<td>R</td>
<td>4.08</td>
<td>.57</td>
<td>3.96</td>
<td>.76</td>
</tr>
<tr>
<td>L</td>
<td>3.88</td>
<td>.83</td>
<td>4.32</td>
<td>.65</td>
</tr>
<tr>
<td>K</td>
<td>3.84</td>
<td>.55</td>
<td>3.92</td>
<td>.88</td>
</tr>
</tbody>
</table>

* p < .05 per t-test
Analysis of Correlations by Instructional Level, Grade Level, and Sex

As a first step in the process of correlating the cognitive style inventory scores with the teacher assessment scores, a scattergram was plotted for each of the cognitive style elements. The scattergrams revealed generally rectilinear patterning in a positive direction; hence, the Pearson product-moment procedure was employed as a means of determining the degree of correlation between the two measures.

Pearson "r" coefficients of correlation between inventory scores and teacher assessment scores were first computed separately for the two groups. This resulted in two correlation coefficients for each cognitive style element: one for the French I group and the other for the French II group (Table 5). Each pair of coefficients was then tested for significant difference between the two groups, according to the procedure outlined by Guilford and Frucher.² Paired coefficients were first converted to z-value equivalents (z_r) from the Table of z for Values of r. The difference between the z_r values was then divided by the standard error of the sampling distribution. The significance of the resulting criterion value was judged in relation to a standard score of ±1.96 in the normal distribution, representing the .05 level of significance for a two-tailed test.

H₀: There is no significant difference between French I students and French II students with respect to obtained coefficients of correlation between cognitive style inventory measures and teacher
### TABLE 5

**Correlations Between Cognitive Style Inventory Scores and Teacher Assessment Scores by Instructional Level**

<table>
<thead>
<tr>
<th>Cognitive Style Element</th>
<th>French I ((N = 49))</th>
<th>French II ((N = 50))</th>
</tr>
</thead>
<tbody>
<tr>
<td>T(Al)</td>
<td>.511</td>
<td>.559</td>
</tr>
<tr>
<td>T(Vl)</td>
<td>.627</td>
<td>.803</td>
</tr>
<tr>
<td>Q(A)</td>
<td>.450</td>
<td>.505</td>
</tr>
<tr>
<td>Q(V)</td>
<td>.683</td>
<td>.695</td>
</tr>
<tr>
<td>Q(P)</td>
<td>.621</td>
<td>.633</td>
</tr>
<tr>
<td>Q(CEM)</td>
<td>.680</td>
<td>.409</td>
</tr>
<tr>
<td>Q(CES)</td>
<td>.567</td>
<td>.435</td>
</tr>
<tr>
<td>Q(CET)</td>
<td>.524</td>
<td>.407</td>
</tr>
<tr>
<td>Q(CH)</td>
<td>.530</td>
<td>.589</td>
</tr>
<tr>
<td>Q(CK)</td>
<td>.384</td>
<td>.353</td>
</tr>
<tr>
<td>Q(CKH)</td>
<td>.483</td>
<td>.530</td>
</tr>
<tr>
<td>Q(CP)</td>
<td>.420</td>
<td>.251</td>
</tr>
<tr>
<td>Q(CS)</td>
<td>.388</td>
<td>.483</td>
</tr>
<tr>
<td>Q(CT)</td>
<td>.483</td>
<td>.576</td>
</tr>
<tr>
<td>I</td>
<td>.424</td>
<td>.461</td>
</tr>
<tr>
<td>A</td>
<td>.384</td>
<td>.572</td>
</tr>
<tr>
<td>P</td>
<td>.485</td>
<td>.225</td>
</tr>
<tr>
<td>M</td>
<td>.377</td>
<td>.237</td>
</tr>
<tr>
<td>D</td>
<td>.192</td>
<td>.188</td>
</tr>
<tr>
<td>R</td>
<td>.422</td>
<td>.598</td>
</tr>
<tr>
<td>L</td>
<td>.481</td>
<td>.587</td>
</tr>
<tr>
<td>K</td>
<td>.155</td>
<td>.282</td>
</tr>
</tbody>
</table>
assessment measures on any of the 22 selected elements of educational cognitive style. Although the differences in correlation coefficients between the two groups appeared substantial in the case of several cognitive style elements, the test yielded no criterion value as great as ±1.96. The null hypothesis was retained for all cognitive style elements.

Since tenth grade subjects had responded to the inventory twice within a period of six months, whereas ninth grade subjects had taken it only once, it was felt that some effect might appear in the form of between-groups correlation differences. Accordingly, correlation coefficients were computed by grade level and tested for significant differences between the ninth and tenth grade subgroups.

\[ H_0 : \text{There is no significant difference between ninth grade subjects and tenth grade subjects with respect to coefficients of correlation between inventory measures and teacher assessment measures on any of the 22 selected elements of educational cognitive style.} \]

Table 6 shows correlations by grade level. The analysis produced no criterion values as great as ±1.96; therefore, the null hypothesis was retained for all cognitive style elements.

It was also anticipated that male and female subjects might differ with respect to correlations between inventory scores and teacher assessment scores. Correlation coefficients were therefore computed by subjects' sex and tested for between-group differences.

\[ H_0 : \text{There is no significant difference between male subjects and female subjects with respect to coefficients of correlation between inventory measures and teacher assessment measures of any of} \]
TABLE 6
CORRELATIONS BETWEEN COGNITIVE STYLE INVENTORY SCORES AND TEACHER ASSESSMENT SCORES BY GRADE LEVEL

<table>
<thead>
<tr>
<th>Cognitive Style Element</th>
<th>Grade 9 (N = 32)</th>
<th>Grade 10 (N = 67)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T(AL)</td>
<td>.580</td>
<td>.492</td>
</tr>
<tr>
<td>T(VL)</td>
<td>.546</td>
<td>.767</td>
</tr>
<tr>
<td>Q(A)</td>
<td>.371</td>
<td>.512</td>
</tr>
<tr>
<td>Q(V)</td>
<td>.648</td>
<td>.710</td>
</tr>
<tr>
<td>Q(P)</td>
<td>.475</td>
<td>.676</td>
</tr>
<tr>
<td>Q(CEM)</td>
<td>.708</td>
<td>.479</td>
</tr>
<tr>
<td>Q(CE'S)</td>
<td>.542</td>
<td>.468</td>
</tr>
<tr>
<td>Q(CE'T)</td>
<td>.622</td>
<td>.413</td>
</tr>
<tr>
<td>Q(CH)</td>
<td>.533</td>
<td>.583</td>
</tr>
<tr>
<td>Q(CK)</td>
<td>.364</td>
<td>.388</td>
</tr>
<tr>
<td>Q(CXH)</td>
<td>.510</td>
<td>.503</td>
</tr>
<tr>
<td>Q(CP)</td>
<td>.440</td>
<td>.249</td>
</tr>
<tr>
<td>Q(CS)</td>
<td>.414</td>
<td>.450</td>
</tr>
<tr>
<td>Q(CT)</td>
<td>.517</td>
<td>.555</td>
</tr>
<tr>
<td>I</td>
<td>.496</td>
<td>.425</td>
</tr>
<tr>
<td>A</td>
<td>.440</td>
<td>.539</td>
</tr>
<tr>
<td>P</td>
<td>.338</td>
<td>.376</td>
</tr>
<tr>
<td>M</td>
<td>.170</td>
<td>.326</td>
</tr>
<tr>
<td>D</td>
<td>.194</td>
<td>.208</td>
</tr>
<tr>
<td>R</td>
<td>.476</td>
<td>.540</td>
</tr>
<tr>
<td>L</td>
<td>.380</td>
<td>.598</td>
</tr>
<tr>
<td>K</td>
<td>.062</td>
<td>.279</td>
</tr>
</tbody>
</table>
# Table 7

## Correlations Between Cognitive Style Inventory Scores and Teacher Assessment Scores by Sex

<table>
<thead>
<tr>
<th>Cognitive Style Element</th>
<th>Males (N = 38)</th>
<th>Females (N = 61)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T(AL)</td>
<td>.464</td>
<td>.506</td>
</tr>
<tr>
<td>T(VL)</td>
<td>.582</td>
<td>.809*</td>
</tr>
<tr>
<td>Q(A)</td>
<td>.479</td>
<td>.432</td>
</tr>
<tr>
<td>Q(V)</td>
<td>.639</td>
<td>.751</td>
</tr>
<tr>
<td>Q(P)</td>
<td>.591</td>
<td>.644</td>
</tr>
<tr>
<td>Q(CRM)</td>
<td>.621</td>
<td>.535</td>
</tr>
<tr>
<td>Q(CRS)</td>
<td>.526</td>
<td>.422</td>
</tr>
<tr>
<td>Q(CET)</td>
<td>.572</td>
<td>.339</td>
</tr>
<tr>
<td>Q(CH)</td>
<td>.582</td>
<td>.518</td>
</tr>
<tr>
<td>Q(CK)</td>
<td>.265</td>
<td>.456</td>
</tr>
<tr>
<td>Q(CKH)</td>
<td>.239</td>
<td>.559</td>
</tr>
<tr>
<td>Q(CP)</td>
<td>.360</td>
<td>.229</td>
</tr>
<tr>
<td>Q(CS)</td>
<td>.294</td>
<td>.521</td>
</tr>
<tr>
<td>Q(CT)</td>
<td>.630</td>
<td>.462</td>
</tr>
<tr>
<td>I</td>
<td>.431</td>
<td>.485</td>
</tr>
<tr>
<td>A</td>
<td>.409</td>
<td>.616</td>
</tr>
<tr>
<td>F</td>
<td>.472</td>
<td>.307</td>
</tr>
<tr>
<td>M</td>
<td>.432</td>
<td>.162</td>
</tr>
<tr>
<td>D</td>
<td>.131</td>
<td>.230</td>
</tr>
<tr>
<td>R</td>
<td>.502</td>
<td>.533</td>
</tr>
<tr>
<td>L</td>
<td>.478</td>
<td>.534</td>
</tr>
<tr>
<td>K'</td>
<td>.052</td>
<td>.278</td>
</tr>
</tbody>
</table>

* *p < .05 per z-test*
the 22 selected elements of educational cognitive style. Table 7 shows correlations by sex and z-test results. Between groups correlation differences were found to be significant only in the case of T(VL) \( z = 2.11, p < .05 \), and the null hypothesis was rejected for this one element. For all other elements it was retained.

**Analysis of Individual Subject Correlations**

It was expected that there would be a wide range of differences in the degree of overall match — or mismatch — between individual subjects' inventory scores and their corresponding teacher assessment scores. The following procedure was devised as a means of determining how great the range of this agreement/discrepancy might be and whether it might have resulted in any between-groups differences.

For each subject a Pearson product-moment correlation coefficient was computed, using as correlates the subject's 22 inventory scores for the elements T(AL) through K and his corresponding teacher assessment scores for those elements. This yielded a series of 99 coefficients, each of which represented the degree of agreement/discrepancy between the teacher's overall assessment of the subject's cognitive style and the overall inventory measure for that subject. As Table 8 shows, the \( r \)-values ranged from -.150 to .806, with a median of .473 for the French I group and a median of .471 for the French II group.

Since a parametric test would have been inappropriate with this data, a nonparametric procedure, the Mann-Whitney U Test, was used to test for significant difference between the two groups. According
### Table 8

**Minimum, Maximum, and Median Values of Coefficients of Correlation Between Individual Subjects' Cognitive Style Inventory Scores and Teacher Assessment Scores by Instructional Level**

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>French I</td>
<td>49</td>
<td>-.150</td>
<td>.785</td>
<td>.473</td>
</tr>
<tr>
<td>French II</td>
<td>50</td>
<td>.168</td>
<td>.806</td>
<td>.471</td>
</tr>
</tbody>
</table>

### Table 9

**Mann-Whitney U Test for Coefficients of Correlation Between Individual Subjects' Cognitive Style Inventory Scores and Teacher Assessment Scores**

<table>
<thead>
<tr>
<th>n₁</th>
<th>n₂</th>
<th>U</th>
<th>z₀</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
<td>50</td>
<td>1130</td>
<td>.665</td>
<td>.50</td>
</tr>
</tbody>
</table>

to Siegel, this test is a powerful alternative to the parametric
\textit{t}-test. Of the several nonparametric procedures considered, it was
judged the best suited to the type of data under scrutiny.

The Mann-Whitney U Test involved the calculation of a \textit{z}-score
equivalent, \( z_u \). The obtained value of \( z_u \) was referred to the \textit{Table\ of\ Probabilities\ Associated\ With\ Values\ As\ Extreme\ As\ Observed\ Values\ of\ \textit{z}\ in\ the\ Normal\ Distribution}. The resulting two-tailed
probability was then used as a criterion in determining whether the
null hypothesis should be rejected or retained.

\textit{H}_0: \textit{There is no significant group difference between French I
subjects and French II subjects with respect to degree of agreement/
discrepancy between the overall cognitive style inventory measure
and the overall teacher measure of educational cognitive style.}

Table 9 shows the results of the Mann-Whitney U Test. No significa-
can difference was discerned between the two groups (\( z_u = -.665, \)
\( p > .05 \)). The null hypothesis was retained.

The finding was directly contrary to the investigator's ex-
pectation. As anticipated, individual subjects in each group ranged
widely in the degree of match between their inventory scores and
their teacher assessment scores. The surprising effects were the
closeness of the two correlation coefficient medians and the fact
that the \textit{U} Test revealed no significant difference between the two
groups with respect to the variable in question. However, the power
of the test, as emphasized by Siegel, and the size of the probabili-
ty associated with the obtained value of \( z_u \) (\( p = .50 \)) left little
doubt that the null hypothesis should be accepted.
The finding, taken together with the results of the other five analyses, was interpreted as conclusive evidence that the two sample groups had been drawn from the same population. It was further concluded that any differences between the two participating teachers in their assessments of subjects' cognitive styles were such as to have no appreciable effect on correlations computed on the basis of the total sample.

**Total-Sample Correlations**

As an index of the relationship between the inventory measures and the teacher measures, a Pearson product-moment correlation coefficient was computed for each cognitive style element, based on the total sample of 99 subjects. In addition, a 95-percent confidence interval was calculated for each of the correlation coefficients. Values of $r^2$ and $k^2$, representing, respectively, the proportions of explained and residual variance in the inventory and the teacher assessment measures, were also derived.

The SPSS PEARSON CORR subprogram automatically tests each output correlation coefficient for significance with respect to the null hypothesis of zero correlation in the population. Since the alternate hypothesis was directional, predicting positive correlations, a one-tailed test was employed.

$H_0$: For each of the 22 selected elements of cognitive style, the correlation between cognitive style inventory measures and teacher assessment measures is zero in the population from which the sample was selected. Table 10 shows Pearson product-moment
### TABLE 10

**CORRELATIONS BETWEEN COGNITIVE STYLE INVENTORY SCORES AND TEACHER ASSESSMENT SCORES FOR TOTAL SAMPLE (N = 99)**

<table>
<thead>
<tr>
<th>Cognitive Style Element</th>
<th>Correlation Coefficient</th>
<th>Level of Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>T(AL)</td>
<td>.523</td>
<td>.001</td>
</tr>
<tr>
<td>T(VL)</td>
<td>.731</td>
<td>.001</td>
</tr>
<tr>
<td>Q(A)</td>
<td>.459</td>
<td>.001</td>
</tr>
<tr>
<td>Q(V)</td>
<td>.689</td>
<td>.001</td>
</tr>
<tr>
<td>Q(P)</td>
<td>.625</td>
<td>.001</td>
</tr>
<tr>
<td>Q(GEM)</td>
<td>.570</td>
<td>.001</td>
</tr>
<tr>
<td>Q(GES)</td>
<td>.504</td>
<td>.001</td>
</tr>
<tr>
<td>Q(GET)</td>
<td>.450</td>
<td>.001</td>
</tr>
<tr>
<td>Q(CH)</td>
<td>.547</td>
<td>.001</td>
</tr>
<tr>
<td>Q(CK)</td>
<td>.382</td>
<td>.001</td>
</tr>
<tr>
<td>Q(CKH)</td>
<td>.490</td>
<td>.001</td>
</tr>
<tr>
<td>Q(CP)</td>
<td>.287</td>
<td>.002</td>
</tr>
<tr>
<td>Q(CS)</td>
<td>.447</td>
<td>.001</td>
</tr>
<tr>
<td>Q(CT)</td>
<td>.519</td>
<td>.001</td>
</tr>
<tr>
<td>I</td>
<td>.460</td>
<td>.001</td>
</tr>
<tr>
<td>A</td>
<td>.543</td>
<td>.001</td>
</tr>
<tr>
<td>F</td>
<td>.365</td>
<td>.001</td>
</tr>
<tr>
<td>M</td>
<td>.267</td>
<td>.004</td>
</tr>
<tr>
<td>D</td>
<td>.190</td>
<td>.030</td>
</tr>
<tr>
<td>R</td>
<td>.521</td>
<td>.001</td>
</tr>
<tr>
<td>L</td>
<td>.502</td>
<td>.001</td>
</tr>
<tr>
<td>K</td>
<td>.219</td>
<td>.015</td>
</tr>
</tbody>
</table>
coefficients of correlation between inventory scores and teacher assessment scores for the total sample \((N = 99)\) on the 22 cognitive style elements. The level of significance for each correlation coefficient is also presented. All correlation coefficients were found to be significant beyond the .05 level. The null hypothesis was rejected for all cognitive style elements.

In only two cases, however, did the correlation between the inventory measure and the teacher measure approach or exceed the level of .70 which the investigator had hoped could be attained. The \(T(VL)\) and \(Q(V)\) elements showed correlations of .731 and .689, respectively. For a third element, \(Q(F)\), the correlation was .625. At the same time, several extremely low correlations emerged: notably, .287 for \(Q(CP)\), .219 for \(K\), and .190 for \(D\). For 16 of the 22 elements, the correlation was .45 or higher. For 12 elements it was equal to or greater than .50.

Table 11 shows 95 percent confidence intervals for the total-sample correlation coefficients. The intervals were derived by first calculating upper and lower values of \(z_r\) for each obtained \(r\), based on a \(z\)-value constant of \(\pm 1.96\) (95% level) and adjusted for a standard error of .10. These were then converted to correlation coefficient equivalents from the Table of \(r\) for Values of \(z\). The two figures given for each interval represent the upper and lower limits between which the population correlation can, with 95 percent probability, be expected to lie.
### TABLE 11

**95 PERCENT CONFIDENCE INTERVALS FOR CORRELATIONS BETWEEN INVENTORY SCORES AND TEACHER ASSESSMENT SCORES**

<table>
<thead>
<tr>
<th>Cognitive Style Element</th>
<th>r</th>
<th>Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>T(AL)</td>
<td>.523</td>
<td>.363 - .647</td>
</tr>
<tr>
<td>T(VL)</td>
<td>.731</td>
<td>.623 - .811</td>
</tr>
<tr>
<td>Q(A)</td>
<td>.459</td>
<td>.300 - .598</td>
</tr>
<tr>
<td>Q(V)</td>
<td>.689</td>
<td>.572 - .778</td>
</tr>
<tr>
<td>Q(F)</td>
<td>.625</td>
<td>.501 - .735</td>
</tr>
<tr>
<td>Q(CEM)</td>
<td>.570</td>
<td>.422 - .698</td>
</tr>
<tr>
<td>Q(CES)</td>
<td>.504</td>
<td>.336 - .635</td>
</tr>
<tr>
<td>Q(CEF)</td>
<td>.450</td>
<td>.282 - .592</td>
</tr>
<tr>
<td>Q(CH)</td>
<td>.547</td>
<td>.397 - .670</td>
</tr>
<tr>
<td>Q(CK)</td>
<td>.382</td>
<td>.197 - .537</td>
</tr>
<tr>
<td>Q(CHK)</td>
<td>.490</td>
<td>.328 - .623</td>
</tr>
<tr>
<td>Q(CP)</td>
<td>.287</td>
<td>.100 - .462</td>
</tr>
<tr>
<td>Q(CS)</td>
<td>.447</td>
<td>.282 - .592</td>
</tr>
<tr>
<td>Q(CT)</td>
<td>.519</td>
<td>.363 - .647</td>
</tr>
<tr>
<td>I</td>
<td>.460</td>
<td>.291 - .598</td>
</tr>
<tr>
<td>A</td>
<td>.543</td>
<td>.380 - .664</td>
</tr>
<tr>
<td>F</td>
<td>.365</td>
<td>.188 - .523</td>
</tr>
<tr>
<td>M</td>
<td>.267</td>
<td>.080 - .438</td>
</tr>
<tr>
<td>D</td>
<td>.190</td>
<td>-.040 - .371</td>
</tr>
<tr>
<td>R</td>
<td>.521</td>
<td>.363 - .647</td>
</tr>
<tr>
<td>L</td>
<td>.502</td>
<td>.336 - .635</td>
</tr>
<tr>
<td>K</td>
<td>.219</td>
<td>.030 - .397</td>
</tr>
</tbody>
</table>

\[ N = 99 \quad S. E. = .10 \]
Table 12 shows proportions of explained and residual variance shared in common by the cognitive style inventory measures and the teacher assessment measures. For each element, the "explained variance" figure, which is the square of the obtained correlation coefficient, represents the proportion of variation in the teacher assessment measure accounted for by variation in the inventory measure. It is thus a more representative index of the strength of the relationship between the two variables than the correlation coefficient, which is simply the slope of the regression line. The "residual variance" figure represents the proportion of variation in the teacher assessment measure left linearly unexplained by variation in the inventory measure. In this sense, it can be considered as an index of the strength of non-relationship between the two variables.

The relationship between the obtained correlation coefficients and the corresponding proportions of explained variance is evident from a comparison of Tables 10 and 12. In the case of the T(VL) element, \( r = 0.731 \), 54.3% of the variance is explained. At the opposite end of the scale, for the D element \( r = 0.190 \) only 3.6% of the variance is accounted for by the inventory and teacher assessment measures, leaving fully 96.4% of the total variance unaccounted for.

As the foregoing results indicate, there is a significant, positive, linear relationship between formal inventory measures and informal teacher assessment measures of the 22 selected elements of educational cognitive style. The strength of that relationship, however, varies considerably from element to element. At the most,
### Table 12
PROPORTIONS OF EXPLAINED AND RESIDUAL VARIANCE IN INVENTORY AND TEACHER ASSESSMENT MEASURES BY COGNITIVE STYLE ELEMENT

<table>
<thead>
<tr>
<th>Cognitive Style Element</th>
<th>Proportion Explained</th>
<th>Residual Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>T(AL)</td>
<td>.274</td>
<td>.726</td>
</tr>
<tr>
<td>T(VL)</td>
<td>.534</td>
<td>.466</td>
</tr>
<tr>
<td>Q(A)</td>
<td>.211</td>
<td>.789</td>
</tr>
<tr>
<td>Q(V)</td>
<td>.475</td>
<td>.525</td>
</tr>
<tr>
<td>Q(P)</td>
<td>.391</td>
<td>.609</td>
</tr>
<tr>
<td>Q(CEM)</td>
<td>.325</td>
<td>.675</td>
</tr>
<tr>
<td>Q(CES)</td>
<td>.254</td>
<td>.746</td>
</tr>
<tr>
<td>Q(CET)</td>
<td>.203</td>
<td>.797</td>
</tr>
<tr>
<td>Q(CH)</td>
<td>.299</td>
<td>.701</td>
</tr>
<tr>
<td>Q(CK)</td>
<td>.146</td>
<td>.854</td>
</tr>
<tr>
<td>Q(CKH)</td>
<td>.240</td>
<td>.760</td>
</tr>
<tr>
<td>Q(CP)</td>
<td>.082</td>
<td>.918</td>
</tr>
<tr>
<td>Q(CS)</td>
<td>.200</td>
<td>.800</td>
</tr>
<tr>
<td>Q(CT)</td>
<td>.269</td>
<td>.731</td>
</tr>
<tr>
<td>I</td>
<td>.212</td>
<td>.788</td>
</tr>
<tr>
<td>A</td>
<td>.295</td>
<td>.705</td>
</tr>
<tr>
<td>P</td>
<td>.133</td>
<td>.867</td>
</tr>
<tr>
<td>M</td>
<td>.071</td>
<td>.929</td>
</tr>
<tr>
<td>D</td>
<td>.036</td>
<td>.964</td>
</tr>
<tr>
<td>R</td>
<td>.271</td>
<td>.729</td>
</tr>
<tr>
<td>L</td>
<td>.252</td>
<td>.748</td>
</tr>
<tr>
<td>K</td>
<td>.048</td>
<td>.952</td>
</tr>
</tbody>
</table>
53.4% of the variation in the one measure is accounted for by variation in the other measure. Furthermore, for some elements only a negligible proportion of the total variance shared in common by the two measures is explained. There is no appreciable evidence that beginning and intermediate, ninth and tenth grade, or male and female French students differ as groups with respect to correlations between cognitive style inventory measures and teacher assessment measures.
CHAPTER IV NOTES

1. Paul Sackett. Personal communication. (Statistical consultation.)


3. Students in the ninth grade in the fall of 1976, when the inventory was administered a second time, were in the junior high school when it was given unsuccessfully the first time at the high school level. (See Chapter III, p. 70.)

Summary

The purpose of the study was to determine whether a test of educational cognitive style, administered at the beginning of the school year, could yield as accurate a diagnosis of foreign language students' cognitive style as teachers' informal diagnosis, based on knowledge and observation of the students throughout the year. It was posited that correlations of .70 or greater between the test measures and the teacher measures could be interpreted as evidence favoring early administration of the test (cognitive style inventory) for the purpose of individualizing foreign language instruction on the basis of students' cognitive styles from the outset of the course.

Two teachers trained in educational cognitive style theory and mapping procedures participated in the study. Teacher A made informal assessments of 49 randomly selected French I students on 22 of the 27 cognitive style elements measured by the cognitive style inventory. Teacher B made similar assessments of 50 French II students. The teachers used an assessment instrument focusing on learning-related behaviors characteristic of individuals having a
strong orientation in the 22 selected elements of educational cognitive style. Subjects' cognitive style inventory data was provided by the school district.

A multivariate analysis of variance was performed as a means of determining whether the two sample groups differed significantly with respect to the combined effects of the 22 cognitive style inventory measures. Teacher assessment data was analyzed by means of t-tests. Pearson product-moment coefficients of correlation between inventory scores and teacher assessment scores were computed by instructional level (French I and French II), grade level (Grade 9 and Grade 10), and subjects' sex. These were analyzed by z-test for significant between-groups differences. A correlation coefficient was also computed for each subject, using the subject's 22 cognitive style inventory scores and his 22 corresponding teacher assessment scores as correlates; this data was tested nonparametrically for significant differences between the two sample groups.

Finally, correlations between inventory scores and teacher assessment scores were computed on the basis of the total sample of 99 subjects. For each obtained correlation coefficient a 95-percent confidence interval was calculated, together with proportions of explained and residual variance.

Discussion

As noted in Chapter III, circumstances compelled the investigator to select two sample groups from two different instructional levels of French. In view of this fact, it was initially thought that each group could be considered as a sample from a different
population, and it was hypothesized that French I students and French II students would differ significantly with respect to inventory score group means. The first suspicion that this was not the case appeared when group means for the 22 cognitive elements were compared and found to be highly similar. Further evidence emerged when the data was tested for homogeneity of variance. The SPSS T-TEST subprogram was used for this purpose, since it automatically tests for variance homogeneity. The incidental t-test results showed no significant differences between the two groups on 20 of the 22 cognitive style variables, with extremely low t-values and concomitantly large probability values in most cases. Subsequently, the multivariate analysis of variance revealed no significant between-groups difference with respect to the combined effects of the 22 dependent variables. Although two elements, Q(CRM) and A, did prove to be significant per both t-test and one-way ANOVA, the investigator was assured that this effect could be attributed to chance factors or sampling error.

Further data analysis also yielded results contrary to the investigator's expectations. First, group means of Teacher A's assessments of French I subjects differed significantly from group means of Teacher B's assessments of French II subjects with respect to only five of the 22 cognitive style elements, despite the fact that the two teachers had made their assessments independently. Second, when inventory scores and teacher assessment scores were correlated separately for the two sample groups, correlation differences, which appeared substantial for some cognitive style
elements, were found to be nonsignificant. Similarly, ninth and tenth grade subgroups did not differ with respect to inventory/assessment correlation coefficients, while male and female subgroups differed only in the case of the T(VL) element. Finally, although there was a wide range, from low negative to high positive, in the extent to which the overall inventory measure and the overall teacher measure agreed with each other in the case of individual subjects, the two group medians differed by only .002 and the non-parametric test yielded an unusually high probability value \( p = .50 \) as a basis for accepting the null hypothesis of no significant difference between groups with respect to this variable.

Judging from the foregoing evidence, there seems to be little doubt that the two sample groups were in fact drawn from the same population. That is not to say, of course, that subjects did not differ substantially from each other in their individual cognitive style profiles. However, the overall similarity of the two groups was such as to defy discernment of more than negligible differences. Moreover, the effect extended to both grade level and sex subgroupings which cut across the two sample instructional level groups. It is also possible that the similarity may have contributed in some way to offset any differences between the two participating teachers in their assessments of subjects' cognitive styles.
Learning Behavior Related to Cognitive Style Elements.

The following is a description of learning behaviors related to the 22 elements of educational cognitive style included in the present study. It is presented here as a preface to the discussion of the correlation results contained in the next section.

T(AL) - Theoretical Auditory Linguistic - refers to the sound of words and the individual's ability to acquire and communicate meaning through spoken words. The major T(AL) student is ear-oriented with respect to verbal information. He is a good listener, responds well to oral presentations, likes to read aloud, and performs well on target-language listening comprehension exercises.

T(VL) - Theoretical Visual Linguistic - refers to the written or printed word and the individual's ability to acquire and communicate meaning by means of it. The major T(VL) student is eye-oriented with respect to verbal information. He needs written directions and explanations, takes written notes during oral presentations, and reads with a high level of comprehension.

Q(A) - Qualitative Auditory - refers to the individual's ability to perceive meaning through the sense of hearing (other than hearing verbal and numerical symbols). The major Q(A) student is easily disturbed or distracted by noises and thus needs a quiet learning environment. He should be able to perceive and accurately reproduce patterns of rhythm and intonation and other suprasegmental phenomena in the target
language.

Q(V) - Qualitative Visual - refers to the individual's ability to perceive meaning through the sense of sight, other than seeing verbal and numerical symbols. The major Q(V) student responds well to visual forms of presentation (such as pictures, films, filmstrips, slides, etc.). He prefers instructional materials that are amply illustrated and can often make meaningful visual illustrations to accompany instructional materials.

Q(P) - Qualitative Proprioceptive - refers to the individual's ability to coordinate a number of behaviors simultaneously in order to perform a complex physical task. The major Q(P) student is physically well-coordinated. He is adept at setting up and operating audiovisual equipment and generally writes legibly when taking notes or dictation. He learns folk dances easily and performs them well.

Q(CEM) - Qualitative Code Empathic - refers to empathy or the individual's sensitivity to the feelings of others. The major Q(CEM) student exhibits kindness and concern for the others, will not laugh at others' mistakes, and is a good tutor because he is patient with slower learners. He also often identifies with characters in stories and films.

Q(CES) - Qualitative Code Esthetic - refers to the individual's ability to perceive beauty in surroundings, objects, or ideas. The major Q(CES) student enjoys poetry, art, and music. He
places importance on the appearance of things and tends to produce neat assignments and papers. He may also enjoy the structure and sound of the target language for their esthetic qualities.

**Q(CEt)** - Qualitative Code Ethic - refers to the individual's commitment to a set of values, principles, obligations, and/or duties. The major Q(CEt) student generally adheres to school and classroom rules and established procedures, turns in assignments regularly and on time, keeps on working when the teacher is absent, sticks to a job until it is done, and can be counted on to meet deadlines.

**Q(CH)** - Qualitative Code Histrionic - refers to the individual's ability to exhibit a deliberate behavior or play a role. The major Q(CH) student enjoys role-playing, dramatics, and simulation activities. He is a good actor and frequently volunteers to participate in dialog and skit performances.

**Q(CK)** - Qualitative Code Kinesics - refers to the individual's ability to understand and communicate by means of non-verbal behavior. The major Q(CK) student enjoys learning gestures typical of the target culture and uses appropriate gestures when performing dialogs or skits. He is also sensitive to the teacher's non-verbal expressions of approval or disapproval.

**Q(CKH)** - Qualitative Code Kinesthetic - refers to the individual's willingness to practice a psychomotor activity so as to
perform according to an accepted form. The major Q(CKH) student strives to achieve perfection of performance and can generally be expected to practice pronunciation, dialogs, skits, structure drills, folk dances, and other psychomotor activities until the "correct" form is achieved.

Q(CP) - Qualitative Code Proxemics - refers to the individual's ability to judge appropriate physical and social distance between himself and others. The major Q(CP) student is generally sensitive to cultural differences and readily accepts the notion that social relations in the target culture are often more formal than in the United States.

Q(CS) - Qualitative Code Synnoetics - refers to the individual's ability to assess his own capacities and limitations so as to establish realistic goals. The major Q(CS) student knows his personal limits and does not try to do more than he is capable of. He generally learns through self-correction and past experience, paces himself appropriately on self-instructional materials or assigned projects, and asks for help when he needs it.

Q(CT) - Qualitative Code Transactional - refers to the individual's ability to relate positively to others so as to influence their behavior. The major Q(CT) student is a good group leader or organizer of extra-class activities. He can generally be counted on to get group activities going, keep them moving smoothly, and keep other participants involved in
group activities.

I - **Individuality** - refers to the individual's tendency to direct his own behavior. The major I student prefers to work alone and responds well to self-instructional materials, individual study options, and individual projects.

A - **Associates** - refers to the individual's predisposition toward peer-group influence. The major A student enjoys working with his peers and works well in paired-partner or small-group situations. In general, he prefers to choose those he will work with, rather than be arbitrarily assigned to a group.

F - **Family** - refers to the individual's predisposition toward authority, security, and tradition. The major F student needs structure, guidance, and one-to-one reinforcement from the teacher. He generally prefers whole-class rather than small-group or individual learning activities, and readily accepts directions and suggestions from the teacher.

M - **Magnitude** - refers to the individual's tendency to reason in terms of rules, definitions and categories. The major M student likes rules and definitions without exceptions. In general, he prefers specific, detailed directions without alternatives, and objective rather than essay tests. He tends to produce neat, orderly, and brief written assignments.

D - **Difference** - refers to the individual's tendency to reason in terms of one-to-one contrasts or comparisons. The major D
student seeks to understand or define a concept in terms of what it is not. He likes to have alternative learning activities from which to choose. He tends to be a descriptive writer who enjoys essay tests.

**R - Relationship** - refers to the individual's tendency to reason in terms of similarities, to analyze a situation in order to discover its components, or to synthesize a number of dimensions, characteristics, or incidents into a unified whole. The major R student is good at grammatical analysis, able to perceive complex relationships with relative ease, but needs numerous examples as a basis for formulating concepts. He also responds well to analysis of stories, poems and other literary selections and tends to prefer essay rather than objective tests. In creating dialogs, skits, stories and the like, he is a good synthesizer.

**L - Appraisal** - refers to the individual's tendency to analyze, question, and thoroughly "appraise" all aspects of whatever is under consideration in the process of coming to a conclusion. The major L student looks at all angles of a situation or assignment, considering many alternate ways of doing things before deciding on a course of action. As a result, he needs a great deal of time to complete tests, assignments, and projects and tends to work right up to a deadline, which he may fail to meet. When writing, he often adds extra thoughts in the margins of the paper, with lines
and arrows directing the reader's attention to them.

**K - Deduction** - refers to the individual's tendency to reason deductively, on the basis of logical proofs or syllogistic reasoning. The major K student can generally give elaborate, systematic reasons for his actions or defend a position logically. He enjoys games and mystery stories that involve logical deduction. He can generally accept a grammatical structure or aspect of the target culture which differs from his own if its internal "logic" can be demonstrated to him.

**Correlations Between Inventory and Teacher Assessment Measures.**

Obtained coefficients of correlation between inventory scores and teacher assessment scores, based on the total sample of 99 subjects, were found to be significant at the .05 level or beyond for all cognitive style elements (Table 10). The conclusion is that in the population there is a positive, linear relationship between the two measures. The obtained r-values can therefore be considered point estimates of the magnitude and direction of that relationship in the population, based on the sample of the present study. The upper and lower confidence interval limits (Table 11) are estimates of r-values between which the actual population correlation for each element can, with 95% probability, be expected to lie.

As previously noted, in only two cases did the total-sample correlations approach or exceed the predetermined criterion level of .70. This occurred for the elements T(VL) (r = .73) and Q(V) (r = .69). The confidence intervals, however, show that the actual
population correlation for T(VL) could be as high as .81 or as low as .62, while for Q(V) it could be expected to fall between .57 and .78. Table 12 shows that for T(VL) 53.4% of the variation in the teacher assessment scores is accounted for by variation in the inventory scores, leaving 46.6% of the variance unexplained by the linear relationship between the two measures. For Q(V), 47.5% of the variance is explained, with 52.5% linearly unaccounted for.

For T(VL) there were substantial between-groups correlation differences on all three independent variables: instructional level, grade level, and sex (Tables 5, 6, and 7). However, only the difference between male and female subjects was found to be significant. Given the finding of no significant difference with respect to the other 21 elements, that result could have occurred by chance. Alternatively, it could have been an artifact of either the magnitude of the correlation or the difference in the size of the two groups.

For Q(V), there were only negligible correlation differences between instructional level and grade level groups, whereas males and females differed by .11. However, none of the three between-groups differences was found to be significant.

T(VL) and Q(V) are both related to the student's visual orientation. T(VL), in particular, is associated with behaviors displayed in foreign language classes, which characteristically place heavy emphasis on reading and writing. Q(V) is reflected in the foreign language student's response to visual materials of a non-verbal nature: pictures, transparencies, slides, films, filmstrips, and the like. For both of these elements, the results of the study indicate
a relatively high degree of correspondence between the inventory measure and the teacher assessment measure. The foreign language teacher can therefore be fairly confident that inventory scores for T(VL) and Q(V) represent, within reasonable limits, as accurate an assessment of students' degree of strength in these elements as he or she might be able to make on the basis of a year's observation and classroom contact.

For T(AL) and Q(A), the auditory counterparts of the visual elements discussed above, substantially lower correlations emerged: .52 and .46, respectively. The population correlation for T(AL) can be expected, with 95% confidence to fall within the interval from .36 to .65, while for Q(A) it is estimated to lie between .30 and .60. In the case of T(AL), 27.4% of the variance is accounted for, while for Q(A), 21.1% is explained by the linear correlation between the inventory and the teacher assessment measures.

Total-sample correlations of less than .45 were found for six elements. The lowest of these occurred in the case of three modalities of inference: M (r = .27), D (r = .19), and K (r = .22). The other three were Q(CK) (r = .38), Q(CP) (r = .28), and F (r = .37). In the case of Q(CP), M, D, and K, less than 10% of the variance is explained.

As noted in Chapter IV, total-sample correlation coefficients of .45 or greater were found for 16 of the 22 cognitive style elements included in the study. Of these, 11 were .50 or greater, indicating at least a moderate degree of relationship between formal inventory measures and informal teacher assessment measures for one half
of the elements in question. The average of the 22 correlation coefficients, as calculated from their related values of $z_r$, was .480. This was almost identical to the total sample median (.471) of the individual-subject correlations showing the degree of overall agreement/discrepancy between each subject's 22 inventory scores and 22 teacher assessment scores.

**Interview With Participating Teachers.**

After the data had been collected the investigator interviewed the two participating teachers regarding various aspects of the study. The following is a summary of the tape-recorded interview.

Both teachers had some reservations regarding the inventory as a means of diagnosing students' cognitive styles. Both expressed reluctance to form prejudgments about students. Teacher B said he would prefer to diagnose students' cognitive styles on the basis of observation, then use the inventory data to adjust his diagnoses. Teacher A, too, felt that observation of students' behavior in various kinds of learning situations results in a more accurate diagnosis. She also stated her belief that some students may have responded to the inventory on the basis of an idealistic image of themselves, rather than a realistic self-appraisal.

Both teachers expressed highly positive reactions to the teacher assessment instrument. Despite their lengthy inservice training in educational cognitive style mapping, neither had previously seen a list of behaviors related to specific cognitive style elements. They felt that the use of the instrument throughout the school year would
have been extremely helpful as a means of diagnosing students' cognitive styles, and requested the investigator's permission to share the instrument with colleagues in other departments. They also commented favorably on the 1-5 scale which, they felt, permitted them a more discriminating judgment than the conventional, 3-level Major-Minor-Negligible scale established by Hill and his associates.

The teachers were asked to comment on the extent to which they found it easy or difficult to assess students' cognitive styles using the assessment instrument. Both agreed that the Modalities of Inference elements - M, D, R, L, and K - were the most difficult to diagnose; of these, the D element was the hardest. When the investigator remarked that diagnosis of the inference modalities on the basis of observation was difficult because they generally do not yield as much externalized, observable behavior as the other elements, Teacher B noted that the amount of the target language spoken in the classroom makes the task even more difficult, since the students communicate with the teacher less than they would in English, and then only on a relatively elementary level. He also found the Q(P) element was difficult to assess on the basis of foreign language classroom experience and reported that in some cases he had had to refer to his knowledge of subjects in relation to activities outside the foreign language classroom in order to arrive at a judgment.

Despite their reservations regarding the inventory, both teachers are strongly committed to the concept of educational cognitive style. They firmly believe in its value as a means by which they can better identify students' individual strengths and
weaknesses, and thus facilitate foreign language learning for all students to the maximum extent possible.

Inventory Validity and Reliability.

At the present writing, there appears to be no published information regarding the validity and reliability of the original, adult form of the cognitive style inventory. A form letter issued by Oakland Community College contains brief data, based on community college samples. Validity and Kuder-Richardson reliability coefficients, derived from subtests of the Differential Aptitude Tests, the Nelson-Denny Reading Test, the Carlsen-Brown Listening Test, and the "quantitative section of the 'Wechsler,'" are listed as follows:

Validity

\[
\begin{array}{ccc}
T(VL) & \text{Females} & .80 \\
T(AL) & \text{Females} & .75 \\
\end{array}
\]

\[
\begin{array}{ccc}
\text{Males} & .72 \\
\text{Males} & .70 \\
\end{array}
\]

Reliability

\[
\begin{array}{ccc}
T(VL) & \text{Females} & .93 \\
T(AL) & \text{Females} & .89 \\
\end{array}
\]

\[
\begin{array}{ccc}
\text{Males} & .92 \\
\text{Males} & .87 \\
\end{array}
\]

The document also cites point-biserial correlation coefficients for the qualitative symbolic, cultural determinants, and modalities of inference elements (excluding K) ranging from .54 to .93, with an average of .78. The Kuder-Richardson reliability coefficient given for these elements is .81.

Skeen reports that as a measure of reliability, the inventory adaptation used in the Niagara Falls Adult Education Project was administered to a sample of 72 high school students, then re-administered six weeks later. T-tests discerned no significant difference
between the test and retest group means. The report also notes that the adapted inventory items appeared to have a reasonable degree of face validity. However, a factorial analysis of project participants' inventory data showed some items to be more effective than others in measuring a given element, while some items evidently tapped another element than that which they were intended to measure. The factorial analysis also revealed that a maximum of 18 factors, rather than 26, were being measured, with 68% of the variance explained by the first 13 factors. The first two factors accounted for 27% of the variance.

The inventory adaptation from which cognitive style data was obtained for the present study was not subject to analysis to determine its validity and reliability before being administered. If one examines the inventory items grouped by cognitive style element (Appendix B), most seem to have good face or content validity. Some items, however, appear related to elements other than those they are intended to measure. Items 27 and 49, for example, are ostensibly designed to measure the Q(CKH) element which purportedly reflects the individual's willingness to practice a psychomotor activity according to an accepted form. In reality, these seem more closely related to the Q(P), or general psychomotor coordination element. Similarly, Items 7 and 142 are listed under the Q(CT) element. The first of these is more likely measuring Q(CEM) whereas the second is more probably tapping the A element.

There are also items which seem to invite the student to respond on the basis of an ideal image of himself rather than a realistic appraisal. Examples of these are Items 15, 31, 50, 133, and 189 (see
Appendix A). In other cases, — notably Items 21, 29, 41, 47, 74, 93, and 186 — anything but the highest value response would be extremely unlikely.

These few examples are the most obvious cases of questionable face validity. Together they constitute more than 7 percent of the total test. A formal validation study, especially one involving a factorial analysis, would undoubtedly reveal other weaknesses in greater detail and thus identify areas in need of revision. If the moderate correlations obtained in the present study can be taken as any indication of the concurrent validity of the secondary level inventory as it is now constituted, there is every reason to expect that a high degree of concurrent validity could be established for an appropriately revised instrument evaluated against a more stable, objective criterion.

Conclusions

The following conclusions are based on the results and findings of the present study as they related to the research hypotheses set forth in Chapter I.

1. (Hypothesis 7) For beginning and intermediate high school French students, there is a significant, positive, linear relationship between formal inventory measures and informal teacher assessment measures of educational cognitive style. The degree of that relationship, however, varies considerably from element to element. For the elements T(VL) and Q(V), the correlation between the two measures approaches the level of validity coefficients reportedly
obtained in studies using standardized tests as criterion measures. For the elements Q(CK), Q(CP), F, M, D, and K the correlation is less than .45. For other elements it ranges from .45 to .63. On the whole, there is sufficient evidence of disparity between the two measures to warrant a caution against unqualified acceptance of inventory results as an indication of the foreign language student's degree of strength in most cognitive style elements as it might be assessed by the teacher on the basis of a year's observation and classroom contact.

2. (Hypothesis 1) There is no significant group mean difference between high school beginning students of French and high school intermediate students of French with respect to the combined effects of inventory measures of the 22 elements of educational cognitive style included in the study. That is not to say that individual students do not differ markedly in their cognitive styles as measured by the inventory. Group profiles, which were not a relevant factor in the present study, may also differ from one instructional level to another, or even from one class to another in the same instructional level. With respect to the statistical mean of cognitive style inventory scores, however, French I and French II students can be considered as a single population.

3. (Hypotheses 3, 4, and 5) There is no significant difference between high school French I and French II students, ninth grade and tenth grade students of French I and French II, or male and female students of French I and French II with respect to
correlation between formal inventory measures and informal teacher assessment measures of the 22 elements of educational style included in the study. As noted above, the only instance in which a significant correlation difference was found in the present study was between males and females with respect to the T(VL) element. Given the finding of no significant difference with respect to the other 21 elements, this result could well have occurred by chance or through sampling error.

4. (Hypotheses 2 and 6) It is possible for two teachers trained in educational cognitive style theory and mapping procedures to make independent cognitive style assessments of two separate groups of foreign language students in such a way that the assessments substantially reflect the lack of difference between the groups. Group means of the teacher assessment scores differed significantly in the case of only five of the 22 cognitive style elements included in the study. In addition, despite the fact that individual subject correlations ranged widely with respect to degree of agreement/discrepancy between inventory scores and teacher assessment scores, no significant difference on this variable was discerned between the two sample groups. It is difficult to account for this phenomenon except in terms of a strong similarity between the two participating teachers in their use of the assessment instrument.
Limitations

The findings and conclusions of the study should be considered in the light of the following limitations:

1. The study was limited to middle and upper middle class students of French in a large, suburban, midwestern high school. For that reason, there is some question as to whether the findings can be generalized beyond that population. Moreover, they may not apply in the case of a different adaptation of the cognitive style inventory, or in a situation involving teachers untrained in educational cognitive style.

2. Both instruments used to collect the data for the study were relatively subjective in nature. The cognitive style inventory was adapted locally for use with high school students. As a result it cannot be assumed to have the same validity and reliability as the original adult form whose reported validity and reliability were established on the basis of community college samples. Moreover, since it is a self-reporting instrument, its accuracy as a means of diagnosing cognitive style is largely dependent on individual respondents' ability to appraise their own behavior quickly and objectively under test conditions. The tendency of some students to respond to the inventory on the basis of an idealistic image of themselves rather than an objective self-appraisal has already been noted.

The teacher assessment instrument, in turn, cannot be assumed to have more than face validity, since it was subjected only to scrutiny by persons judged to be expert in educational cognitive
style mapping. Its accuracy as a diagnostic instrument is largely dependent on the trained teacher's accuracy in observing student behaviors related to cognitive style elements and in gauging the strength of their orientation on that basis. In that sense, it can probably be considered no more or less valid a means of diagnosing educational style than the observation-based procedures exclusively employed prior to the development of more formal instruments.

Recommendations for Further Research

1. Of prime importance is the need for research regarding the reliability and validity of the secondary level inventory as an instrument for diagnosing the cognitive style strengths and weaknesses of foreign language students. Such research might well be aimed at refinement of the inventory. A shortened form, perhaps one focusing on fewer elements more directly related to foreign language learning, might be desirable.

2. Research should be directed toward cognitive style diagnosis of other kinds of foreign language students than were represented in the present study; i.e., students of other languages, as well as those of different socioeconomic backgrounds. Particularly instructive would be knowledge of how and to what extent these various populations differ from or resemble each other with respect to educational cognitive style. Such information could have profound implications for foreign language instruction in terms of goals and teaching strategies appropriate for specific
3. Investigation should also be conducted relative to educational
cognitive style as a predictor of foreign language achievement.
The two predictive instruments currently available to the pro-
profession are now more than ten years old. In that period of
time, both students and the goals of foreign language instruction
have changed drastically. There is a definite need today for a
valid means of gauging a given student's probability of success
at foreign language learning, in addition to diagnosing his
various strengths and weaknesses with respect to different as-
pects of language learning.

4. Finally, the area of interaction between the teacher's cognitive
style and that of the foreign language student should be ex-
plored. Evidence from research in other subject areas, support-
ed by one study in foreign language education, indicates that
teachers and students with similar cognitive styles relate more
positively to each other than do those whose cognitive styles
differ appreciably. Further knowledge is needed regarding the
extent to which this phenomenon is operative in the foreign lan-
guage classroom, as well as what effects it has on student
achievement and attitudes toward language learning. Such know-
ledge could have considerable implication for both preservice and
inservice teacher education.
CHAPTER V NOTES

1. It should be noted that for a Pearson r correlation coefficient of .50, only 25% of the variation in the one measure \(100 \times r^2\) is explained by its linear relationship to the other measure.

2. A similar effect was observed in the Niagara Falls Adult Education Project. (See Gerardo Franciosa, proj. dir., *The Identification of Preferred Cognitive Styles and Matching Adult Reading Program Alternatives for the 0-4 Grade Levels: Final Report*. Niagara Falls: Niagara Falls Board of Education, 1975. EDRS: ED 118 906.)


4. It is not clear why this unusual procedure was employed. Presumably, test-retest reliability figures could have been easily obtained by correlating the results of the two measurements.
APPENDIX A

COGNITIVE STYLE INVENTORY
STOW CITY SCHOOLS
STOW, OHIO

COGNITIVE STYLE MAPPING

INTEREST INVENTORY
SECONDARY LEVEL
1. I can remember a telephone number once I hear it.

12. In group discussions, I am the leader in reaching decisions.

2. I understand a topic better if I examine it to learn how it differs from other topics.

13. My "best" decisions are made alone.

3. I can act hurt and depressed in order to get favors.

14. I can tell who is on the phone by listening for a few moments.

4. I can tell how well I will do in most activities.

15. When I ride my bike, I look ahead and in other directions.

5. I can pretend that I am happy and comfortable even though I am angry and uncomfortable.

16. I would wait to be introduced to an important person rather than introduce myself.

6. I find it easier to win an argument when I use logic.

17. I do things I know I can do.

7. If a new student came into the class I would help him feel comfortable.

18. I can convince others to do the things that I would like them to do.

8. I feel uncomfortable when teachers call me by my last name.

19. My classmates find it easy to get along with me.

9. I know what makes me uptight.

20. I can tell whether or not I will be able to get my work done.

10. I use facial expressions to show how I feel.

21. If I bump against another person in a store, I say I'm sorry.

11. I don't ask others to help me make decisions.

22. Information should be looked at in a number of ways before I make a decision.
23. My written explanations are better than my spoken ones.

24. People ignore me.

25. I like to be in lecture type classes.

26. I find it easy to add spoken numbers in my head.

27. I am well coordinated.

28. I know what I have to do to be able to perform a particular task.

29. I enjoy concerts.

30. I know how to act in a formal situation.

31. When taking a test I would be quiet even if the teacher left the room.

32. I use my fingers to see if finish on wood is rough or smooth.

33. I can tell fresh bread from stale bread by the smell.

34. I can tell "what's for dinner" by the smell.

35. I can tell the difference between someone walking and someone running when not looking at someone.

36. Walking with a spring in your step makes other people think that you are happy.

37. In my choice of clothing, I usually wear different colors.

38. I can tell if milk is sour by tasting it.

39. I enjoy the beauty of people dancing.

40. Oral math tests are easy for me.

41. I choose music to fit my mood.

42. The taste of food is more important than the way it looks.

43. People say I speak better than I write.

44. I can remember page numbers when the teacher tells me the assignment.

45. After I write a letter, I ask someone to read it to me so that I know that it sounds right.

46. I understand the daily news if I hear it on the radio.

47. The rules of our society should be the same for everyone.
48. I do not let personal matters interfere with completing an assignment.

49. I can repair objects with small parts without watching my hands.

50. I have no sympathy for people who break the law.

51. I do well on a test if it is about information I heard in a lecture.

52. I prefer furniture that "feels" good when I run my hand over the upholstery.

53. I prefer to communicate with friends by telephone rather than writing notes to them.

54. I discuss the "sale" prices before I go shopping.

55. Eye movement is an important addition in my conversation.

56. I can write clearly when the teacher lectures to the class.

57. I decide that my hair needs washing by the way it feels.

58. When given a job to do, I prefer to work on it myself.

59. I am able to offer criticism without hurting the person I am criticizing.

60. My friends tell me that I am understanding.

61. I avoid saying things which hurt the feelings of others.

62. When looking at something made by someone else (like a painting, a building, a piece of furniture) I like to figure out why the person created it as he did.

63. I prefer to read a story myself rather than have someone read it aloud to me.

64. My "suffering" in the dentist's chair is less if he does not use unpleasant tasting materials in my mouth.

65. I prefer to read directions rather than have someone read them to me.

66. I like beauty in my surroundings.

67. I understand the feelings of others.

68. When someone is frightened, I can be patient and calm rather than get angry with them.
69. I am able to "play a role" if I agree to.

70. I prefer to ask favors of close friends and classmates rather than from teachers.

71. Religion is a purely personal thing.

72. When given a problem to solve, I can solve it best by myself.

73. Sounds interfere with my ability to concentrate.

74. I choose clothes for the way they look.

75. I keep a good written record of the page numbers for my homework assignments.

76. I score high on tests which measure reading understanding.

77. I can run and catch a ball that has been batted or thrown.

78. I choose my own friends.

79. I like to share ideas with friends and classmates.

80. I would rather do things my own way even if they don't agree with what my parents and friends expect.

81. I regard my personal goals as most important.

82. Before taking a new class, I discuss it with my friends.

83. Sales people find the merchandise that I'm asking for.

84. I "talk" with my hands.

85. I enjoy listening to good music for the quality of its sound.

86. I can understand when someone is not paying attention in class.

87. I can imitate someone else before a group.

88. I often have to make a decision before I am ready.

89. I talk with my family before doing anything that might affect them.

90. Before voting in a student council election, I review choices with my family.
91. I make it a point not to let my work interfere with family plans.

103. I shrug my shoulders when saying "I don't know."

92. I can act attentive and interested even when bored when listening to a teacher.

104. Unless spoken to first, I do not speak to a teacher.

93. I try to do the right thing.

105. I have no difficulty in understanding how to put puzzles together.

94. I understand how a person feels when being punished.

106. In general, I follow the rules.

95. I work just as hard when the teacher is away.

107. I find it important to check with my family in planning a party or activity.

96. I prefer spoken directions.

108. I can tell how well I will do in a new situation.

97. When I go shopping, I read the prices of my purchases and add them in my head.

109. I am able to tell which groups of instruments are playing at different times during a concert.

98. I enjoy art shows.

110. Characteristics for successful people are not the same as those for unsuccessful people.

99. When shopping for clothes, I like to have a friend along to help me make choices.

111. When taking classes in math, I find it easy to "talk math terms" with my classmates and teacher.

100. I feel better acquainted with someone after seeing pictures of him rather than reading about him.

112. I pat strangers on the back if I have an occasion to congratulate them.

101. I know a person's mood by the way he sits or poses.

113. I enjoy the beauty of the stars.

102. I do well in classes which rely heavily on textbooks.
<table>
<thead>
<tr>
<th>Number</th>
<th>Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>114.</td>
<td>I quote figures to others in order to prove my point in an argument.</td>
</tr>
<tr>
<td>115.</td>
<td>I solve written mathematical problems rapidly.</td>
</tr>
<tr>
<td>116.</td>
<td>I enjoy practicing so that I can compete successfully in sports.</td>
</tr>
<tr>
<td>117.</td>
<td>Poetry is beautiful because of its ideas as well as its words and structure.</td>
</tr>
<tr>
<td>118.</td>
<td>I know my capabilities.</td>
</tr>
<tr>
<td>119.</td>
<td>I do best on written math tests.</td>
</tr>
<tr>
<td>120.</td>
<td>When a teacher gives me an assignment, I prefer to have the page numbers written on the board.</td>
</tr>
<tr>
<td>121.</td>
<td>When I notice shavings dropping from the pencil sharpener, I realize it should be emptied.</td>
</tr>
<tr>
<td>122.</td>
<td>I am considered a &quot;good&quot; athlete.</td>
</tr>
<tr>
<td>123.</td>
<td>I find it easy to understand written numerical problems.</td>
</tr>
<tr>
<td>124.</td>
<td>I enjoy an activity more when my friends participate in it with me.</td>
</tr>
<tr>
<td>125.</td>
<td>When solving problems, I look for the reason to prove my conclusions.</td>
</tr>
<tr>
<td>126.</td>
<td>Paint smell in a room is disturbing to me.</td>
</tr>
<tr>
<td>127.</td>
<td>I understand the reasoning of problem solving math.</td>
</tr>
<tr>
<td>128.</td>
<td>When shopping for clothes, if I find the article I had in mind at a fair price, I buy it without further comparison.</td>
</tr>
<tr>
<td>129.</td>
<td>I disagree with people to force them to look at other points of view.</td>
</tr>
<tr>
<td>130.</td>
<td>I am a good actor.</td>
</tr>
<tr>
<td>131.</td>
<td>Teachers tell me my handwriting is clear.</td>
</tr>
<tr>
<td>132.</td>
<td>I can tell if something is wrong with an engine by listening to it.</td>
</tr>
<tr>
<td>133.</td>
<td>I would not do something if I knew it were wrong.</td>
</tr>
<tr>
<td>134.</td>
<td>I can shout and act tough in order to frighten others when I am frightened myself.</td>
</tr>
<tr>
<td>135.</td>
<td>I practice handwriting skills until I write clearly.</td>
</tr>
</tbody>
</table>
136. I enjoy outdoor activities more if my family is with me.

137. I check with my immediate family before making important decisions.

138. I understand events better after I have discussed them with my family.

139. I make personal decisions after discussing them with my friends.

140. I like to do things with my family.

141. I can convince two students who are fighting to make up.

142. I involve my friends when trying to solve my problems.

143. I enjoy trying new foods in order to find new tastes that are pleasing to me.

144. I would rather read articles which are accompanied by pictures or drawings.

145. I would return to a restaurant because the food tasted good.

146. The tone of a speaker's voice gives extra meaning to what he says.

147. I can get dressed in the dark.

148. I see how people cannot understand a problem until they know as much about it as possible.

149. Learning to swing a bat or golf club the right way is important.

150. When I attack a problem, I approach it from as many angles as possible.

151. I tune the radio by sound, not by looking at the dial.

152. I can feel the difference between blue jeans and corduroy.

153. I won't taste something if it smells bad.

154. When I walk up the stairs, I look at the steps.

155. At parties I can talk others out of arguing before they go too far.

156. I blush easily.

157. Life is simple if you go by the rules.

158. I work best in a highly organized situation.
159. I avoid statements of what might happen when solving problems.

160. I can identify musical notes well enough to recognize a "tune" the next time I hear it.

161. I prefer working in situations where rules are clearly stated.

162. I pick up and feel clothes in the store before buying them.

163. I value my friends' opinions.

164. I can see the reasoning in scientific laws.

165. I enjoy practicing until I can do something perfectly.

166. I understand more easily by reading than by hearing.

167. When I shake hands with someone, the handshake tells me something about them.

168. A person can never know enough about life.

169. I try to understand why people break rules.

170. There's always a reason for a person's behavior.

171. I like to find out how the parts fit together.

172. I laugh with the person who laughs when he stubs his toe because I know it hurts.

173. In selecting a beverage, my choice is based on taste.

174. I tend to see all parts of the world as being related to each other.

175. I find the type of thinking used in math suits my style of thinking.

176. To become a good typist, I would practice correct finger movements.

177. I "think" in pictures instead of words.

178. When I change the station on the radio, I pay close attention to the numbers on the dial.

179. When cooking, I use various spices until the food tastes "right."

180. Problem-solving involves related examples.

181. I can force myself to handle boring tasks.
182. It is easy for me to remember the numbers and formulas I hear during class.

183. If I had an allowance I would keep a written record of the money.

184. I would find it interesting to discover how people behave by evaluating things which make people tick.

185. I enjoy games or puzzles in which the solution is figured out from information contained in the rules.

186. Holidays are different from other days of the year.

187. I look at different solutions in solving problems.

188. I learn a subject better when I can discuss it with my friends or classmates.

189. I believe that a promise should be kept.

190. I know how far I can go without being punished.

191. After I write a letter, I have to read it to be certain it is correct.

192. When I play golf or other sports, I take several practice swings before I start to play.

193. I can tell when a ditto has been freshly run by smelling it.

194. When I am in a group of people trying to solve a written problem involving numbers I am among the first to reach the solution.

195. I find reasoning like this statement helps me to clarify my thoughts: "All men are mortal; Socrates is a man: Socrates is mortal."

196. The more I know about a problem, the more I want to know about it.

197. I would rather turn down money than give up on my principles.

198. Usefulness and saving time are important but they should not be so important as to leave out appearance.

199. In evaluating the performance of others I find it helpful to determine how this performance differed from another performance.
135

200. The "smell" is an important part of the pleasure connected with a new car.

201. I prefer to write with a pen that "feels" good to my fingers.

202. I can tell the difference between a nickel and a dime in my pocket without looking at it.

203. Blindfolded, I can taste the difference between chicken and beef.

204. The smells in a room determine for me whether it is pleasant or unpleasant.

205. I would go out of my way to see beautiful scenery.

206. I don't find sufficient reason to change my mind on a subject once I identify the rule which applies.

207. I use jokes or humorous remarks to change the subject in different situations.

208. When there are gas fumes in the car or the house, I notice them.

209. In evaluating the performance of others, I find it important to determine the rules which were set for them.

210. I have no difficulty in following a map.

211. I understand a lecturer better if I can see him while he talks.

212. I would join a particular group because my friends belong to it.

213. I can make more sense out of what a person means when he speaks to me rather than when he writes to me.

214. I take longer than others in making a decision because I want to know more about a problem than they do.

215. I can pitch horseshoes or lawn darts quite well.

216. A story is easier to understand in a movie than in a book.
APPENDIX B

COGNITIVE STYLE INVENTORY:

ITEMS GROUPED BY COGNITIVE STYLE ELEMENT
\(T(AL) - \text{Theoretical Auditory Linguistic}\)

25. I like to be in lecture type classes.

43. People say I speak better than I write.

45. After I write a letter, I ask someone to read it to me so that I know that it sounds right.

46. I understand the daily news if I hear it on the radio.

51. I do well on a test if it is about information I heard in a lecture.

53. I prefer to communicate with friends by telephone rather than writing notes to them.

96. I prefer spoken directions.

213. I can make more sense out of what a person means when he speaks to me rather than when he writes to me.

\(T(AQ) - \text{Theoretical Auditory Quantitative}\)

1. I can remember a telephone number once I hear it.

26. I find it easy to add spoken numbers in my head.

40. Oral math tests are easy for me.

44. I can remember page numbers when the teacher tells me the assignment.

54. I discuss the "sale" prices before I go shopping.

111. When taking classes in math, I find it easy to "talk math terms" with my classmates and teacher.

114. I quote figures to others in order to prove my point in an argument.

182. It is easy for me to remember the numbers and formulas I hear during class.
**T(VL) – Theoretical Visual Linguistic**

23. My written explanations are better than my spoken ones.

63. I prefer to read a story myself rather than have someone read it aloud to me.

65. I prefer to read directions rather than have someone read them to me.

76. I score high on tests which measure reading understanding.

102. I do well in classes which rely heavily on textbooks.

166. I understand more easily by reading than by hearing.

191. After I write a letter, I have to read it to be certain it is correct.

210. I have no difficulty in following a map.

**T(VQ) – Theoretical Visual Quantitative**

75. I keep a good written record of the page numbers for my homework assignments.

97. When I go shopping, I read the prices of my purchases and add them in my head.

115. I solve written mathematical problems rapidly.

119. I do best on written math tests.

120. When a teacher gives an assignment, I prefer to have the page numbers written on the board.

123. I find it easy to understand written numerical problems.

183. If I had an allowance I would keep a written record of the money.

194. When I am in a group of people trying to solve a written problem involving numbers I am among the first to reach the solution.
Q(A) - Qualitative Auditory

14. I can tell who is on the phone by listening for a few moments.

35. I can tell the difference between someone walking and someone running when not looking at someone.

73. Sounds interfere with my ability to concentrate.

109. I am able to tell which groups of instruments are playing at different times during a concert.

132. I can tell if something is wrong with an engine by listening to it.

146. The tone of a speaker's voice gives extra meaning to what he says.

151. I can tune the radio by sound, not by looking at the dial.

160. I can identify musical notes well enough to recognize a "tune" the next time I hear it.

Q(O) - Qualitative Olfactory

33. I can tell fresh bread from stale bread by the smell.

34. I can tell "what's for dinner" by the smell.

126. Paint smell in a room is disturbing to me.

153. I won't taste something if it smells bad.

193. I can tell when a ditto has been freshly run by smelling it.

200. The "smell" is an important part of the pleasure connected with a new car.

204. The smells in a room determine for me whether it is pleasant or unpleasant.

208. When there are gas fumes in the car or the house, I notice them.
\textbf{Q(S) - Qualitative Savory}

38. I can tell if milk is sour by tasting it.

42. The taste of food is more important than the way it looks.

64. My "suffering" in the dentist's chair is less if he does not use unpleasant tasting materials in my mouth.

143. I enjoy trying new foods in order to find new tastes that are pleasing to me.

145. I would return to a restaurant because the food tasted good.

173. In selecting a beverage, my choice is based on taste.

179. When cooking, I use various spices until the food tastes "right."

203. Blindfolded, I can taste the difference between chicken and beef.

\textbf{Q(T) - Qualitative Tactile}

32. I use my fingers to see if finish on wood is rough or smooth.

52. I prefer furniture that "feels" good when I run my hand over the upholstery.

57. I decide that my hair needs washing by the way it feels.

147. I can get dressed in the dark.

152. I can feel the difference between blue jeans and corduroy.

162. I pick up and feel clothes in the store before buying them.

201. I prefer to write with a pen that "feels" good to my fingers.

202. I can tell the difference between a nickel and a dime in my pocket without looking at it.
Q(V) - Qualitative Visual

74. I choose clothes for the way they look.

98. I enjoy art shows.

100. I feel better acquainted with someone after seeing pictures of him rather than reading about him.

144. I would rather read articles which are accompanied by pictures or drawings.

177. I "think" in pictures instead of words.

178. When I change the station on the radio, I pay close attention to the numbers on the dial.

211. I understand a lecturer better if I can see him while he talks.

216. A story is easier to understand in a movie than in a book.

Q(P) - Qualitative Proprioceptive

15. When I ride my bike, I look ahead and in other directions.

56. I can write clearly when the teacher lectures to the class.

77. I can run and catch a ball that has been batted or thrown.

121. When I notice shavings dropping from the pencil sharpener, I realize it should be emptied.

122. I am considered a "good" athlete.

151. Teachers tell me my handwriting is clear.

154. When I walk up the stairs, I look at the steps.

215. I can pitch horseshoes or lawn darts quite well.
Q(CEM) - Qualitative Code Empathic

59. I am able to offer criticism without hurting the person I am criticizing.

60. My friends tell me that I am understanding.

61. I avoid saying things which hurt the feelings of others.

67. I understand the feelings of others.

68. When someone is frightened, I can be patient and calm rather than get angry with them.

86. I can understand when someone is not paying attention in class.

94. I understand how a person feels when being punished.

172. I laugh with the person who laughs when he stubs his toe because I know it hurts.

Q(CES) - Qualitative Code Esthetic

29. I enjoy concerts.

39. I enjoy the beauty of people dancing.

66. I like beauty in my surroundings.

85. I enjoy listening to good music for the quality of its sound.

113. I enjoy the beauty of the stars.

117. Poetry is beautiful because of its ideas as well as its words and structure.

198. Usefulness and saving time are important but they should not be so important as to leave out appearance.

205. I would go out of my way to see beautiful scenery.
Q(CET) – Qualitative Code Ethic

31. When taking a test I would be quiet even if the teacher left the room.

47. The rules of our society should be the same for everyone.

48. I do not let personal matters interfere with completing an assignment.

93. I try to do the right thing.

95. I work just as hard when the teacher is away.

133. I would not do something if I knew it were wrong.

189. I believe that a promise should be kept.

197. I would rather turn down money than give up on my principles.

Q(CH) – Qualitative Code Histrionic

3. I can act hurt and depressed in order to get favors.

5. I can pretend that I am happy and comfortable even though I am angry and uncomfortable.

30. I know how to act in a formal situation.

69. I am able to "play a role" if I agree to.

87. I can imitate someone else before a group.

92. I can act attentive and interested even when bored when listening to a teacher.

130. I am a good actor.

134. I can shout and act tough in order to frighten others when I am frightened myself.
Q(CK) - Qualitative Code Kinesics

10. I use facial expressions to show how I feel.

36. Walking with a spring in your step makes other people think that you are happy.

55. Eye movement is an important addition in my conversations.

84. I "talk" with my hands.

101. I know a person's mood by the way he sits or poses.

103. I shrug my shoulders when saying "I don't know."

156. I blush easily.

167. When I shake hands with someone, the handshake tells me something about them.

Q(CKH) - Qualitative Code Kinesthetic

27. I am well coordinated.

49. I can repair objects with small parts without watching my hands.

116. I enjoy practicing so that I can compete successfully in sports.

135. I practice handwriting skills until I write clearly.

149. Learning to swing a bat or golf club the right way is important.

165. I enjoy practicing until I can do something perfectly.

176. To become a good typist, I would practice correct finger movements.

192. When I play golf or other sports, I take several practice swings before I start to play.
Q(CP) - Qualitative Code Proxemics

8. I feel uncomfortable when teachers call me by my last name.
16. I would wait to be introduced to an important person rather than introduce myself.
21. If I bump against another person in a store, I say I'm sorry.
24. People ignore me.
70. I prefer to ask favors of close friends and classmates rather than from teachers.
104. Unless spoken to first, I do not speak to a teacher.
112. I pat strangers on the back if I have an occasion to congratulate them.
190. I know how far I can go without being punished.

Q(CS) - Qualitative Code Synnoetics

4. I can tell how well I will do in most activities.
9. I know what makes me uptight.
17. I do things I know I can do.
20. I can tell whether or not I will be able to get my work done.
28. I know what I have to do to be able to perform a particular task.
108. I can tell how well I will do in a new situation.
118. I know my capabilities.
181. I can force myself to handle boring tasks.
Q(CT) – Qualitative Code Transactional

7. If a new student came into the class I would help him feel comfortable.

12. In group discussions, I am the leader in reaching decisions.

18. I can convince others to do the things that I would like them to do.

19. My classmates find it easy to get along with me.

83. Sales people find the merchandise that I'm asking for.

141. I can convince two students who are fighting to make up.

142. I involve my friends when trying to solve my problems.

155. At parties I can talk others out of arguing before they go too far.

I – Individuality

11. I don't ask others to help me make decisions.

13. My "best" decisions are made alone.

58. When given a job to do, I prefer to work on it myself.

71. Religion is a purely personal thing.

72. When given a problem to solve, I can solve it best by myself.

78. I choose my own friends.

80. I would rather do things my own way even if they don't agree with what my parents and friends expect.

81. I regard my personal goals as most important.
A - Associates

79. I like to share ideas with friends and classmates.
82. Before taking a new class, I discuss it with my friends.
99. When shopping for clothes, I like to have a friend along to help me make choices.
124. I enjoy an activity more when my friends participate in it with me.
139. I make personal decisions after discussing them with my friends.
163. I value my friends' opinions.
188. I learn a subject better when I can discuss it with my friends or classmates.
212. I would join a particular group because my friends belong to it.

F - Family

89. I talk with my family before doing anything that might affect them.
90. Before voting in a student council election, I review choices with my family.
91. I make it a point not to let my work interfere with family plans.
107. I find it important to check with my family in planning a party or activity.
136. I enjoy outdoor activities more if my family is with me.
137. I check with my immediate family before making important decisions.
138. I understand events better after I have discussed them with my family.
140. I like to do things with my family.
M - Magnitude

50. I have no sympathy for people who break the law.

106. In general, I follow the rules.

128. When shopping for clothes, if I find the article I had in mind at a fair price, I buy it without further comparison.

157. Life is simple if you go by the rules.

158. I work best in a highly organized situation.

161. I prefer working in situations where rules are clearly stated.

206. I don't find sufficient reason to change my mind on a subject once I identify the rule which applies.

209. In evaluating the performance of others, I find it important to determine the rules which were set for them.

D - Differences

2. I understand a topic better if I examine it to learn how it differs from other topics.

37. In my choice of clothing, I usually wear different colors.

41. I choose music to fit my mood.

110. Characteristics for successful people are not the same as those for unsuccessful people.

129. I disagree with people to force them to look at other points of view.

186. Holidays are different from other days of the year.

199. In evaluating the performance of others I find it helpful to determine how this performance differed from another performance.

207. I use jokes or humorous remarks to change the subject in different situations.
R - Relationship

62. When looking at something made by someone else (like a painting, a building, a piece of furniture) I like to figure out why the person created it as he did.

105. I have no difficulty in understanding how to put puzzles together.

169. I try to understand why people break rules.

170. There's always a reason for a person's behavior.

171. I like to find out how the parts fit together.

174. I tend to see all parts of the world as being related to each other.

180. Problem-solving involves related examples.

184. I would find it interesting to discover how people behave by evaluating things which make people tick.

L - Appraisal

22. Information should be looked at in a number of ways before I make a decision.

88. I often have to make a decision before I am ready.

148. I see how people cannot understand a problem until they know as much about it as possible.

150. When I attack a problem, I approach it from as many angles as possible.

168. A person can never know enough about life.

187. I look at different solutions in solving problems.

196. The more I know about a problem the more I want to know about it.

214. I take longer than others in making a decision because I want to know more about a problem than they do.
K - Deductive

6. I find it easier to win an argument when I use logic.

125. When solving problems, I look for the reason to prove my conclusions.

127. I understand the reasoning of problem solving math.

159. I avoid statements of what might happen when solving problems.

164. I can see the reasoning in scientific laws.

175. I find the type of thinking used in math suits my style of thinking.

185. I enjoy games or puzzles in which the solution is figured out from information contained in the rules.

195. I find reasoning like this statement helps me to clarify my thoughts: "All men are mortal; Socrates is a man; Socrates is mortal."
APPENDIX C

TEACHER ASSESSMENT INSTRUMENT
EDUCATIONAL COGNITIVE STYLE MAPPING
STUDENT BEHAVIOR INVENTORY

STUDENT NUMBER SEX (Circle): M F GRADE LEVEL (Circle): 9 10 11 12

1) Ability to obtain meaning from spoken words
- Likes to read aloud
- Prefers to have directions given orally
- Uses speech rather than writing when conveying information to others
- Prefers oral presentation forms of instruction (lectures, films, etc.)
- Retains information given orally
- Performs well on target-language listening comprehension exercises

2) Ability to obtain meaning from written words
- Prefers to read a story rather than listen to it
- Prefers written directions; writes down oral directions
- Takes written notes during oral presentations
- Chooses and reads written materials over information presented orally
- Reads with good comprehension in either English or the target language

3) Ability to obtain meaning through the sense of hearing (other than hearing words)
- Is easily disturbed or distracted by noises
- Recognizes people by the sound of their footsteps or their voices
- Easily learns the melody of target-language songs
- Can accurately reproduce patterns of rhythm and intonation in the target language

4) Ability to obtain meaning through the sense of sight (other than seeing words)
- Notices subtle changes in classroom arrangements
- Can visualize imagery in reading selections
- Enjoys visual forms of presentation (pictures, films, filmstrips, slides, etc.)
- Prefers instructional materials that are amply illustrated
- Can make a meaningful pictorial representation to illustrate materials

5) Psychomotor coordination
- Performs well on tasks requiring physical coordination (athletics, music, typing, etc.)
- Avoids bumping into, tripping over, or dropping objects
- Is adept at setting up and operating audiovisual equipment
- Learns folk dances easily; performs them well

6) Empathy: Ability to put oneself in another person's position
- Exhibits kindness, concern, etc. for others
- Identifies with characters in stories or films
- Will not laugh at others' errors
- Is patient with slower learners

7) Ability to see beauty in surroundings, objects, or ideas
- Talks about color, size, shape, and form of things
- Enjoys poetry, art, music, or the structure of poems and stories
- Coordinates clothing; is a "sharp dresser"
- Exhibits pride in the appearance of work and possessions

8) Adherence to a set of values, principles, obligations, or duties
- Adheres to school and classroom rules, procedures, etc.
- Sticks to a job until it is done
- Keeps on working when the teacher is absent
- Turns in assignments regularly and on time

9) Ability to exhibit a deliberate behavior or play a role
- Enjoys role-playing, dramatics, and simulation activities
- Attracts the teacher's attention when he wants to be called on
- Can get his way by acting in a particular manner (angry, hurt, dejected)
- Volunteers to participate in dialog and skit performances

10) Ability to understand and communicate by means of non-verbal behavior
- Uses a great deal of "body language" (gestures, facial expressions) in communication
- Responds appropriately to the teacher's expressions or gestures of approval or disapproval
- Enjoys learning gestures typical of the target culture
- Uses appropriate gestures when performing dialogues or skits
11) Willingness to practice a psychomotor activity so as to perform according to accepted form
   - Practices a psychomotor activity (dialog, skit, pronunciation, structure drill, folk dances, songs) until correct form is achieved
   - Participates in warm-up activity before engaging in actual performance
12) Ability to judge appropriate physical and social distance between oneself and others
   - Addresses older people in an unoffending manner
   - Is able to penetrate others' "personal space" without offending
   - Accepts the fact that social relations in the target culture are often more formal than in the U.S.
13) Ability to assess one's capacities and limitations so as to establish realistic goals
   - Knows personal units; doesn't try to do more than he is capable of
   - Learns through self-correction and past experience
   - Paces self appropriately on self-instructional materials or assigned projects
   - Asks for help when he needs it
14) Ability to relate positively to others so as to influence their actions
   - Is a good group leader or organizer of extra-class activities
   - Can be counted on to get group activities started and keep them moving smoothly
   - Attempts to reconcile differences between others, especially friends
   - When in groups, attempts to move others to a mutually agreeable course of action
15) Individuality: Tendency to direct one's own behavior
   - Prefers to work alone
   - Makes his own decisions
   - Chooses independent study options
   - Decides when he is ready to take a test
16) Tendency to be influenced by one's associates or peers
   - Enjoys working with peers; works well with partners or in small groups
   - Solicits ideas or opinions from peers before making decisions
   - Has many friends of the same age
   - Prefers to choose those he will work with, rather than be arbitrarily assigned to a group
17) Tendency to be influenced by one's family and/or authority figures
   - Seeks direction from the teacher; readily accepts the teacher's suggestions
   - Needs one-to-one reinforcement from the teacher
   - Talks about home and family experiences
   - Considers the effect on his family before making decisions
   - Prefers whole-class activities that are directed by the teacher
18) Tendency to reason in terms of rules, definitions, and/or classifications
   - Produces neat, orderly assignments
   - Prefers objective tests; writes briefly on essay tests
   - Likes specific, detailed directions without alternatives
   - Likes rules or definitions without exceptions
19) Tendency to reason in terms of contrasts
   - Prefers to work alone
   - Makes "what if" questions; makes "but if" statements
   - Uses "it is/it is not" contrasts
   - Enjoys essay tests; is a descriptive writer
   - Needs alternatives
20) Tendency to reason in terms of comparisons
   - Often examples of things similar to what is being discussed
   - Seeks cause-effect relationships
   - Gains examples when asked by the teacher
21) Tendency to reason by appraisal (an even balance among 13, 19, and 20 above)
   - Is slow to make decisions in new situations
   - Suggests alternate ways of doing things
   - Needs a great deal of time to complete tests, assignments, and projects
   - When writing, adds extra thoughts in margins, with lines and arrows
22) Tendency to reason deductively
   - Likes games and mystery stories that involve logical deduction
   - Uses "if...then" statements in discussions
   - Can defend his position logically
   - Gives elaborate, systematic reasons for his actions
LIST OF REFERENCES


157


