

A COMPARISON OF COGNITIVE STYLES:
AN EXPLORATORY INVESTIGATION

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PREFACE

The present investigation was concerned with determining and comparing the cognitive styles of Indian children in the elementary grades three through six. It is hoped that as a result of this investigation a better understanding of cross-cultural intellectual development will ensue. It is further hoped that the findings will initiate more investigations in this area.

I would like to take this opportunity to express my sincere appreciation for the assistance and guidance given me by the following members of my committee: Dr. Kenneth Wiggins, who served as chairman of my advisory committee and who has given more than I can express in words; Dr. Thomas Johnsten, who was always available for counsel and encouragement and who gave so generously of his time and whose suggestions and directions were indispensable; Dr. Herbert Bruneau, for his personal interest, friendliness, and encouragement; Dr. Edwin Biggerstaff, for his warmth, friendliness, and assistance toward the realization of this goal; and, Dr. Robert Walton, who gave untiringly of himself in guiding and encouraging the investigator, for his constructive criticisms and assistance. Through their efforts, this investigation has been a highly-valued learning experience.

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"we will make up for the past three years in the future".

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CHAPTER I

NATURE OF THE PROBLEM

Introduction

A major social problem confronting educators in America today is academic failure. Some of the reasons for this failure that have been generally agreed on in studies during the past decade are health, social status, and environmental influences.

During the past fifteen years there has been renewed interest in problems of cognition. There has been an increase in research concerning the identification of cognitive styles and the understanding of their relation to personal functioning.

Despite the lack of research information, teachers report that children perceive the same task differently, that some students comprehend situations better through discussion than by reading or independent study, that some are able to analyze and evaluate information readily in arriving at concepts and principles inductively and others are not. Thus, differences among students in styles of perceiving, cognizing, and conceptualizing are probably as real as are differences in general intellectual ability and educational achievements (Fredrick and Klausmeier, 1970).

With the quality of teaching being scrutinized today as never before in the history of education, it seems that we need to take a look at some of those variables that can possibly help us in the process of better educating children.

Justification of the Study

The style in which children learn has recently received wide attention. Studies are being conducted in an effort to learn more about this dimension.

Piaget (1964), through his work with both children and adults, has given evidence which indicates that there are certain levels of development through which individuals progress; and at each stage in this development, thinking patterns are altered enabling the individual to handle information in a more efficient and effective manner. For example, a child of seven or eight is usually unable to mentally manipulate material he cannot see or feel, whereas the child of twelve or more, in most cases, has reached a stage of development where it is possible to make abstractions. This individual no longer needs the actual experience with the material as he can mentally generalize from one situation to another. Children do not all make this developmental change at the same time. Evidence indicates that some never reach the abstract stage of thought. In light of this evidence, it appears to be necessary for educators to be aware of the dimension of cognitive style of children and its relationship to how children learn.

Education of Indian children has been the topic of much discussion. Havighurst (1970) stated that teachers and schools are not geared to Indian ways. His report calls for more effective teaching methods and more meaningful school curriculum. The report also calls for the recognition of special needs of Indian children. Further he wrote: "... most schools and educators have expected Indian children to accommodate to styles of instruction and curriculum which were not designed (for) special requirements of many Indian youngsters." Also, "... if the educational profession learns to teach Indian children more effectively and if the educational system supports such efforts."

If however, Indian children are not any different from others from the standpoint of cognitive style, then it might be that they do not need special instruction and curriculum. We need to know beyond the point of speculation if Indian children do differ in cognitive style. This study is an attempt to obtain concrete evidence as to the cognitive styles of Indian children as compared to Caucasian children.

If descriptive children perform better academically and have higher intelligence, there may be important educational implications from this exploratory research. If Indian children possess different cognitive styles from other children in a similar setting, this would have important implications for all educators.

Psychologists and educators are becoming increasingly aware of the significance of cognitive style in children.

It seems that in this day and age when considerable emphasis and attention is turned to education of children, research dealing with cognitive functions has a unique and important contribution to make. There is an increased interest in the search for talent. There is also increased concern to challenge children intellectually through the school curriculum. Certainly the kinds of information that can be obtained in studies of cognition are of fundamental importance.

Statement of the Problem

The purpose of this investigation is to determine and compare cognitive styles of Indian and Caucasian children in grades three through six. Previous studies by Kagan et al. (1964), Baggaley (1955), and Goodenough and Karp (1961) reveal that large percentages of white children are analytical. According to the literature, the performance of these children is intellectually superior to those who are relational or non-analytical in dealing with non-verbal materials.

An increasing number of psychologists have begun to study the development of thought, reasoning, and conception of the physical and moral world (Sigel, 1960). The variable of conception of the physical world plays a role in the intellectual development of children. Understanding this characteristic is of considerable significance in understanding how boys and girls learn.

Research Questions

This investigation attempts to answer the following questions?

1. Does the descriptive part-whole responses of Indian boys in the elementary grades three and four differ significantly from Caucasian boys in elementary grades three and four?
2. Does the relational-contextual responses of Indian boys in the elementary grades three and four differ significantly from Caucasian boys in elementary grades three and four?
3. Does the descriptive part-whole responses of Indian girls in the elementary grades three and four differ significantly from Caucasian girls in elementary grades three and four?
4. Does the relational-contextual responses of Indian girls in the elementary grades three and four differ significantly from Caucasian girls in elementary grades three and four?
5. Does the descriptive part-whole responses of Indian boys in the elementary grades five and six differ significantly from Caucasian boys in the elementary grades five and six?

6. Does the relational-contextual responses of Indian boys in the elementary grades five and six differ significantly from Caucasian boys in the elementary grades five and six?
7. Does the descriptive part-whole responses of Indian girls in the elementary grades five and six differ significantly from Caucasian girls in the elementary grades five and six?
8. Does the relational-contextual responses of Indian girls in the elementary grades five and six differ significantly from Caucasian girls in the elementary grades five and six?
9. Are Indian boys in the elementary grades five and six more descriptive than Indian boys in the elementary grades three and four?
10. Are Indian girls in the elementary grades five and six more descriptive than Indian girls in the elementary grades three and four?

Definition of Terms

The basic definitions of the principal terms in this study follow. The meanings of these and other important terms are expanded in the selected review of the literature.

Cognitive Style

This refers to individual consistencies in behavior resulting from the individual's perceptual and conceptual organization of the external environment (Kagan et al., 1963).

Cognitive Style Test

An experimental instrument (male and female versions), consisting of sets of three drawings of familiar objects in which the subjects group two of three objects together and explain the basis of grouping (Sigel, 1970).

Indian Children

Children who have one-fourth or more Indian ancestry; one or both parents on tribal rolls; identified themselves as Indian; and his teacher or friends identified him as Indian.

Descriptive (Stimulus Center)

Concepts which are derived directly from the physical attributes of the stimulus and one in which the conceptual

label contains a direct reference to a physical attribute present in the stimulus.

Relational Contextual

Concepts which are used to tie together (or relate) two or more people, objects, events, or ideas. No stimulus is an independent instance of the concept, each stimulus selected gets its meaning and its definition in the sort from a relationship with other stimuli.

Global Manner

Non-analytical, associative, or relational-contextual perception of certain visual stimuli.

Analytical Children

Those children that are descriptive (stimulus centered) in the manner in which they perceive and analyze a complex stimulus array.

Non-Analytical Children

Those children that are relational-contextual, or tie together familiar objects in a set on the basis of functional relationships.

Field-Independent

Those children who are descriptive (stimulus centered) or analytical in their cognitive style (Witkin et al., 1954).

DPW

Descriptive part-whole (analytical responses).

RC

Relational-contextual (non-analytical responses).

Assumption of the Study

1. That the Sigel Cognitive Test (male and female versions) is a valid and reliable indicator of a child's preferred style of categorization as defined by Sigel (1970).

Limitations of the Study

1. Interpretation of the results of this investigation is limited to the children in grades three through six at the three public elementary schools included in this study.
2. The reported study was geographically restricted to a rural area of Central Oklahoma.

Summary

CHAPTER I has been an introduction to the study. CHAPTER II is devoted to a review of related research and literature. CHAPTER III presents a description of the instrument used in the study and the procedures followed by the investigator in gathering and analyzing the data.

CHAPTER IV presents a statistical treatment of the data used in the study. Finally, CHAPTER V summarizes the entire study, gives conclusions drawn from the findings, and suggests areas for further research.

CHAPTER II

SELECTED LITERATURE REVIEW

Cognitive Style and Social Difference

Cognitive style is not arbitrary. It is determined partly by how man's mind works and partly by the nature of the subject, i.e., the "intellectual discipline to be learned" (Gage, 1963).

Bruner (1960), Luchins (1961), and Schwab (1961) cited by Gage (1963) suggest that maximum advantage should be taken of the cognitive properties of learners. Properly organized subject matter presented to learners whose cognitive development and processes are correctly understood will produce learning of the best kind.

According to Bruner (1966), at each stage of development the child has a characteristic way of viewing the world and explaining it to himself. He states further that the task of teaching a subject to a child at any particular age is one of representing the structure of that subject in terms of the child's cognitive style.

Sigel (1966) made a comparison of the sorting behavior of middle-class and disadvantaged children. He reported that young disadvantaged children who were able to sort, gave a higher frequency of relational-contextual responses, that is,

they sorted items based on functional or thematic relations -- on the basis of associations between items that were based on their own experience. Middle-class children more often sorted on the basis of descriptive characteristics.

In a finding not yet formally reported differences in style of responding to problematic situations in relation to cultural background in a visual matching test was found. Mexican-American students responded quickly and inaccurately when asked to make visual discriminations. Anglo-American students showed much more hesitation, but responded accurately when they did respond (Stanford Center for Research and Development, 1970).

Maccoby and Modian (1969) investigated the cognitive styles of children of different cultures in rural and urban Mexico. The results indicated that cognitive style plays a significant part in a child's understanding and achievements.

Sigel and Olmstead (1968) did a study in which they endeavored to modify the cognitive skills of lower-class Black children through classification training. They found styles such as structural, relational, categorical being used in greater proportion. The increase in structural response was of interest since it was interpreted as analytic response, reflecting the ability to disengage items from an embedding context and reflecting some independence from the environment. Witkin et al. (1962) suggested that such responses could be interpreted as an indication of intellectual maturity.

Hallahan (1970) suggests that more attention be given to cognitive style. He writes that preschool programs for the disadvantaged have not taken into account the cognitive style of these boys and girls.

Lowery and Allen (1970), in examining the performance of three distinct socio-economic groups on several dimensions within the lowest level of a classificatory hierarchy, (Kofsky, 1966) revealed that figures involving single attributes are correctly sorted more frequently than figures involving two attributes. Also, figures containing two attributes tended to be easier for first graders to sort than figures containing three variables. Shape was utilized more successfully than the other attributes in their study. Figures containing the attribute of size were sorted or matched with the least frequency. Upper SES, Average SES, and Lower SES females generally had higher mean scores than the males for the categories selected in this study.

Almy (1966) showed that progress from one level of understanding to the next was considerably slower for children who came from a lower-class background. The study also showed that differences between the middle and lower-class groups may also be matters of cognitive style.

Cognitive Style and Personality

Holzman and Klein (1950) did a study on perception and personality. The results suggest that perception could be another factor that is related to individual consistency

(cognitive style) in an individual.

Gardner's study (1953) found that persons are characterized by unique equivalence-range preferences in a variety of adaptive tasks. Quantitative and qualitative results suggested that certain central aspects of an individual's orientation towards the outer world find expression in tasks demanding widely different degrees of conscious conceptualizing.

Witkin et al. (1954) in a wide scale study of perception and personality in adults found a relationship between these factors, as revealed by correlation of perceptual and personality test scores. Subjects identified as field-dependent on the basis of perceptual performance were found to possess non-analytic characteristics. Those classified as field-independent yielded an opposite picture in that they possessed characteristics that were analytic.

A similar investigation with a developmental sample was conducted. The findings were consistent with the findings of the adult samples. Individuals at all age levels were self-consistent in their perception. Females at all ages were found to be more field-dependent than males. One major difference was the younger children as a group tended to be more field-dependent than older children (Witkin et al., 1954).

Gardner et al. (1959) in an investigation of cognitive control drew attention to structural constants, cognitive controls, and styles that condition and limit the influence of environmental forces and tensions provoked by motives. The study found that many time perception-motivation studies

have tended to overlook the fact that motivational effects do have limits, that there are restrictions on how much a drive can distort reality, and that motivational variables will not alone account for these limits. Alleged distortions of cognition by drives or needs have been difficult to confirm because the formal or structural components of cognition, and differences among individuals in these respects, are often neglected. These studies have demonstrated that people differ in the emphasis they give to one or another of the configurational qualities of objects.

Witkin et al. (1962) states that cognitive styles may offer a very useful medium in which to investigate broad issues of psychological development. Cognitive styles are salient yet specific dimensions of behavior, that are rather readily identified and measured, and also tie in with broad networks of psychological characteristics which provide us with "tracer elements." These elements may be used in pursuing the course of individual development.

Vick and Jackson (1967) did a study on perception and referred to leveling and sharpening as cognitive style. The concept of leveling and sharpening was considered as bipolar. Analytical and non-analytical individuals behave as though on a continuum. If one was analytical, then he was on one end of the continuum. On the other hand, if he was non-analytical, he is at the other end of the continuum. It was concluded from these studies that there are certain observable and measurable individual consistencies (cognitive

styles).

Jackson et al. (1964), evaluating group and individual forms of embedded figures and measures of field-independence, found marked differences in patterns of correlations among perceptual measures. Data for males revealed more differentiated performances in measures of perceptual speed, embedded-figures, and spatial orientation than did data for females. Suggestive but not high correlations were obtained between perceptual and personality measures.

Ohnmacht (1967) investigated teacher characteristics and their relationship to some cognitive styles. Fifty-seven undergraduate senior male subjects were used. In addition to analytical ability, he also considered another variable, dogmatism. Measures representing analyticity and open-mindedness were explored as possible moderator variables. Low analytic-high dogmatic subjects were significantly different from other subjects in their tendency to give information indicating that they are dynamic teaching personalities.

Cognitive Style, Task Performance, and Concept Identification

Baggaley (1955) suggested that cognitive style was significant in concept identification. In this investigation, subjects were presented cards that varied along five bivalved dimensions and were asked to identify two dimensions which were relevant to classifying the cards. He found that sub-

jects who performed in an analytical manner on a Concealed Figures Test also performed significantly better on a concept identification task than did subjects who performed in a more global manner on the Concealed Figures Test.

Bruner et al. (1956) observed that individuals differed in the strategies they utilized in identifying concepts but he did not make any attempt to relate these differences to other variables. Hunt (1962) and Bourne (1966) in extensive reviews of the concept identification literature indicated that the role of individual differences was largely unexplored.

Fitzgibbons et al. (1963) found that recall and recognition of social works incidentally presented was significantly correlated with field-dependence. Similar findings were reported by Vaught and Ellinger (1966) after an investigation of tactile form discrimination. Guetzkow (1951) found that successful performance in problem solving was correlated with successful performance on the Embedded Figures Test.

Bourne (1966) in a concept identification study presented to a subject a series of stimulus patterns which usually varied along several dimensions such as size, shape, and color. The subject's task was to learn which dimensions defined the concept and which dimensions were irrelevant to the problem.

Ohnmacht (1966) found that field-independent subjects were superior to field-dependent subjects in a reversal-non-concept identification task regardless of the particular

shift condition. Quite similar results were obtained by Goodenough and Karp (1961).

Elkind et al. (1963) found that field-independent subjects scored significantly higher on a "perceptual concept formation task" (Shipley Abstraction Scale) than did field-dependent subjects. Based on these data, it was suggested that field-independence was an asset in conceptual tasks which require perceptual concept formation.

In investigating how a child organized new objects and how categories function in a child, twelve six- and twelve eight-year olds were given individual sorting tasks. The results of the experiment suggested that in very young children, categorization can be used as a means to explore the environment. In older children, it serves primarily as a means of reducing memory load by causing the child to ignore previously noticed aspects of the environment. A most significant finding of this study related to the function of categorization at different ages (Feldman, 1969).

Kagan et al. (1963) formulated a Conceptual Style Test. The test was a result of their findings during an investigation of cognitive styles of individuals. The subjects studied were asked to sort an array of human figures into meaningful groups. Subjects who grouped the figures on the basis of a shared element were considered analytical. Subjects who grouped the figures on the basis of functional relationships between the figures were considered non-analytical. The results suggested that an individual's preferred cognitive style

was influential in a wide variety of situations ranging from the production of word associations to simple reaction time tasks. In their style of responding across the various situations, individuals were found to be relatively consistent. If an individual responded in an analytic fashion on the Conceptual Style Test, he tended to respond in an analytic fashion when sorting human figures or interpreting ambiguous stimuli such as ink blots, and so forth. They concluded that the analytic-non-analytic mode of responding corresponded to a dimension of cognitive style representing the ability to differentiate relevant from irrelevant cues.

Goodenough and Karp (1961) studied three factors with groups of ten and twelve-year old boys. Verbal, concentration, and analytic factors were studied. It was found during administration of the intelligence tests that the children studied were different on those parts of the tests which featured analytical ability but not on parts which required verbal ability or capacity for sustained attention. It was concluded that field-independent subjects are intellectually superior to field-dependent subjects only in terms of analytical subtests. Witkin (1964) in a similar investigation obtained the same result. He concluded that field-independent subjects are intellectually superior to field-dependent subjects only in terms of analytic subtests.

Davis (1967) investigated whether an individual's cognitive style differentially influenced his performance on a standard concept identification task. An individual's cognitive style

influenced his concept identification performance. Individuals identified as analytical on the Hidden Figure Test experienced little difficulty in identifying concepts. Those identified as low-analytical experienced considerable difficulty in concept identification. Individuals falling between the two extremes, analytical and low-analytical of the Hidden Figures Test, performed at an intermediate level on the concept identification task. Studies conducted by Feldman (1969), Baggaley (1955), and Kagan (1963) support Davis's findings.

Lee et al. (1963) endeavored to determine whether analytic performance on the Conceptual Style Test was associated with rate of learning concepts in third graders. Equal numbers of analytic and non-analytic responders were given a concept learning task in which analytical, relational, or inferential concepts were to be learned. The stimulus material consisted of pictures of common objects which were grouped on an analytical, relational, or inferential basis and were paired with nonsense syllables. The findings in this study showed that the analytic subjects learned the analytic concepts in the fewest trials and took the longest to learn the relational concepts. The opposite was found for the non-analytic boys who learned the relational concepts in the fewest trials and the analytic concepts in the greatest number of trials.

Scott (1970) described the significance of styles of categorization in a three-year exploratory study. Two groups were involved, an experimental group of twenty-five fifth

graders who were introduced to inquiry and a conventionally taught group which was not introduced to the inquiry approach. The experimental group and the comparison group were administered the Sigel Cognitive Style Test. The inquiry children were more inclined to label small visible details, both human and inanimate, and to describe the background configurations of the illustrations than were the comparison children. The comparison groups were relational or non-analytical in their responses. He concluded that the preference for analytical categorization of the twenty-five experimental fifth graders was due to the inquiry approach used in teaching those children.

Scholnick (1970), investigating inference and preference in children's conceptual performance, pointed out that cue salience, which can be considered as preference or style was not a determinant of performance in older subjects as it related to inference for them. She suggests that the task of inference is more complicated for the older children because they pay attention to both dimensions and use feedback to determine both the relevant dimension and the correct value on the dimension. It is probably that their increasing inferential skill reflects the acquisition of the logical structure of multiplication of classes which enables them to keep track of information (Inhelder and Piaget, 1964). The interpretation of Scholnick (1970) is supported by the performance of seven and nine year-olds who err most frequently because they treat the tasks inappropriately as classification

and choose the value common to both stimuli.

It appears that this is in agreement with earlier work of Inhelder and Piaget (1964). They found that there are a number of logical operations which can be categorized into simple grouping skills and hierarchial operations. Children must achieve these in order to classify. They have shown that most second and third grade children can perform grouping operations. They also have shown that some of these children can perform hierarchial type operations. Their work also indicates that there are primary level elementary school children that have difficulty with both of these operations. This suggests that it can possibly be related to the initial information processing of the children or cognitive style of the individual.

Sabatino and Hayden (1970) investigated variation in information processing behaviors in primary and intermediate elementary grades. They found significant differences between the means of the age groups on perceptual and psycholinguistic behaviors that were not accompanied by significant differences on language function. The generally held developmental hypothesis that six years and nine years is the maximum growth period for perceptual functional performance was supported by this study.

Gallagher and Jenne (1967), studying cognitive style and its relationship to expressiveness and associated variables in a group of boys and girls, found no significant differences between the boys' group. Sixty-eight academ-

ically talented students were the subjects for this study. The subjects were grouped separately by sex and ranked on the basis of their performance on measures of divergent thinking and IQ scores. There were significant differences among the girls. The High IQ-High Divergent girls were significantly more expressive than the other two style groups of girls in the study.

Baird and Bee (1969) experimenting with modification of conceptual style preference by differential work reinforcement revealed some interesting findings. Using sixty first and second-grade boys as their subjects, they administered the nineteen item Conceptual Style Test by Kagan et al. (1964). Subjects that were selected as high or low in analytic responding on a pretest, were given analytic, non-analytic, or random reward training which was followed by a posttest. They found that training significantly altered initial response tendencies. They also found that during training, regardless of initial predisposition, the subjects increased in the type of response which was rewarded. The results indicated that the residual effects of training, which were assessed by comparing posttest with pretest performance, were greater for analytic training than for non-analytic training.

Summary

The literature in the area of cognitive style and social difference suggests that style is a variable that should be considered in the education of children. Evidence indicates that children from higher socio-economic statuses perform more accurately and descriptively than those from lower statuses. According to the literature reviewed, there is a direct correlation between social difference and descriptiveness or analytical ability of children. There is evidence that descriptive or analytical subjects perform better than relational or non-analytical subjects.

The literature in the area of personality indicates that it could be another factor that is related to cognitive style in an individual. Similar studies in the areas of cognitive control, leveling and sharpening, and teacher characteristics speak to the feasibility of consideration of cognitive style and its importance.

Finally, the literature in the area of cognitive style, task performance, and concept identification is more conclusive. This is supported by numerous studies in these areas.

CHAPTER III

DESIGN AND METHODOLOGY

The design of the study called for administration of the Cognitive Style Test by Sigel to children in elementary grades three and four and children in elementary grades five and six.

Instrumentation

One of the primary problems in the analysis, interpretation, and integration of data pertaining to cognitive style is that a variety of criterion tests are employed to identify the same cognitive style. The investigator decided to use the research model initiated by Sigel for this study.

Several investigators have reported reliability coefficients for different versions of this style of categorization test. Sigel (1961) reported odd-even coefficients ranging from .51 to .61 for the subcategories on one set of tasks. Scott and Sigel (1965) indicated that test-retest correlations for the Sigel Cognitive Style Test varied from .45 to .83 for the test's six subcategories with a coefficient of .71 (N=34) for the overall test. Kagan et al. (1964) stated that the corrected split-half reliability coefficient was .94 based on three-hundred protocols. The results were

quite acceptable, however only one factor, the analytic style (descriptive part-whole) was considered. Those reported by Scott and Sigel (1965) were for the six categories of the test including the descriptive part-whole or analytic style.

They attempted to resolve the issue of test reliability. The result was a reduction in the number of cards from thirty-five to sixteen for females and twenty cards for males. This presents a problem of comparisons between the sexes which still has not been resolved.

In an effort to resolve the issue, urban high school students were selected for field testing of the two modified versions of the test. Thirty-seven males took form HSMCM and sixty-three females took form HSMCF. The corrected split-half correlation coefficients for males (Form HSMCM) were as follows:

Descriptive-Part Whole (analytical)	.87
Descriptive-Whole	.63
Relational-Contextual (non-analytical)	.75
Categorical-Functional	.59
Categorical-Class Naming	.73
Categorical-Attribute	.79

The overall test correlation coefficient was .74 for this form. The results for the corrected split-half correlation coefficients for females (Form HSMCF) were:

Descriptive-Part Whole (analytical)	.92
Descriptive-Whole	.81
Relational-Contextual (non-analytical)	.79

Categorical-Functional	.68
Categorical-Class Naming	.80
Categorical-Attribute	.80

The overall test correlation coefficient was .81 for form HSMCF.

Pilot Study

A pilot study was conducted during the spring semester of 1971. Sigel's Cognitive Test Form A 1967, experimental model was used. This pilot study involved ninety-six children in elementary grades one through three and elementary grades four through six at a parochial school in Central Oklahoma. The purpose of the pilot study was to familiarize the investigator with the procedure for administration of the Sigel Cognitive Style Test, to develop a procedure for recording data, and to determine the time involved in the administration of the test.

Description of the Sample

The population for this exploratory study included students of the third, fourth, fifth, and sixth grades enrolled in the public schools of three rural communities in Central Oklahoma. The IQ's of all the students were conquerable (see APPENDIX B). The estimated population of the counties in which these communities are located are 31,469, 49,687, and 11,399, respectively (Oklahoma Data Book, 1968). These schools were selected because of the large number of Indian

children enrolled in the elementary grades as compared to the other schools in the area.

The writer conducted the cognitive style testing with a minimum amount of inconvenience to the school's regular program. This resulted in a number of trips to the schools where the testing was conducted.

Procedure

The Sigel Cognitive Style Test (male and female versions) was administered to all the children in elementary grades three through six in the schools that had been selected for the study. Answer pads were distributed to the children and they were instructed to place their complete name, school, date, and sex on the front page. Style booklets were distributed to the children. A thorough explanation was given about the style test. The children were given an opportunity to practice on Card No. 1 in the booklet before taking the test which began with Card No. 2 and proceeded through Card No. 16 for the females and Card No. 20 for the males. Ninety seconds were permitted for Cards Nos. 2 and 3. For Cards 4-16 for females and 4-20 for males, seventy-five seconds were allowed. The children were not permitted to continue on their own if they finished before the time allotted. They were instructed to wait until the next signal was given before moving on to the next card. The investigator checked each child's procedure during the second card to see if they were following the directions that were given in the expla-

nation.

The investigator was primarily concerned with the descriptive part-whole (analytical) response which is operationally defined as concepts which are derived directly from the physical attribute present in the stimulus, and relational-contextual response which is operationally defined as concepts which are used to tie together (or relate) two or more people, objects, events, or ideas.

The sub-classes of descriptive categorization were descriptive part-whole and descriptive global. Under descriptive part-whole there were several kinds of sorts: D-1, sorts in which the physical attributes or properties of the materials presented were the basis of similarity such as color, texture, shading or shape; D-2, sorts in which the description of the objects depicted were employed such as heads, legs, guns, belts, clothing, including posture, hair color, or any part of the object; D-3, sorts based on (or dealing specifically with) physical attributes (structural material) such as made out of wood, plastic, or steel. Sorts under descriptive global were: D-4, sorts in which the label designates the status, occupation, where the cues are manifest in the stimulus such as policeman, cowboy, WAC, nurse; D-5, sorts in which discrete age categories were employed such as children, old people, adults, babies, young people; D-6, sorts in which one of the sexes is grouped such as males, females, men versus women; D-7, sorts based on age and sex such as old men, young women, boys, or girls.

Under the relational-contextual category no stimulus is an independent instance of the concept, each stimulus selected derives its meaning and its definition in the sort from a relationship with other stimuli such as a scene in a mental hospital, a family scene, "you can make a triangle out of this square", "these two things could make a carburetor", "alcohol comes from wood". There are several kinds of sorts under relational-contextual. They are: R-1, thematic, sorts which are based on themes, plots, or stories where no category is used such as he killed this man, she is giving him food, sort implies interaction; R-2, geographical, sorts in which the instances are related in space -- locale, geographic, domiciliary, for example, this man and this woman work in an office, this table with the chair belongs in the kitchen, they live in a jungle, they swim in water; R-3, temporal, sorts in which the figures are grouped on the basis of the temporal development of the individual such as, this is a person growing up, these are the stages of life in a person, or a temporal sequence, for example before and after of a crime; R-4, comparative, sorts based on comparison between two figures such as better than this one; R-5, functional, sorts in which objects are grouped together on the basis of their interdependent use or function, for example, the steam shovel digs sand to put on the truck, hammer is used to bang nail, ham and bread make a sandwich, this woman helps this man, they help us; R-6, sorts in which objects are grouped on the basis of and understood relationship state between.

the figures: (A) kindship only for example family, mother-son; (B) other relationship states such as doctor-nurse, teacher-student; R-7, sorts in which the objects are grouped together on the basis of a relationship to some social event, institution, or organization such as these people have something to do with crime or with law, they are in the armed forces. The investigator was not concerned with the category inferential segment of the Sigel Cognitive Style Test.

Statistical Procedures

A total of four hundred forty-eight children were administered the Sigel Cognitive Style Test. The test records for eighteen of the children in the study were not utilized. Two of the eighteen children were verbal and sixteen of them did not follow directions. This left a total of four hundred thirty tests that were utilizable, of which one hundred six were from Indian children and three hundred twenty-four were from Caucasian children. In order to have a more representative number for comparison with the group of Indian children, one hundred six Caucasian children were randomly selected from the group of three hundred twenty-four. This was done by using a table of random numbers from Popham (1967). Within this random sample were forty-seven females and fifty-nine males. It was decided that the t-test technique was appropriate for this analysis. Popham (1967) discusses the t-test technique at length while pointing out the basic assumptions underlying its use. The size of the N being

of considerable magnitude in this study, the investigator assumed that the entities were normally distributed.

A homogeneity of variance check was done to determine if the variances of the groups to be compared were homogeneous. The F ratios were insufficient in magnitude to reject the hypothesis of homogeneity of variance among the comparison groups with one exception. In the groups that had F ratios that were insufficient in magnitude to reject the hypothesis of homogeneity of variance, the pooled variance t was employed. A separate variance formula was employed for the groups that had F ratios sufficient in magnitude to reject the hypothesis of homogeneity of variance. The alpha was set at the .05 level. The formula used for computation of the standard deviation was

$$S = \sqrt{\frac{x^2}{N-1}} .$$

The groups were analyzed by the computation of ten t models. The pooled variance formula was used for eight of the tests and the separate variance formula was used for the remaining tests.

CHAPTER IV

RESULTS OF THE STUDY

This study is an exploratory investigation in which the cognitive styles of Indian and Caucasian children in grades three through six were determined and compared. The results of the analysis of the ten research questions are presented in this chapter. The principal statistical tool used was an independent t-test. The .05 level of confidence was used for each research question asked. For convenience of the reader, the tables are placed close to the test to which they refer most directly.

The first statistical test necessary was that to ascertain the most appropriate form of the t-test to use. This was accomplished by a homogeneity of variance check. There was no significant differences in variances for the two categories considered for all groups with one exception. The separate variance formula was employed in this instance, while the pooled variance formula was employed where significant differences did not occur. Data related to the variance checks are summarized in TABLES I and II.

TABLE I
STANDARD DEVIATIONS, VARIANCES, OBTAINED F RATIOS,
AND CRITICAL F RATIOS FOR ALL COMPARISON
GROUPS' DPW RESPONSES

Groups	N	S	S ²	F Ratio	Critical F Ratio	P
<u>Grade Level 3-4</u>						
Indian Male	37	7.69	59.10	1.797	1.80	>.05
Caucasian Male	22	10.31	106.23			
<u>Grade Level 5-6</u>						
Indian Male	27	11.42	130.52	1.394	1.76	>.05
Caucasian Male	37	9.68	93.61			
<u>Grade Level 3-4</u>						
Indian Female	28	10.25	105.13	1.754	2.00	>.05
Caucasian Female	21	7.74	59.93			
<u>Grade Level 5-6</u>						
Indian Female	37	10.84	117.53	1.033	1.85	>.05
Caucasian Female	26	10.67	113.76			
<u>Indian Male</u>						
Grade Level 3-4	37	7.69	59.10	2.208	1.76	<.05
Grade Level 5-6	27	11.42	130.52			
<u>Indian Female</u>						
Grade Level 3-4	28	10.25	105.13	1.118	1.81	>.05
Grade Level 5-6	37	10.84	117.53			

TABLE II
STANDARD DEVIATIONS, VARIANCES, OBTAINED F RATIOS,
AND CRITICAL F RATIOS FOR ALL COMPARISON
GROUPS' RC RESPONSES

Groups	N	S	S ²	F Ratio	Critical F Ratio	P
<u>Grade Level 3-4</u>						
Indian Male	37	2.43	5.92	1.649	1.93	>.05
Caucasian Male	22	1.89	3.59			
<u>Grade Level 5-6</u>						
Indian Male	27	4.12	16.95	6.890	1.76	<.05
Caucasian Male	37	1.57	2.46			
<u>Grade Level 3-4</u>						
Indian Female	28	2.14	4.59	1.106	2.00	>.05
Caucasian Female	21	2.04	4.15			
<u>Grade Level 5-6</u>						
Indian Female	37	2.00	3.98	1.482	1.76	>.05
Caucasian Female	26	2.43	5.90			

Research Questions

- Q.1. Does the descriptive part-whole responses of Indian boys in the elementary grades (3-4) differ significantly from Caucasian boys in elementary grades (3-4)?

The t -value obtained as a result of the t -test for independent means for this questions was 1.7553. The value required for significance at the .05 level was 2.021. The magnitude of the t -value is less than the required value and therefore, the null hypothesis is accepted. Data related to this test are presented in TABLE III.

- Q.2. Does the relational-contextual responses of Indian boys in the elementary grades (3-4) differ significantly from Caucasian boys in elementary grades (3-4)?

The t -value obtained as a result of the t -test for independent means for this question was .5285. The value required for significance at the .05 level was 2.021. The magnitude of the t -value is less than the required value and therefore, the null hypothesis is accepted. Data related to this test are presented in TABLE III.

- Q.3. Does the descriptive part-whole responses of Indian girls in the elementary grades (3-4) differ significantly from Caucasian girls in elementary grades (3-4)?

The t -value obtained as a result of the t -test for independent means for this question was .9346. The value required for significance at the .05 level was 2.021. The magnitude of the t -value is less than the required value and therefore, the null hypothesis is accepted. Data related to

this test are presented in TABLE IV.

TABLE III

t-TEST BETWEEN ALL MALE COMPARISON GROUPS
GRADE LEVELS 3-6 DPW AND RC RESPONSES

Groups	N	\bar{X}	Obtained t	Critical t	P
<u>DPW RESPONSES</u>					
<u>Grade Level 3-4</u>					
Indian	37	14.19	1.7553	2.021	>.05
Caucasian	22	18.32			
<u>Grade Level 5-6</u>					
Indian	27	22.85	.8212	2.000	>.05
Caucasian	37	20.68			
<u>RC RESPONSES</u>					
<u>Grade Level 3-4</u>					
Indian	37	1.73	.5285	2.021	>.05
Caucasian	22	1.41			
<u>Grade Level 5-6</u>					
Indian	27	3.22	2.2446	2.049	<.05
Caucasian	37	1.35			

TABLE IV

t-TEST BETWEEN ALL FEMALE COMPARISON GROUPS
GRADE LEVELS 3-6 DPW AND RC RESPONSES

Groups	N	\bar{X}	Obtained t	Critical t	P
<u>DPW RESPONSES</u>					
<u>Grade Level 3-4</u>					
Indian	28	15.36	.0346	2.021	>.05
Caucasian	21	17.86			
<u>Grade Level 5-6</u>					
Indian	37	22.41	.6390	2.000	>.05
Caucasian	26	20.65			
<u>RC RESPONSES</u>					
<u>Grade Level 3-4</u>					
Indian	28	1.00	.0825	2.021	>.05
Caucasian	21	1.05			
<u>Grade Level 5-6</u>					
Indian	37	3.73	2.6031	2.000	<.05
Caucasian	26	2.50			

- Q.4. Does the relational-contextual responses of Indian girls in the elementary grades (3-4) differ significantly from Caucasian girls in elementary grades (3-4)?

The t-value obtained as a result of the t-test for independent means for this question was .0825. The value required for significance at the .05 level was 2.021. The magnitude of the t-value is less than the required value and therefore, the null hypothesis is accepted. Data related to this test are presented in TABLE IV.

- Q.5. Does the descriptive part-whole responses of Indian boys in the elementary grades (5-6) differ significantly from Caucasian boys in the elementary grades (5-6)?

The t-value obtained as a result of the t-test for independent means for this question was .8212. The value required for significance at the .05 level was 2.000. The magnitude of the t-value is less than the required value and therefore, the null hypothesis is accepted. Data related to this test are presented in TABLE III.

- Q.6. Does the relational-contextual responses of Indian boys in the elementary grades (5-6) differ significantly from Caucasian boys in the elementary grades (5-6)?

The t-value obtained as a result of the t-test for independent means for this question was 2.2446. The value required for significance at the .05 level was 2.049. The magnitude of the t-value is greater than the required value and therefore, the null hypothesis is rejected. Data related to this test are presented in TABLE III.

Q.7. Does the descriptive part-whole responses of Indian girls in the elementary grades (5-6) differ significantly from Caucasian girls in the elementary grades (5-6)?

The t -value obtained as a result of the t -test for independent means for this question was .6390. The value required for significance at the .05 level was 2.000. The magnitude of the t -value is less than the required value and therefore, the null hypothesis is accepted. Data related to this test are presented in TABLE IV.

Q.8. Does the relational-contextual responses of Indian girls in the elementary grades (5-6) differ significantly from Caucasian girls in the elementary grades (5-6)?

The t -value obtained as a result of the t -test for independent means for this question was 2.6031. The value required for significance at the .05 level was 2.000. The magnitude of the t -value is greater than the required value and therefore, the null hypothesis is rejected. Data related to this test are presented in TABLE IV.

Q.9. Are Indian boys in the elementary grades (5-6) more descriptive than Indian boys in the elementary grades (3-4)?

The t -value obtained as a result of the t -test for independent means for this question was 3.4149. The value required for significance at the .05 level was 2.049. The magnitude of the t -value is greater than the required value and therefore, the null hypothesis is rejected. Data related to this test are presented in TABLE V.

TABLE V

t-TEST BETWEEN INDIAN MALES GRADE LEVELS 3-4 AND
INDIAN MALES GRADE LEVELS 5-6 DPW RESPONSES

Groups	Grade Level	N	\bar{X}	Obtained t	Critical t	P
Indian Males	5-6	37	14.19	3.4149	2.000	<.05
Indian Males	3-4	27	18.32			

Q.10. Are Indian girls in the elementary grades (5-6) more descriptive than Indian girls in the elementary grades (3-4)?

The t-value obtained as a result of the t-test for independent means for this question was 2.6579. The value required for significance at the .05 level was 2.000. The magnitude of the t-value is greater than the required value and therefore, the null hypothesis is rejected. Data related to this test are presented in TABLE VI.

TABLE VI

t-TEST BETWEEN INDIAN FEMALES GRADE LEVELS 3-4 AND
INDIAN FEMALES GRADE LEVELS 5-6 DPW RESPONSES

Groups	Grade Level	N	\bar{X}	Obtained t	Critical t	P
Indian Females	5-6	28	15.36	2.6579	2.000	<.05
Indian Females	3-4	37	17.86			

Summary

Ten t-tests were utilized for analysis of the ten research questions. Ten homogeneity of variance checks were run prior to selecting the appropriate t-model. There was no significant difference for all comparison groups on DPW responses. Significant differences were found on RC responses at the fifth and sixth-grade levels between Indian males and Caucasian males. Significant differences were also found between RC responses for Indian females and Caucasian females at the fifth and sixth-grade levels. The results of the t-tests between Indian boys in the fifth and sixth grades, and Indian boys in the third and fourth grades on DPW indicated significance. There was also a significant difference between Indian girls in the fifth and sixth grades, and Indian girls in the third and fourth grades on DPW responses.

CHAPTER V

DISCUSSION OF RESULTS, SUMMARY, IMPLICATIONS, AND RECOMMENDATIONS

Discussion of Results

This study, a determination and comparison of cognitive styles of Indian and Caucasian males and females in the elementary grades three through six, was intended as exploratory research. There was no attempt to control for major intervening variables, such as the precise occupational role of the head of the household or the amount of formal education received. The investigator was primarily interested in obtaining information from which tenable inferences might be made. In light of this aim, the following conclusions might be advanced: The lack of statistically significant differences on descriptive part-whole responses for questions one through eight between all comparison groups of Indian and Caucasian males and females in the elementary grades three through six suggests that, perhaps from the standpoint of cognitive style, Indian children do not need special curricula and instruction as advocated by many educators. It further suggests that Indian children can accommodate to styles of instruction similar or the same as that of Caucasian children. This does not lend support to the Havinghurst (1970) report

on American Indian Education.

The statistically significant results in grades five and six, on the relational-contextual responses (non-analytical) between Indian males and Caucasian males and Indian females and Caucasian females, is an enigma. It would appear to lend support to Coombs et al. (1950) view, cited by Havighurst (1970), concerning the performance of Indian children in the primary elementary grades as compared with majority culture children. He found that the Indian group scored 4.3 in the fourth grade, and 5.0 in the fifth grade, against national norms of 4.1 and 5.1, respectively. The older Indian groups were substantially below national norms. The literature indicates from previous investigations that those children who are descriptive part-whole (analytical) in their cognitive style have higher intelligences and achieve more academically. Previous investigations also indicate that those children who are relational-contextual (non-analytical) have lower intelligences and achieve less. This would appear to indicate a relation between cognitive style, intelligence, and achievement. The significance between the Indian and Caucasian males and females at these levels would tend to support these findings.

The statistical non-significance between all of the comparison groups (male and female) on the descriptive part-whole responses and relational-contextual responses at the third and fourth-grade levels from the standpoint of cognitive style of these Indian children appears to lend support

to Piaget's Developmental Theory, since results obtained in this respect, indicate that they have similar capabilities to comparative age groups in a similar setting of the majority culture. It also tends to confirm the belief of many educators, including this investigator, that perhaps all Indian children should attend school with children from the majority culture. The result would be beneficial to all concerned, but most of all to Indian children. The statistically significant results between Indian males in the fifth and sixth grades, and Indian males in the third and fourth grades, and Indian females in the fifth and sixth grades, and Indian females in the third and fourth grades also suggest normal development along Piagetian lines, since the results obtained appear to indicate fewer responses in the younger group and more responses in the repertoire of the older group. This was not surprising to the investigator.

Data obtained in this investigation supports the hypothesis that descriptive part-whole (analytical) and relational-contextual (non-analytical) responses are on a continuum. This corroborates with Lee et al. (1963) and Kagan et al. (1963). Data obtained also suggests that the cognitive style of Indian children appears to move toward a relational style with an increase in age. An interesting aspect of the subjects in this sample is the fact that they were all analytical in their style.

Summary

During the Spring Semester of 1971, four hundred forty-eight children were administered the Sigel Cognitive Style Test (1970). The test records for eighteen of the students were not utilized. Within the four hundred thirty tests, there were one hundred six Indian males and females. A random sample was taken from the remaining three hundred twenty-four Caucasian males and females. The total number of descriptive part-whole and relational-contextual responses were counted for each subject in the study. The category that had the majority of responses was the criterion used for determining whether a subject was descriptive part-whole (analytical) or relational-contextual (non-analytical) in cognitive style. The mean for the total number of descriptive part-whole and relational-contextual responses for all comparison groups was computed and compared utilizing the t-test technique.

Implications

In light of the findings and conclusions from this exploratory research, the following implications are seen:

Teachers should become more cognizant of the differences and similarities among children and teach for those differences and similarities. The need for individualization of instruction is a primary concern for all teachers. The dimension of cognitive style should be given serious thought

in individualizing instruction.

The information obtained as a result of this study suggests that verbal skills should be emphasized in dealing with similar groups. The rationale for emphasis on verbal skills rests in the fact that all of the subjects in this study were analytical which suggests the need for practice in the verbal sphere.

Since cognitive styles can be measured rather reliably, it can be used to advantage in the classroom. Perhaps teachers and children with the same cognitive style should be matched. Teachers who have analytical styles tend to operate in an analytical manner. It would appear that the non-analytic student is at a disadvantage.

Recommendations

In light of the problem underlying this investigation and the findings, the following recommendations are advanced:

1. That a study be conducted which compares the cognitive style of Indian and Caucasian children in the rural, grades three through six controlling socio-economic and educational level of parents.
2. That a study be designed and conducted in grades kindergarten through three to determine if there are certain antecedent conditions that occur prior to grade three.

3. That a study be conducted which compares the cognitive style of Indian and Caucasian children in grades three through six in an urban or metropolitan area controlling socio-economic and educational level of head of household.
4. That a study be conducted which compares the cognitive style of Indian children removed from the majority culture in grades three through six, and Indian children attending public schools.
5. That a study be conducted which compares the cognitive style of Indian children removed from the majority culture in grades three through six, and Caucasian children in grades three through six.

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APPENDIX A

STATISTICAL TREATMENT

t-Test

When comparing two sets, the following standard formula will be used (Popham, 1967).

Separate Variance t-model

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{N_1} + \frac{S_2^2}{N_2}}}$$

where,

t = the value by which the statistical significance of the mean difference will be judged,

\bar{X}_1 = the mean of set 1,

\bar{X}_2 = the mean of set 2,

S_1^2 = the variance of set 1,

S_2^2 = the variance of set 2,

N_1 = the number of subjects in set 1,

N_2 = the number of subjects in set 2.

There are several variants of the standard formula which may be used depending on the number of subjects, the presence of correlation between group data, and homogeneity of group variances.

F Test

Homogeneity of two variances can be determined by the F ratio in which the smaller variance is divided into the larger variance; the resulting quantity is known as F and is interpreted for statistical significance. To test the null hypothesis of homogeneous population variability, the sample variances S_1^2 and S_2^2 are used in the formula for F (Popham, 1967).

$$F = \frac{S_g^2}{S_1^2}$$

where

F = the value by which variance homogeneity will be tested,

S_g^2 = the greater variance, and,

S_1^2 = the lesser variance.

The resulting quotient, (F), is interpreted for statistical significance using the degrees of freedom for each variance. Degrees of freedom for this test are equal to the number of subjects in the group minus one (N-1).

Pooled Variance t-Model

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\left(\frac{\Sigma X_1^2 + \Sigma X_2^2}{N_1 + N_2 - 2}\right) \frac{1}{N_1} + \frac{1}{N_2}}}$$

Where ΣX_1^2 is the sum of the squared deviations from the mean of group 1, ΣX_2^2 is the sum of the squared deviations from the mean of group 2, \bar{X}_1 is the mean score for group 1, \bar{X}_2 is the mean score for group 2, N_1 is the number of scores in group 1, and N_2 is the number of scores in group 2.

Degrees of Freedom

Pooled variance formula.

$$N_1 + N_2 - 2$$

Separate variance formula.

$$N_1 - 1.$$

APPENDIX B

TABLE VII
 MEAN IQ SCORES FOR ALL
 COMPARISON GROUPS

Groups	IQ
<u>Grade Level 3-4</u>	
Indian Males	99.04
Caucasian Males	97.00
Indian Females	93.85
Caucasian Females	103.67
<u>Grade Level 5-6</u>	
Indian Males	100.20
Caucasian Males	95.06
Indian Females	97.83
Caucasian Females	98.94

APPENDIX C

TABLE VIII
 RAW DATA CHARACTERISTICS FOR ALL
 COMPARISON GROUPS DPW RESPONSES

Groups	Low Score	High Score	\bar{X}
<u>Grade Level 3-4</u>			
Indian Males	1	35	14.19
Caucasian Males	2	44	18.32
Indian Females	1	41	15.36
Caucasian Females	5	33	17.86
<u>Grade Level 5-6</u>			
Indian Males	3	55	22.85
Caucasian Males	0	42	20.68
Indian Females	3	41	22.41
Caucasian Females	4	45	20.65

APPENDIX D

TABLE XIX
 RAW DATA CHARACTERISTICS FOR ALL
 COMPARISON GROUPS RC RESPONSES

Groups	Low Score	High Score	X
<u>Grade Level 3-4</u>			
Indian Males	0	11	1.73
Caucasian Males	0	7	1.41
Indian Females	0	8	1.00
Caucasian Females	0	7	1.05
<u>Grade Level 5-6</u>			
Indian Males	0	18	3.22
Caucasian Males	0	6	1.35
Indian Females	0	11	3.73
Caucasian Females	0	9	2.50

APPENDIX E

SIGEL COGNITIVE STYLE TEST

For further information on the Sigel Cognitive Style Test, contact I. E. Sigel, University of New York, Buffalo, New York.

VITA ≈

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