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A Comparison of Cognitive Styles between the Most Successful Michigan Directors of Community Education and Other Michigan Directors of Community Education

Thomas Russell Niles II
Western Michigan University

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A COMPARISON OF COGNITIVE STYLES BETWEEN THE MOST SUCCESSFUL
MICHIGAN DIRECTORS OF COMMUNITY EDUCATION AND OTHER
MICHIGAN DIRECTORS OF COMMUNITY EDUCATION

by

Thomas Russell Niles, II

A Dissertation
Submitted to the
Faculty of The Graduate College
in partial fulfillment
of the
Degree of Doctor of Education

Western Michigan University
Kalamazoo, Michigan
April 1974

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A COMPARISON OF COGNITIVE STYLES BETWEEN THE MOST SUCCESSFUL MICHIGAN DIRECTORS OF COMMUNITY EDUCATION AND OTHER MICHIGAN DIRECTORS OF COMMUNITY EDUCATION

Thomas Russell Niles, II, Ed.D.
Western Michigan University, 1974

The purpose of the study was to determine how the cognitive styles of the most successful Michigan directors of community education compared with the cognitive styles of other Michigan directors of community education. Being an hypothesis-generating study, primary emphasis was directed toward the collection and analyzation of data useful in generating hypotheses to be tested in future educational research efforts. At the same time, conclusions were drawn from the results of the study which indicated the different ways in which directors of community education prefer to employ symbols in deriving meaning from the environment.

A total of 126 directors of community education included on a community education reimbursement list supplied by the Michigan State Department of Education comprised the total population. Two samples were chosen from the population—one consisting of the most successful directors of community education as selected by the four Michigan Regional Centers for Community Education and another composed of an equal number of other directors selected at random. By utilizing the interview method and the Oakland Community College Cognitive Style Mapping Interest Inventory test battery, each director was mapped according to his cognitive style.
Cognitive style, a part of the educational sciences, is a concept employing the different elements (or symbols) that man appears to use in acquiring meaning. A cognitive style map, in the form of a computer printout, was derived from the results of each director's interest inventory test. The individual cognitive style maps, which show one's relative strengths and weaknesses in the usage of the cognitive style symbols, were then collectively employed to construct an overall cognitive style map from each of the director groups.

A comparison between the two collective cognitive style maps led to the following results that were the basis upon which pertinent hypotheses were formulated:

1. In comparison to the undesignated directors of community education, the most successful directors of community education scored higher in the following cognitive style elements:
   - T(AQ)  Theoretical audio quantitative
   - Q(CH)  Qualitative code histrionics
   - Q(CK)  Qualitative code kinesics
   - Q(CP)  Qualitative code proxemics
   - Q(CT)  Qualitative code transactional
   - A     Associates
   - D     Differences

2. In comparison to the undesignated community education directors, the most successful directors of community education scored lower in the following cognitive style elements:
   - T(VL)  Theoretical visual linguistics
   - Q(CET) Qualitative code ethics

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In addition to formulating hypotheses, the findings of the study may be of assistance in planning future community education workshops, counseling new directors, and identifying cognitive styles of directors of community education who have demonstrated a high degree of success.
ACKNOWLEDGEMENTS

The author is deeply indebted to the people who have assisted in the production of this work. Special thanks is given to Dr. Rodney Roth for participating as chairman of the dissertation committee. Recognition is also directed toward Dr. Donald Weaver, who served a dual role as committee member and doctoral advisor, and to Dr. Fred Gault, who performed as talented teacher and the third member of my committee.

Words can not adequately express the appreciation felt for Dr. Joseph Hill, President of Oakland Community College and originator of the Educational Sciences. It was largely through his many hours of patient explanations that I acquired an understanding of the Educational Sciences and their exciting potential.

Despite the unselfish efforts of these men, perhaps the greatest applause should go to my wife, Judythe. Not only has she provided much of our financial support, but she has also been responsible for typing the paper, as well as living with me through the last two difficult, but rewarding years.

A final note of appreciation is extended to the Mott Foundation and the Western Michigan University Community School Development Center for their generous fellowships, without which my extended education and completed dissertation would not have been possible.

Thomas Russell Niles, II

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CHAPTER I

THE PROBLEM

Statement of the Problem

The purpose of the study was to determine how the cognitive styles of the most successful directors of community education in Michigan compare with the cognitive styles of other Michigan community education directors. While the purpose may be sufficiently clear, caution to semantics should be observed to prevent misunderstanding of key concepts. With this objective in mind, the definitions of terms essential to the understanding of the problem have been introduced.

Cognitive style has been defined in the Educational Sciences as being the way in which one finds meaning from his environment. Its most important components consist of symbols and their meaning, cultural determinants, and modalities of inference. Most successful, on the other hand, means a very favorable termination of a venture. Operationally, the term refers to those Michigan community school directors who have been selected by the four Regional Center Directors as being one of the top directors in their respective regions.

The director of community education is the person responsible for implementing and coordinating community education within a school district. Rather than being addressed as the director of community education, the same individual may be referred to as the community education director, the community school director, and even more accurately, as the community education coordinator. Regardless of

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title, if the individual is held responsible for the total school district coordination of community education, then he is assumed to fit the definition of director of community education.

Importance of the Study

"The effectiveness of any single agency depends upon its leadership (Totten & Manley, 1969, p. 61)." "The time-worn axiom which states that a system is only as good as the people in it is, perhaps more applicable to the concept of community education than to any other field (Keidel, 1969, p. 76)." Providing outstanding leaders may logically be a method to insure the expansion and improvement of community education. Since 1967 there have been 1,927 new community schools initiated throughout the United States (Charles Stewart Mott Foundation, 1973). Quite likely the continued propagation of new and better programs of community education will be largely determined by the success of the many school districts to obtain well-trained community education leaders. For the sake of clarity, these local community education leaders have usually been called directors of community education or community school coordinators.

Training and recruitment of competent personnel has become an important goal in community education (Seay, 1972a). Progressing from the early stages of community education when Frank Manley selected and provided on-the-job training for his staff, the job of training and recruiting community education directors has been broadened and formalized by the inception of a number of specified training centers. The university centers and the NCCE have been given a prime responsibility for training prospective community educators. Since 1963, under the funding of the

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Mott Foundation, the NCCE has provided leadership training in community education to hundreds of participants (Bush, 1972). As for the university centers, most of them are serving as training grounds for Mott interns, as well as offering their regular numbers of workshops, seminars, and courses in community education.

Particular emphasis for this study has come from the Mott Inter-University Leadership Program Handbook. In the handbook has been listed the numerous educational goals that provide direction for the training of community directors and other community educators (Mott Leadership Center, 1970):

1. To create an organizational climate in which all members may make significant contributions.
2. To communicate effectively in oral and written form.
3. To diagnose priority needs of the organization and its members.
4. To evaluate programs and practices.
5. To coordinate efforts of group members to achieve goals.
6. To demonstrate indepth knowledge of the field of community education.

In the attempt to successfully execute these training goals, the Mott Leadership Center has been searching for efficient methods in which information and educational materials can be most readily transferred from teacher to learner.

Another primary emphasis for the study came from the work completed by the Research Symposium in Community Education (1971). During this session a number of topics were recommended for research—of which the following two suggestions were especially pertinent:
"What are the necessary characteristics for a director of community education?"

"How can the universities and colleges best provide training programs in community education?"

In reference to the first of the symposium questions, further evidence as to the need for this study has been gleaned from the interviews with several widely known community educators. For instance, Warsh (Director of Education Projects, Charles Stewart Mott Foundation, personal interview, May 27, 1973) indicated that the Mott Intern Program would like to develop methods to assess the potential success of directors of community education. Bush (Director, NCCE, personal interview, March 20, 1973) stated that determining the cognitive style of prospective directors of community education might improve the process of selecting successful directors. Further support for this study has come from Nicholos (Professor of Educational Administration, Wayne State University, personal interview, May 27, 1973). He explained that in determining the potential success of future job applicants, more emphasis will be placed on gathering descriptive information on a person's abilities, such as is being done by the mapping of cognitive styles.

Selection of top candidates has become an important objective to many community educators. Many of the experts in the field obviously have not been completely satisfied with present methods of identifying good potential community education leaders. Perhaps Van Voorhees best summarized this area of discontent when he explained to Edwards (1973):

Current expectations by the field tend to be that we will select people whose ultimate goal in life is to be of service to community education; however,
past experience has proven that we have not selected people who do; but we have, in fact, chosen some people who are anti-community education and are sometimes destructive and disruptive of the process. As a consequence, criticism from the field has focused on the negative process, rather than on the positive, to the detriment of the interns of the training program. Therefore, it behooves the trainees at NCCE to develop a method for the selection of the ultimate best "community educators". The selection on the basis of potential university success, past experiences in community education, or other single criterion previously used by different selectors, has not proven adequate. We need a better system (p. 31).

The second symposium question asked how can the universities and colleges best provide training programs in community education. Though the development of selection criteria is important, possibly a more important need is to discover ways in which to train prospective candidates (Campbell, Professor of Educational Administration, Michigan State University, personal interview, May 27, 1973; Weaver, 1972). There are times when a particular type of individual may not be available as a job applicant. In this case, it would be necessary to develop successful community education directors from the available supply of candidates. Furthermore, it would not be desirable to have to replace presently employed directors that may be only partially successful. Instead of discharging employees and suffering through the difficult times of hiring new staff, it would be much easier to train or retrain those community education directors who have had or may have some difficulties in their position.

In earlier days when the community education program was much smaller, it was relatively easy to select and train personnel on an informal basis.

However, present and future demands for personnel
capable of providing competent leadership in community education has resulted in the need to recruit potential community educators among candidates with limited training and no experience in the field (Weaver, 1972, p. 62).

What seems to be needed is for more study to be done in areas of improving training for the community education novices or for those who wish further training. As the luxury of smallness has left the community education movement, so has arrived the need for better educational and organizational methods to teach the growing number of community education trainees.

There are those who recognize that the increasing numbers of students in the field will mean an ever increasing number of people with varying backgrounds and abilities. Not wishing to stagnate these individuals' potential for growth, men such as Gerard Keidel (1969) have offered suggestions as to the types of training programs that should be established. "Formal training programs offering definite alternatives need to be formulated. As will be seen later, these programs must be varied enough to provide for the needs of a broad-based source of potential employees (p. 78)." In writing against credentialism, Hoyle (1973) also called for types of training more suited to the individual. He complained that "... students are too often given the same information in the same amount of time and asked to give the same answers in order to gain the 'ticket' to life (p. 21)."

With the realization of the growing numbers of community education students and the knowledge that many of these students will come from diverse backgrounds, it would seem as if new and better programs will have to be found to teach the various human, technical, and conceptual
skills needed in community education. Experimentation and research in the best methods of course presentation and delivery systems would likely be encouraged. In fact, there are already in existence examples of this searching for more effective teaching methods. For instance, in the program components of the NCCE, the third component has called for "... experimentation, evaluation, and dissemination of alternative methods of preparing community education leaders (Becker, 1971, p. 30)."

Possibly influenced by this third program component of the NCCE, some studies have already been completed in the field of training community educators. One in particular by Johnson (1973) has identified delivery systems deemed useful in teaching community education; however, these methods were provided by a panel of experts and not identified by the learners themselves. Further research into the learning preferences of community educators could provide an important educational tool and act as a checking device on the results gained from Johnson's study.

Training has become very important in the community education movement. From its early informal beginnings where Frank Manley, himself, held in-service days for his handpicked directors, it has expanded to the point where the NCCE has set forth a priority to develop new and better methods to train prospective directors of community education and other community education personnel. Perhaps the need for additional studies in developing more effective long-term and short-term training programs can best be expressed by Sullivan as he spoke to Jonathan Livingston Seagull. Referring to the need for more effective learning, Sullivan pronounced:

... the same rule holds for us now, of course:
we choose our next world through what we learn in this one. Learn nothing, and the next world is the same as this one, all the same limitations and lead weights to overcome (Bach, 1972, p. 62).

Thus, the primary needs for this study center on the areas of selection and training. Stating these general needs more precisely, the Mott Intern Program and others concerned with the quality of community education are looking for methods that can be used (1) to help determine the potential success of a candidate for the position of director of community education, and more importantly, (2) to better train those candidates who fulfill the general qualifications for the position, but have need for additional training.

Definition of Terms

1. Community Education - a philosophical concept which serves the entire community by providing for all of the educational needs of its community members. It uses the local school to serve as the catalyst for bringing community resources to bear on community problems in an effort to develop a positive sense of community, improve community living, and develop the community process toward the end of self-actualization (Minzey & LeTarte, 1972).

Operationally, community education is defined as those programs and processes which are under the direction of a director of community education in a school district. These include "... budgeting and finance, personnel procurement, administration and operational policy-making in addition to interpreting, adapting, and coordinating his activities with existing programs (Johnson, 1973, p. 28)."
2. Director of Community Education - the individual responsible for implementing and coordinating community education within a school district. He has often been called the community school coordinator or community school director.

3. Most Successful - a very favorable termination of a venture. Operationally, the most successful directors will be defined as those directors of community education who are selected by one of the four Regional Center Directors as being one of the top directors in that regional area. The number selected in each region will depend upon the number of directors in that region compared to the number of directors in Michigan. A total of 16 most successful directors will be selected.

4. Set - a collection of elements of the same kind or type identified by a common characteristic or rule formation.

5. Educational Sciences - a common structure within which the fundamental aspects of the applied field of education can be conducted. The educational sciences, as they exist today, consist of seven distinct areas. They are the sciences of: (1) symbols and their meanings, (2) cultural determinants of the meaning of symbols, (3) modalities of inference, (4) electrochemical and biochemical aspects of the brain and central nervous system or, in short, memory, (5) cognitive style, (6) administrative style, teaching style, and counseling style, and finally, (7) systemic analysis and decision-making theory.

6. Cognitive Style - the construct of cognitive style employed in the educational sciences is defined as the way in which one finds meaning through symbols, cultural determinants, and the modalities of inference.

7. Collective Cognitive Map - a composite of individual cognitive
style maps which indicate those elements that appeared in at least 73% of the individuals sampled.

8. Qualitative Symbol - that symbol which presents and represents to the mind that which it, itself is, i.e., a chair is pictured in the mind as a chair.

9. Theoretical Symbol - that symbol which stands for and represents something other than itself, i.e., the word "chair" standing for the object "chair".

10. Cognitive Map - a written representation of an individual's cognitive style, divided in terms of his major, minor, and null elements of style.

Questions to be Answered

In that much of the work in educational cognitive style is at the hypothesis-generating stage, the author will not attempt to produce an hypothesis-testing type of study. The mapping process will be approached cautiously, with precise attention as to what it can do and what it does not claim to be able to do. Claims and implementations will not be made beyond this basic level. Stated more precisely, the purpose of this study will be to answer the following questions:

1. What types of cognitive styles are demonstrated by those most successful directors of community education in Michigan?

2. Is there a collective cognitive style of most successful directors of community education in Michigan?

3. What types of cognitive styles are demonstrated by those directors of community education in Michigan not designated as most
successful?

4. Is there a collective cognitive style of those directors of community education in Michigan not designated as most successful?

5. How do the cognitive styles of most successful directors of community education in Michigan compare with the cognitive styles of Michigan directors of community education not designated as most successful?

6. Is there an overall collective cognitive style for all of the Michigan community school directors?

Assumptions Underlying Study

1. The design of the study is based on the assumption that the responses of the subjects of the study to the Cognitive Style Mapping Interest Inventory Test represent their actual feelings and convictions. Since the Michigan directors of community education who participated in this study did so voluntarily and were guaranteed strict confidentiality, it seems reasonable to assume that they were honest in their responses.

2. The reliability and validity factors of the instrumentation and procedures used in this study are sufficient for meeting the purposes of the study.

Overview

Chapter I - Introduction of the problem

The statement of the problem, importance of the problem, definitions of terms, questions to be answered, assumptions underlying study, and a
short overview have been provided.

Chapter II - Review of the related literature

Literature from both the position of director of community education and from the educational science of cognitive style has been reviewed.

Chapter III - Research design

The chapter contains the source of the data, methods of gathering data, and the instrumentation employed in the study.

Chapter IV - Analysis of results

In the analysis of results chapter has been included a description of the analytical technique used and tables showing the results of the analysis of data and findings related to the questions.

Chapter V - Summary and conclusions

Questions are answered, conclusions are drawn, discussions are made, and hypotheses are formulated in this chapter.
CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

The review of literature has been focused on the areas of the director of community education and the educational science of cognitive style. Within the section pertaining to the director of community education have been included a brief history of community education, analysis of the personal characteristics and position of the director of community education, and a section attending to the future viability of the community education movement. Within the cognitive mapping portion have been presented an overview of the educational sciences and a review of research findings that have used the educational science of cognitive style. Furthermore, there have been included a number of additional, more specific definitions, as well as a final section dealing with the relationship between the variable of situation and cognitive style.

Development of Community Education

Community education is not a new concept. It has long been present in the form of many guises. In fact, Decker (1972) has charted the movement in the United States as far back as the early 1600's. Though not called community education in earlier times, many of the characteristics of the concept have been practiced since the period of the Massachusetts Charter. Decker's chart demonstrated that from America's infancy, the community education ideas have ebbed and flowed in the
"ocean of history", consistently trending toward a greater degree of societal acceptance.

In more recent times there has been increasingly greater interest in the community education concept. During the last 40 years, Seay (1972b) recalled that there has been great emphasis on educating the community.

During the mid-thirties in the valley of the Tennessee River unschooled carpenters learned to read blueprints, and men who had tilled small farms learned to do electrical work. They were taught in the classrooms and laboratories of the Tennessee Valley Authority's community education program--classrooms and laboratories located at construction villages, at dam sites, in country churches. An their learning achievements were broadened by the reading of books which they borrowed from book-boxes placed near their work-check-out points. Both community and students gained from this training program for adults. The TVA gained skilled workmen to build its dams, and the people of the Valley gained new occupational skills and a broader personal development (p. 16).

The Tennessee Valley Authority was just one example. Other past programs with community education components were carried on in Kentucky (Clapp, 1939), Alabama, and Virginia (Seay, 1972b).

The South, however, was not the only area in the country to become interested in community education. The West was also developing a community education brand of its own. Rogers (1971) traced the antecedents to the Utah community school legislation as far back as the 1830's. During its beginning in the 1800's and with the added push of the 1900's, community education in Utah became strong enough to be supported by state monies by 1970.

Perhaps the greatest contribution to community education came from the mid-western area of the country, situated east of the Mississippi.
River. To be specific, it happened in Flint, Michigan. In the 1930's Frank Manley, the modern founder of community education, noticed that children and adults were being denied the use of the community's most important investment—the schools (Campbell, 1972). The public schools were only being used for a few hours a day to teach the children and then were being locked. The buildings would stand empty for much of the day and night, tucked away from the very people who financed them.

With the aid of C. S. Mott, Manley was able to open five schools as community centers in 1936, which were used to provide recreational and educational services to all of the people of the community (Pendell, 1972). Within these schools, the school day was extended for many hours, allowing great numbers of people to benefit from the additional services of the schools.

In time, other Flint schools were opened as community centers and Flint became a model for community education throughout Michigan. Within ten years of Manley's opening of the first Flint community schools, the Michigan State Department began to give attention to the concept.

The Michigan Community School Service Program grew out of the age-old problem of how schools can best help people to live better. The Michigan Department of Public Instruction turned to the community school concept and asked about the best ways of improving community living through the services of the school. Since satisfactory answers were not available, an experimental program was planned. In June and July of 1945, the State Department of Public Instruction and its advisers agreed upon goals which determined the early course of the Community School Service Program and defined the general scope of local goals to be set up later by individual communities (Seay & Crawford, 1954, p. 19).

During this period of time, other communities within Michigan with

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the support of Flint and the Michigan State Department, initiated the use of community schools.

In 1964, the Mott Fellowship Center was established in Flint with the goals of disseminating and training leaders in community education. Though its name was recently changed to the National Center for Community Education, the Center (1971) is still in existence and has restated its following goals:

I. Leadership Training . . .
II. Inter-Institutional Cooperation . . .
III. Experimentation, Evaluation, and Dissemination of Alternate Methods of Preparing Community Education Leaders . . .
IV. Community Education Materials and Resources Center . . . (p. 28).

With the Center providing for the training of numerous community education leaders and the Mott Foundation providing millions of dollars for the establishment of community education regional and cooperating centers throughout the country, community education has been accepted by hundreds of United States communities and even other countries. As Pendell (1972) observed during an interview with Mr. Mott, even Mr. Mott did not realize the broad scope to which community education would eventually be developed.

... little did he realize that by 1971 over 600 communities throughout the United States would have adopted this basic philosophy that education and educational facilities belong to all the people, all of the time, not just from K-12 age from 8 a.m. to 4 p.m. (p. 32).

The Director of Community Education

Though there are many good definitions of community education, the
one that probably enjoys the greatest degree of acceptance is the one expounded by Minzey and LeTarte (1972).

Community education is a philosophical concept which serves the entire community by providing for all of the educational needs of all of its community members. It uses the local school to serve as the catalyst for bringing community resources to bear on community problems in an effort to develop a positive sense of community, improve community living, and develop the community process toward the end of self-actualization (p. 19).

Accepting the Minzey and LeTarte definition would allow someone to broadly define the director of community education as one who implements this philosophical definition. The simplicity of the definition statement, however, has hidden the complexities of community education and the conflicts of role experienced by directors of community education since the inception of the job title. The following discussion has focused on the opinions of those who have concentrated on identifying the changing, complex role and traits of the directors of community education.

The director comes on duty at noon during each school day, stays on the job until late evening, and is at work on Saturday and throughout summer weeks. Except for the formal instructional program for children during the afternoon, the director is responsible for organization, coordination, supervision, and administration of all programs during the time he is on duty (Totten & Manley, 1969, p. 144).

Totten and Manley (1969) described the community service director, another term for the director of community education, as being in charge of various programs designed to bring about a "oneness of purpose" to the community "... for the good of the whole and of each of its individuals (p. 144)." The director's qualifications should consist of
excellent health and vigor and his being capable of sustained physical activity (Whitt, 1971; Totten & Manley, 1969). "The director should also be endowed with a warm, outgoing personality and enjoy associating and working with people of all ages, races, and creeds (Totten & Manley, 1969, p. 145)."

The earliest directors were handpicked by Manley according to how well they met the preceding requirements (Pendell, 1972). In general, emphasis for selection as director was placed on willingness to work, physical ability, empathy, and friendly personality. Since the director was in charge of many programs, he also had to have a reasonable degree of organization and management skill, as well as a flair for salesmanship.

One who tended to agree with Manley and in fact, co-authored a book with him, was Fred Totten. Totten (1968) described the preferred qualities of a director of community education as being creative and having a warm, outgoing personality. He should also be trusted by people, be of good health, compassionate, quite flexible, and understand himself.

Minzey and LeTarte (1972) have also provided a description of a typical director of community education. They first suggested that a director ought to realize the importance of self-understanding.

There are certain things which the person working with the community must ascertain about himself, and then attempt to develop between himself and the community .... He must be sure that his goal is the self-actualization of the community and not one of self-aggrandizement (Minzey & LeTarte, 1972, p. 37).

These two authors later added that the nature of the director's job is extremely varied.
He will need to be an organizer in order to develop the community with which he is working. He will have to be task-oriented, carrying out his responsibilities, regardless of the time involved or schedule required. He will find himself serving on committees of various kinds, surveying the community, working with other agencies, developing and supervising programs, serving as a resource person to the local school staff, visiting homes, speaking at public meetings, employing staff, developing budgets, seeking funding, and administering programs (Minzey & LeTarte, 1972, p. 161).

After spending a year interviewing directors of community education across the nation, Weaver (1972) has suggested that there exist two basic types of community education. One tends to be program-oriented and school-based, whereas the other one tends to be process-oriented and community-based. The first type seemed to call for a director of community education who could implement and manage adult and recreational programs. Whereas, Weaver felt the process-oriented community education called for a director who could start with "... processes such as coordinating, organizing, demonstrating, and training lay people (p. 9)." Furthermore Weaver has suggested that the director of community education should be assisted by the NCCE in developing professional standards of performance based on a careful analysis of what he is supposed to do.

There are many who would consider the director of community education descriptions of Manley and Totten (1969), Minzey and LeTarte (1972), and Weaver (1972) as being quite representative of the range of beliefs of most of today's community educators. Yet, there are others who have written on the subject, and it seems proper that their ideas, too, should be acknowledged. For instance, Kerenisky and Melby (1971) felt that a
director of community education was:

... not an empire builder, he's a coordinator, a facilitator of existing functions and agencies. To fulfill the role, the community school director listens and learns ... what are the needs of the people in this community (p. 166).

An interesting description of the director of community education has been supplied by Nance (1972).

The community education coordinator should possess the usual preferred personality characteristics, such as honesty, resourcefulness, etc. But above all he must be trustworthy. He must be able to establish a relationship with all elements within the community built upon the highest levels of trust (p. 54).

Nance evidently felt that honesty and trustworthiness were the most important qualities in a director, and without these characteristics, it would be very difficult for a community education director to perform acceptably.

Writing for the Community Education Journal, Hartvigsen (1972) stated that the director of community education must have a rather thorough educational background. He also cited flexibility and knowledge of oneself as being very important qualities of a successful director. On the other hand, a resolution prepared by the NCCE (1973) pointed out that:

The role of the community school director is one which is to mobilize the resources of a community to meet the needs and wants of the community which he serves ... Basic to this assumption is the recognition that his role is to assist in the coordination of the community services available (p. 1).

These many and varied viewpoints concerning the director of community education have been the result of each author's personal
research studies and experience in the community education field. Unfortunately, most of the viewpoints are opinions, and it has often been difficult to distinguish between the various research and experience components comprising these opinions. There has been some documented research completed in community education; however, in many cases it has pertained to areas outside the immediate focus of this study. A few such exceptions to the rule have been mentioned below.

One study of the director of community education completed by Becker (1972) sought to determine the leadership effectiveness of the director of community education as measured by the perceptions of various groups of educators. He found that teachers rated the director of community education highest, and that they and the other groups felt the director's most important qualities were his attitude toward his job, leadership skill, managerial skill, appearance, achievement, drive, supportiveness, and innovativeness.

A second study completed by Edwards (1973) attempted to determine whether similar management and motivational performance characteristics, decision-making characteristics, and personality characteristics identified with effective leadership and management in private enterprise were common to community education leaders. Her review of literature indicated that:

Most of the literature in all fields has discontinued the use of the "trait" approach as a very limited insight into establishing a set of characteristics identifying effective leaders. However, . . . while it is not feasible to identify traits of effective leaders, all fields accentuate the importance of the individual leader and the kind of person he is: his self-understanding; his relationship to others; and
the fusion of both (p. 104).

Her study concluded that the effective community education leader possessed a higher degree of effectiveness, both in producing worthwhile results and being on the move through initiative.

Also, Johnson (1973) prepared a leadership training model to be used to improve the training of directors of community education. His model suggested that community directors should master the functions of coordinating, demonstrating leadership, planning, programming, and public relations. As to the specific task of training directors of community education as leaders, Johnson (1973) compiled a list of well-known educators, whose consensus of opinion suggested that it "... would be futile to impose a standard training program, a doing of things 'to' leaders. Instead a leadership training program should enable leaders to release their unique, possibly latent, potentialities (p. 59)."

Review of literature suggested that there are many different views as to the characteristics of directors of community education. Perhaps Bottom (1971) best summarized the dilemma of identifying competent directors by his following statement:

One of the fastest rising stars on the educational horizon is the Community School Director (or several similar titles such as Community School Coordinator, Community School Agent, etc.) but among educators who hire him and even in his own rank there is a wide difference of opinion as to his role and function. These differences range from one school board member who sees the Community School Director as a recreation director, a superintendent who views him as an adult education director, and a director who perceives himself as "a damn good friend" to community residents (p. 24).
In describing the director of community education, the authors have included many characteristic traits, skills, abilities, and bodies of knowledge. Possibly even more basic to these many qualities, however, is the method by which an individual finds meaning from his environment, or put another way, how the director of community education has developed his unique qualities. Essentially this study seeks to uncover these styles which directors of community education use to find knowledge and meaning from their surroundings.

Future of Community Education

Concentration on discovering cognitive styles of directors of community education would be extremely wasteful if the future survival of the movement, itself, were bleak. This, however, does not seem to be the case. Both financial and social trends seem to point the way for a promising future. The Charles Stewart Mott Foundation (1973) has charted the projected growth of community education up to the year 1978. They forecasted an eventual total national spending for community education of over 139 million dollars, and an eventual two million dollars from the Mott Foundation to support the various regional centers. Also, they have projected a growing total of 8,284 school buildings designated for community education, as well as the establishment of 66 community education cooperating centers. They noted that there may be as many as 41 states providing state funds for the furtherance of community education. Finally, in terms of training, they predicted a need for approximately 70 new year-long degree people per year; whereas the present annual production of these people has been about 20.
Further monies may be expected from the national government. One report has estimated that millions of dollars may be available within the next few years to provide for the placing of community education personnel in state departments and other key educational positions (L. Watt, Executive Secretary NCEA, personal interview, November 27, 1973).

A sound financial future may only be a part of the overall bright picture for community education. As Toffler (1970) recalled:

> Francis Bacon told us that "Knowledge . . . is power." This can be now translated into contemporary terms. In our social setting, "Knowledge is change"—and accelerating knowledge acquisition, fueling the great engine of technology, means accelerating change (p. 32).

As noted by Weaver (1972), Seay (1972a), and Melby (1971), there have been studies and pollings of opinions indicating that the role of the director of community education has been changing to coincide with the changing needs of society. This continued maturation, or at least flexibility, of the position of the director of community education should allow for his continued viability as a useful agent in the future. Talbot (1973), though not specifically mentioning the director of community education, may have best summarized this continued need for change and provided a general conclusion to the topic when he made the following general statement on community education:

> Community Education is the most viable concept that we have had in education for the past several years. If the concept is to succeed, it will have to move from the fringes of the educational program into the mainstream . . . . We have come a long way in this direction and if Community Education in its present form will move from its position as a fringe program and become the foundation of all education, it will have a great future—otherwise, it will have

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The Educational Sciences

The educational sciences have been created as a common structure within which:

... inquiry of significance for the fundamental aspects of the applied field of education can be conducted. The Educational Sciences provide a conceptual framework and scientific language for the applied field of education that approaches the level of precision found in such derivative fields as medicine, pharmacy, engineering, law, and nursing (Svagr, 1973, p. 1).

Hill (1972) has considered an applied field of knowledge as being a:

... system of meanings composed of bodies of information formed mainly by categories and types of logical classifications drawn from the fundamental disciplines to help practitioners explain phenomena and solve problems in certain biological, technological, social, political, and economic areas of the human situation (p. 8).

With this common structure, it has been possible to articulate problems and reduce the probability of misinterpretation and fragmentation within the field of education.

Dr. Joseph Hill, the President of Oakland Community College and the founder of the educational sciences, has been the guiding force in developing the concept. With the assistance of doctoral students and other interested researchers, the educational sciences have become increasingly accepted among educators at the local, state, and national levels. Response has become widespread enough to warrant the initiation of a number of periodic educational sciences workshops throughout the United States (J. Hill, President, Oakland Community College, personal interview, March 1, 1974).
Essential to the educational sciences are the acceptance of three assumptions:

1. Man is a social creature with a capacity for deriving meaning out of his environment and personal experiences.
2. Not content with biological satisfactions alone, man uses symbols in his search for meaning.
3. These symbols acquire meaning through man's cultural experience (Svagir, 1973, p. 1).

Rationale behind these assumptions has been developed by various prominent philosophers and educators throughout history. Hill (1967) has given credit to a number of these men and their contributions:

In recent decades thinkers with widely different orientations have conducted rigorous inquiries into the problem of meaning and many of these efforts have had significant influences on the understanding of this phenomenon. Outstanding in this group would be such names as A. J. Ayer, Boris Carnap, Ernst Cassirer, John Dewey, Lawrence Frank, Alfred Korzybski, George Moore, V. C. Morris, Karl Nagel, K. V. Neurath, Charles Ogden, Charles Pierce, D. W. Richards, Bertrand Russell, Victor Tarski, Alfred North Whitehead and Ludwig Wittgenstein (p. 1).

Particular mention was made of Dewey's (1960) work, which made recognition of man's ability to mediate not one, but two types of symbols into meaning, the qualitative and the theoretical. Further evidence demonstrating the logic of the assumptions has been garnered from Bruner (1966) and Kimura (1973). Bruner studied a child's "stages of knowing" which he felt evolved as the child learned to use various types of symbols. Kimura, in working on the asymmetry of the human brain, has suggested that each side of the cerebral hemisphere of man has special functions in dealing with symbols. She pointed out that though "it is well known that the left hemisphere plays a dominant role in speech
... it turns out that the right hemisphere plays a dominant role in
man's perception of his environment (p. 70)."

It has not been the author's purpose to develop a detailed history
of the educational sciences. Instead, he has been primarily interested
in four of the educational sciences. The first three are symbols and
their meaning, cultural determinants of the meaning of symbols, and the
modalities of inference. A fourth and the one most beneficial to the
study is the educational science of cognitive style, a separate educa-
tional science that has drawn upon the knowledges gained from the
other three.

Development and Meaning of Cognitive Style

McLuhan (1969) has stated that the time has ended when all that
educators have to do is to mass produce human replicas. He claimed
that even in today's automobile plants, each car has been custom-
tailored to its owner. Others have maintained that schooling has not
been directed to the individual's learning needs and desires and has
even discriminated against the concept of individual differences

As an answer to such criticisms, Oakland Community College of
Oakland County, Michigan, has devised an educational program that seeks
to personalize education.

A way to change this situation is to stop
using individual differences as a means of
determining who does well or who fails in group
competition, and instead, adapt to differences
in cognitive styles as a means of varying teaching
techniques to insure the individual's success in his
educational program (Hill & Nunney, 1971, p. 1).
Basing school policy on the assumption that man is "... a social creature with the unique capacity for deriving meaning from his environment and personal experiences through the use of the symbol (Hill, 1972, p. 7)", Oakland Community College has instituted the concept of cognitive style to its educational program.

Cognitive style is not to be associated with Bloom's (1956) definition of cognitive domain. The correct interpretation of cognitive, as related to cognitive style, pertains to an individual's cognition or awareness. Phrased differently, cognitive style would explain how a person finds meaning from his environment. Defined in terms of key abbreviations, cognitive style in the educational sciences is the:

... Cartesian product, $C$, composed of three sets, $S$, $E$, and $H$ where $S$ denotes the set of elements defining symbolic orientation, $E$ indicates the set of cultural determinants of the meaning of symbols and $H$ designates the set of modalities of inference (Hill, 1968, p. 2).

Without further explanation, however, it is unlikely that a reader, not previously acquainted with cognitive style, would have yet adequately grasped the concept. With this in mind, the author has presented a more detailed explanation of cognitive style, containing certain important definitions not previously mentioned.

Hill had taken a look at the field of education and had not been satisfied with its conceptual or language precision (Fragale, 1971). To achieve precision, Hill felt that education had to first be considered as being a set of sciences, and then the conceptual framework and language could be developed to reflect this idea. Within the context of desire for precision, the author has presented the additional definitions and explanations.
The first educational science contained within cognitive style is the science of symbols and their meaning, sometimes referred to as symbologosics. Within symbologosics, two basic types of symbols have been identified—the theoretical (words and numbers) and the qualitative (sensory and code data). Man is continuously finding meaning through one or both of the symbols; therefore, the information contained within symbologosics is fundamental to the other educational sciences (Hill, 1968).

Four theoretical symbols have been identified. They represent a significant portion of symbologosics. Fragale's (1971) explanation of these four symbols, as well as an explanation of all the other cognitive style symbols, has been employed in the following paragraphs to explain the composition of cognitive style. The four theoretical elements are enumerated here with brief explanations of each one:

1. The Theoretical Auditory Linguistic $T(Al)$ symbol is the sound of a word or onomatopoeia.

2. The Theoretical Auditory Quantitative $T(AQ)$ symbol is the sound of a number.

3. The Theoretical Visual Linguistic $T(VL)$ symbol is the written word.

4. The Theoretical Visual Quantitative $T(VQ)$ symbol is the written number.

There are more qualitative symbols than theoretical symbols. The qualitative symbols derive meanings from sensory stimuli, humanly constructed formalisms (codes or games), and the programmatic effects of phenomena which convey an impression of a definite series of images,
events, or operations. Sensory stimuli are generally not included in deriving collective cognitive style. For this reason, sensory stimuli were not used in this paper; however, since they are important in determining individual cognitive style, an explanation of these symbols has been included. Consequently, placing the sensory stimuli-related qualitative symbols into organized form:

1. An example of the **Qualitative Auditory** Q(A) symbol is the sound of music or the clanging of metal on metal.

2. An example of the **Qualitative Olfactory** Q(0) symbol is the smell of flowers or frying bacon.

3. An example of the **Qualitative Savory** Q(S) symbol is the tart taste of lemon or the sweet taste of peach.

4. An example of the **Qualitative Tactual** Q(T) symbol is the smooth feel of silk or the coarse feel of corduroy.

5. An example of the **Qualitative Visual** Q(V) symbol is the color of the setting sun or a drawing of a floor plan.

Organizing the qualitative symbolic codes in similar fashion:

1. **Qualitative Code Empathetic** Q(CEM) is the ability to put yourself in another's place (i.e., to know how it feels when someone hits his thumb with a hammer).

2. **Qualitative Code Esthetic** Q(CES) is the ability to enjoy the "beauty" of an object or idea (i.e., to appreciate an abstract painting).

3. **Qualitative Code Ethic** Q(CET) is the commitment to specific values or duties—persistence to get a job done on time (this does not contain a judgment of morals).

4. **Qualitative Code Histrionic** Q(CH) is the ability to deliberately
stage behavior or emotion to produce a desired effect, such as being able to "cry on cue".

5. **Qualitative Code Kinesics** $Q(CK)$ is the ability to communicate through body motions or positions, such as hand gestures, shrugs, or smiles.

6. **Qualitative Code Kinesthetics** $Q(CKH)$ relates to motor skill abilities—being able to catch a baseball or football, or being able to swim.

7. **Qualitative Code Proxemics** $Q(CP)$ is the ability to judge the "critical" physical and social distance between oneself and others—being able to recognize if you can put your arm around that girl or call the boss by his first name.

8. **Qualitative Code Synnoetics** $Q(CS)$ is an honest knowledge of one's abilities—being able to establish realistic goals for oneself (not impossible, yet not too easily attainable).

9. **Qualitative Code Transactional** $Q(CT)$ is the ability to influence the actions and/or goals of others—to convince someone that your way is best.

10. **Qualitative Proprioceptive** $Q(P)$ is the ability to combine or coordinate several qualitative symbols into a specific function or operation, such as running to and catching a baseball or typing from written material.

The second part of cognitive style makes use of the science of cultural determinants of the meanings of symbols. A person interprets the theoretical and qualitative symbols in relation to roles that have specific expectations imposed upon him. These expectations may be im-
posed by societal norms, peers or associates, or the family and exert influence over the person throughout his life. What the person perceives as the meaning of symbols is greatly determined by:

1. His Associates (A) or peers—this is represented by the various groups with whom the person has the greatest contact, which changes often throughout his lifetime.

2. His Family (F)—either immediate or extended, which tends to establish guidelines of behavior from the earliest age.

3. His Individuality (I), or the person's awareness of the differences which distinguish him from others, and his acceptance or treatment of these differences.

The third part of cognitive style to be considered within the paper is the educational science of modalities of inference ("inferensics"). The meanings of symbols are also influenced by the modes (or patterns) of inference (or reasoning) the individual tends to employ. There are two classifications of modes of inference. First is the inductive process which yields a probability conclusion, and second is the deductive process which yields a conclusion from the given information.

There are four inductive inference processes, which are classified as:

1. Magnitudes (M) or a form of categorical classification and thinking—using definitions and/or putting everything into a pigeonhole.

2. Differences (D) or making one-to-one comparisons of selected characteristics or traits—contrasting the smoothness of silk to the coarseness of corduroy.

3. Relationships (R) or considering the comparison of two or more
selected characteristics or traits—the smoothness, light weight and sheerness of silk as compared with the coarseness, heavy weight, and density of corduroy.

4. Appraisal (L), a unique process in that it provides equal weight to the consideration of Magnitudes, Differences, and Relationships in the process of making a probability conclusion.

The deductive K inferential process is utilized most often in the areas of mathematics and symbolic logic. Although this process is required in performing certain tasks, it is not usually required or used in daily living. For this reason, this process has received less emphasis than the others.

Though cognitive style is also composed of a fourth science dealing with electrophysical and biochemical aspects of the memory function, there has been a lack of a conceptual framework and attendant language which allows these experimenters and educators to communicate effectively, and so this science will not be applied to this study.

Elements from the three pertinent sciences are combined to form a Cartesian Product (G) composed of three sets: S (symbols and their meanings), E (cultural determinants of the meanings of symbols), and H (modalities of inference). The universal (or total element) Cartesian Product is represented by:

\[ G = S \times E \times H \]

The cognitive style of an individual is represented by a Cartesian Product of appropriate elements drawn from each set, forming a sub-set written as:

\[ g = s \times e \times h \]
Cognitive style can be used as a means for diagnosing individuals and for prescribing activities that would provide them with a high probability for success. This diagnostic procedure is applicable to students, teachers, counselors, administrators, educational tasks and materials, and to occupations.

Research Utilizing the Educational Science of Cognitive Style

A number of studies have been conducted dealing with the cognitive styles of individuals and groups. Since the concept has developed within the decade, many of the studies consist of recent doctoral dissertations or papers that are presently unpublished. For the purposes of this paper, the author has emphasized those works demonstrating the effects of matching persons with similar or dissimilar cognitive styles.

Warner (1971) conducted a study to determine how cognitive style was related to learning effectiveness. He initially selected two groups of students, each groups to be taught by a different instructional method. After instruction had ended, successful and unsuccessful students, as determined by a standardized test, were compared by means of their cognitive styles. In the cognitive styles of those being taught by the lecture-demonstration method, the element T(VL) (Theoretical Visual Linguistic) was uniquely characteristic of the successful student. In the cognitive styles of those being taught by the self-instructional technique, the element D (Differences) was uniquely characteristic of the unsuccessful student. Although no attempt was made to compare superiority of teaching methods, the study presented evidence that

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a student's degree of learning success was related to his cognitive style.

Hoogasian (1970) performed a similar experiment when he attempted to discover if students' grades in college English courses were related to their cognitive style. Using a sample of 472 students, he found that certain cognitive styles were more successful in English than were the others. Thus, Hoogasian suggested that the cognitive styles were especially useful as gross predictors of success or failure within the courses under consideration.

Research has indicated that there is a relationship between the similarity of cognitive styles of teacher and pupil and their appraisal results. Wasser (1969) sampled groups of elementary school children and found that cognitive style similarity between teacher and student improved the student's chances for higher grades. Shroeder (1970) performed a similar study, but he had the students rate the teacher in terms of teaching effectiveness. It was found that students who had cognitive styles similar to those of the teacher tended to rate the teacher very effective. Those students with cognitive styles dissimilar to their teacher rated the teacher less effective. Furthermore, students with cognitive styles similar to their teacher received higher grades.

Another study was performed on the cognitive style differences between students in career-oriented courses and others studying engineering (Fragale, 1971). It was found that each group had its own general cognitive style which differentiated from the other group's. Though success or failure was not measured, Fragale suggested that each group of students would be more-at-ease with subject matter tending to reflect
elements within their styles.

Other research, not inspired by the educational sciences, has demonstrated trends somewhat similar to those findings employing cognitive styles (DeLoach, 1969, 1970). Festinger (1957) suggested that similar cognitions (perceived knowledge about oneself or his environment) reduced dissonance (being psychologically uncomfortable). In another study, cognitive compatibility was measured by sampling the students in a large lecture class (Menges, 1967). Results indicated that students cognitively compatible with the instructor tended to rate their instructor more highly than did noncompatible students. Although these other studies tend to agree with findings using the educational science of cognitive style, differences in the researchers' definitions allow for only the most general of comparisons between results of these studies and those utilizing cognitive style.

In an effort to accent personalized learning, a number of educational communities have begun to apply the science of cognitive style to their educational programs. Oakland Community College, a leader in the field, has not only applied cognitive style to the educational enhancement of its students, but has also supported doctoral dissertations and similar studies to expand the concept's potential. Through its sponsorship, there has been a growing body of knowledge dealing with cognitive styles, the most pertinent of which have been reviewed on the previous pages.

Situation and Cognitive Style

There is no neat definition of a situation . . . .
Every situation also has certain identifiable components. These include "things"—a physical setting of natural or man-made objects. Every situation occurs in a "place"—a location or arena within which the action occurs. (It is not accidental that the Latin root "situ" means place (Toffler, 1970, pp. 32-33).

Noting that each situation offers uniqueness, Toffler (1970) felt that people had to be adaptable. On the other hand, since situations demonstrate characteristics similar to other situations, man can learn how to adjust to future situations by observing like situations of the past. Some men adjust to situations better than others, and most men prefer certain general types of situations over others (Reddin, 1970). Because of an individual's ability to adjust or his situational preference, it has been found that certain jobs may be at least temporarily more suitable to one person than another. Shaw (1971) and Reddin (1970) have indicated that people and situations can be matched to obtain a greater possibility for success, and if people are not presently available for a given position, then provision for their training or adjustment can be instituted.

The educational science of cognitive style has provided for the effects of situation. Assuming that education may be thought of as a social system involving the generic elements of persons, processes, and properties, and their interconnections (Homans, 1961), Hill (1972) has interpreted these four elements as containing the basic rudiments of any educational situation. For example, the matching (interconnections-oriented) of one's cognitive style (person-oriented) to a particular job (property-oriented) may increase one's chances for enhanced job performance and self-satisfaction. Zussman (1971) has stated the
same thought another way, referring to a particular type of person and position in the educational profession.

The variant aspects of the conditions of different administrative positions indicate the need for recognition of the fact that different cognitive and administrative styles are needed for different administrative roles; an administrator who is "unsuccessful" in one administrative position may be highly "successful" in another position involving different "conditions" and a different set of responses to his administrative style (p. 2).

In his research, Zussman (1968, 1971) has shown how administrators' cognitive and administrative styles can provide for a greater degree of success in a particular educational situation. Noticing the acceleration of change and the ever shortening duration of situations (Toffler, 1971), it would seem as if further studies such as Zussman's will be produced to confirm the viability of using cognitive styles to improve effectiveness in coping with the variable of situation.

Summary of Chapter

The review of literature has been concentrated in the areas of the community education director and the educational science of cognitive style. Within the general area of community education director has been included a brief summary of the development of community education, information describing the job and characteristics of community education directors, and a section attending to the future of the community education movement.

The second general topic area was concerned with the educational science of cognitive style. The first and second topic divisions
dealt with an overview of the educational sciences and a presentation of additional definitions used in cognitive style development. Part three introduced research findings in the educational science of cognitive style, while part four delved into the relationship between the variable of situation and cognitive style.
CHAPTER III

DESIGN OF THE PROBLEM

Review of the Problem

The intent of the study was to determine how the cognitive styles of the most successful directors of community education in Michigan compare with the cognitive styles of other Michigan directors of community education.

Source of Data

Population

The population consisted of directors of community education in the state of Michigan as identified by the Michigan State Department of Education reimbursement list for community education state monies. Approximately 126 of these individuals have been identified by the Michigan State Department of Adult and Continuing Education. Excluded from the population were those relatively few directors of community education serving within the cities of Detroit and Flint, and those directors occupying their present jobs for less than one year.

Criteria for sample selection

The population was partitioned into two groups. The first was comprised of the most successful Michigan directors of community education. Operationally, this group was defined as the top 32% of the
directors serving within each of the four Michigan Regional Centers for Community Education. Each Regional Center director, considered as an expert within the field of community education and the person most familiar with the directors within his region, was asked to select the top 32% of the directors serving within his geographic area of responsibility. All selections were held confidential, without even the directors knowing their status of perceived success. When all four Regional Directors had made their choices, a random sample of 16 was taken from the selections. Each region contributed to the sample in a proportion equal to the number of directors in the region compared to the total number of directors within the state.

Contained within the second group were those directors of community education not designated as the top 32% of directors in their regions. It is assumed that the undesignated group have enjoyed some success. Although not being perceived as most successful, they have demonstrated a degree of success, by just having remained in the same position for over a year. From this group, a random sample of 16 was selected, using proportionate sampling from each region, as had earlier been done with the most successful directors of community education.

Description of the sample

Within the sample were directors of community education ranging in ages from the middle 20's to age 65. The majority, however, of those interviewed were in the age bracket of the late 20's to the early 40's. In terms of job responsibilities, some directors were in charge of just a few buildings and several programs, while others worked with many
schools, committees, and community property. Though most directors performed similar duties, job titles ranged from community services director to assistant superintendent in charge of curriculum and community education. Most directors had spent at least two weeks in Flint working on intern programs in community education. Finally, over half of the directors sampled had obtained masters degrees in various subjects, with an even larger percentage having spent earlier years working in other educational positions.

Method of Gathering Data

Having derived the samples, it was necessary to contact the sample members. Each individual participant was notified by a personal call from the researcher. All 32 directors of community education agreed to participate, and separate interview times were established. During the phone call, each director was asked to reserve an hour for the interviewer, at which time, he would be given the Cognitive Style Mapping Interest Inventory Test developed by Oakland Community College.

The test consisted of six parts with a total of 216 questions. The first part sought to measure a person's preferences in dealing with the theoretical symbols of words and numbers. The second, third, and fourth portions were used to identify the way in which one uses the qualitative symbols. The fifth of the series measured the individual's cultural preferences, while the sixth dealt with one's modalities of inference.

The directors were issued the test during the early stages of the interview. Each one was asked to read the test questions silently and
answer them aloud with "usually", "sometimes", or "rarely", whichever one of the three responses he felt best applied to him. The interviewer recorded the answers on computer cards, which were later processed, and the results obtained. The results were in the form of a cognitive map, a computer printout which indicated the person's cognitive style.

The interview provided the primary method of collecting data. Research has demonstrated that the interview method, though time consuming and often expensive, usually provides the most complete and accurate information (Kerlinger, 1964; Hill & Kerber, 1967; Glass & Stanley, 1970). Several thousands of miles and two and one-half months provided the ingredients necessary to visit all of the directors included within the samples. There were no refusals; all of the directors eventually met their appointments, although some rescheduling was needed to allow for unforeseen circumstances arising in their busy schedules.

To lessen the possible effects of the directors' lack of familiarity with the researcher and his test, all interviews were conducted in the offices of those being sampled. Most directors appeared receptive, and all were cooperative in answering the questions in the research instrument. Interruptions during testing were few, probably because the researcher asked the directors to concentrate on the test questions and to answer only the most important calls or callers.

The directors took between 15 minutes to an hour to complete the test. No interview required more than one and one-half hours, although extra time was often spent discussing or inspecting the directors' community education programs. At the termination of the visits, the researcher thanked the directors and promised to return each one's
cognitive map and an explanation of results—a promise that was later fulfilled.

Instrumentation

Rationale for using test

The Cognitive Style Mapping Interest Inventory Test is one of a number of tests measuring cognitive style—all of which have been developed under the guidance of Dr. Joseph Hill. Although Oakland Community College gives a three hour battery of tests which directly measure a person's cognitive style, the interest inventory test measures a person's preference in using the various symbols expressed in cognitive style. The interest inventory test was decided upon for two primary reasons:

1. The directors of community education within the sample were individuals with a minimum of a college diploma and at least a year of work experience. The Oakland Community College battery, however, was constructed with emphasis upon measuring students with little or no college background or work experience. It was felt that the battery of tests used at Oakland would not discriminate clearly between the various cognitive styles of well-educated and experienced directors. Realizing that the directors were well-educated, prompted the use of the interest inventory test, which assumed a high level of educational achievement, but sought to measure the director's preferences in interpreting symbols and other areas of the educational sciences.

2. The Cognitive Style Mapping Interest Inventory Test averaged
only 30 minutes to complete, and it was extremely portable. The Oakland Community College battery took much longer for completion and had to be taken at the college. Neither option would have been feasible using the selected sample, not desired by the researcher. Few directors could have afforded the time needed to travel to Oakland Community College, and even if they had been able to go, the comfortable experimental setting of the directors' offices would have been lost.

Validity

The validity of the Cognitive Style Mapping Interest Inventory Test has been based on the concept of construct validity. Construct validity includes the concepts of predictive, concurrent, and content validity, as part of its "program of description" regarding the process of validation (Hill, 1973). No single index of relationship can denote construct validity; rather,

... the determination and description of construct validity is an on-going dynamic process, i.e., a "program", that includes a periodic reporting of a limited number of validity co-efficients pertaining to certain aspects of the instrumentality supplemented by verbal descriptions based upon professional judgements (Hill, 1973, p. 48).

In an effort to obtain at least one validity coefficient, the researcher gave the Cognitive Style Mapping Interest Inventory Test to a total of ten people, all of whom belonged to one of four families. After the test had been completed and scored, the results were explained to each person and to the other members of his family. Content validity, as judged by both the individual test-taker and his family, ranged between .80 and .95 in every case. Thus, the content validity coefficient
of approximately .85 can be used to eventually provide for an accurate assessment of construct validity.

More specifically, calculation of content validity was performed in the following manner. After a family member received his test results, he was asked to determine the degree of validity on each element as it applied to him. Using his map again, a second member of the family was asked to repeat this validating process. Both individuals' ratings were correlated by means of the Pearson product-moment correlation coefficient, and a validity coefficient for each element was obtained. Averaging the validity coefficients for each element gave an overall validity coefficient for a single test. Repeating the validating process for all ten members yielded scores of content validity, a significant portion of construct validity, ranging between .80 and .85. According to Hill (President, Oakland Community College, personal interview, February 15, 1974), other studies using the test battery have yielded content validity coefficients equal to and higher than the results found here.¹

Reliability

The reliability of a test is determined by how consistently a test is able to measure the same thing over and over again. Since one's cognitive style is dynamic and on-going, not every person would demonstrate the same cognitive style each time he took the test. In fact, as time and situation change, the cognitive style of some people may also change.

¹See Appendix A
Reliability of cognitive mapping has been formulated in terms of domain sampling. Within the Cognitive Style Mapping Interest Inventory Test has been included eight questions relating to each one of the elements included in a cognitive map. These questions attempt to measure a person's reaction to a representative domain sampling of various situations, where a particular element being measured is apt to be employed. Most United States adults with a college education would find most of these general situations as being within their realm of experience and would be able to answer the questions with a fair degree of certainty. As the individual's cognitive style changed, however, his way of perceiving the same situations might also change. Naturally the resultant changes would be demonstrated in one's cognitive map, and the reliability coefficient would reflect this result. Since domain sampling provides the means for computing the value of a reliability coefficient on the basis of one set of scores (data), the coefficient's value could be found accordingly. If the reliability of the battery, taken over a period of time is desired, a second administration of the instruments would be required, and the value of the coefficient for this second set of data could be computed. The values of the coefficients, one for the first set of data and another for the second set, could then be compared for significance of difference, thus rendering information regarding the reliability of the battery over a time span.

1 See Appendix B
2 See Appendix C
Cognitive mapping

From the answers obtained from the Cognitive Style Mapping Interest Inventory Test, each director of community education was given a computerized version of his cognitive map. The maps indicated an individual's predominant (majors) and supportive (minors and nulls) elements comprising his personal cognitive style. Major elements were those in which the individual scored above the 72nd percentile rank (raw scores of at least 30). Answering questions relating to a particular element with a majority of "usually's" would tend to yield results at this percentile or higher. Answering "sometimes" to a majority of questions relating to an element would indicate a "minor", a scored obtained when percentiles ranged between 26 and 72. Any percentile rank of a raw score less than 26 has been considered a null orientation and would not show up as an element in a set measuring cognitive style. Predominant responses of "rarely" might lead to a "null" scoring on a particular element of one's cognitive style.

The braces \{ \} symbolize the concept of set. It is a concept of fundamental importance to the process of cognitive mapping. It has been defined as a carefully defined collection of discrete elements, wherein an element has been described as a fundamental constituency of a set. Sets can be composed of any collection of things; however, cognitive mapping has utilized the sets of symbols and their meanings, cultural determinants, and modalities of inference. Within a cognitive map can be seen the three different subsets drawn from a Cartesian product expressed as a \( \emptyset \) function of sets \( S, E, \) and \( H \).
Hill (1973) has made the following explanation of mapping:

Arranging the elements of a Set A into two subsets that are considered to form a second Set B is the process mathematicians term mapping. Mathematical mapping employs only the theoretical symbols of mathematics of abstract logic, in the form of functions or equations, to effect the mapping process. Empirical mapping involves human judgements, based upon a variety of observations and other forms of information to effect the mapping (p. 47).

Since the educational science of cognitive style, $\mathcal{G}$, can be defined as a Cartesian product, $\emptyset$ function of three sets indicated by $S$, $E$, and $H$, the mapping process attempts to draw subsets (using the Cognitive Style Mapping Interest Inventory Test) to represent each of the basic sets. An individual's cognitive map would be composed of the subsets $g = \emptyset \left\{ \left[ a \right] \times \left[ e \right] \times \left[ h \right] \right\}$, where $g$ is cognitive style; $\emptyset$ is the function in the form of a Cartesian product; $g$, $e$, and $h$ are symbols and their meanings, cultural determinants and modalities of inference, respectively. More detailed explanations on mapping can be obtained from outside sources (Hill & Kerber, 1967; Hill, 1973).
It may suffice to say that the concept of cognitive mapping has been rooted in mathematics. Use of the cognitive mapping process has been important in determining cognitive styles of Michigan directors of community education.
CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

Overview

There were three methods employed in the analysis of data. The first method was used to derive each director's cognitive map. It employed the mapping process, and two tables were created to reflect the varied cognitive styles. The second method of analysis was the collective cognitive style map technique. In addition to explaining the technique, this chapter has provided the three collective cognitive style maps that resulted from the study. The third analytical procedure dealt with the matching of collective cognitive style maps. Utilizing this final procedures, a percentage of match was computed, which compared the collective cognitive style maps of the "most successful" with the undesignated directors of community education.

Methods of Analyzing Data

Determining cognitive style

Each director of community education received a cognitive map indicating his cognitive style. Major, minor, and null orientations were scored based on the mathematical work of John Flanagan (1939). A major orientation (+++) indicated an element that a director used quite often (at least 50% of the time). A minor orientation (+) was considered to be an element that was used less frequently (approximately 25% to 49%
of the time); whereas, a null or negligible orientation (0) was an element used less than 24% of the time and not considered to significantly affect one's total cognitive style. Tables 1 and 2 have been presented to show each director's cognitive style map. Table 1 pertains to those cognitive styles identified as belonging to the most successful directors of community education, while Table 2 contains the cognitive styles of the undesignated directors.

To assist in reading Tables 1 and 2, an example has been provided. Note that the numbers refer to the directors of community education, and the symbols pertain to the elements within each director's cognitive style. For instance, Table 1, number 1, refers to the first director within the sample of the most successful directors of community education. He has been identified as having a major orientation (++) in Q(CH), qualitative code histrionics, which indicates that he often stages behavior, i.e., role-playing, in deriving personal meaning. On the other hand, the same director demonstrated a minor orientation (+) in Q(CEM), qualitative code empathetic, an element that can be used, but not to the same extent as major orientations.

Determining collective cognitive style

To obtain an overall cognitive style comprised of the total results from a particular group of directors, it was necessary to use the concept of collective cognitive style. A collective cognitive style can be produced by compiling a list containing the total number of times each cognitive style element appears in the group's maps. The total figure is tabulated according to major, minor, or null orientations for
### TABLE I

**INDIVIDUAL COGNITIVE STYLE MAP RESULTS OF THE MOST SUCCESSFUL DIRECTORS OF COMMUNITY EDUCATION**

<table>
<thead>
<tr>
<th>Directors</th>
<th>Symbols and Their Meaning</th>
<th>Cultural Determinants</th>
<th>Modalities of Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T(VL) T(AL) T(VQ) T(AQ) Q(CBM) Q(CH) Q(CP) Q(CES) Q(CK) Q(CS) Q(CET) Q(CEH)</td>
<td>I E A M L D R K</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>+ + + 0 ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ ++ +=</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### TABLE 2

**INDIVIDUAL COGNITIVE STYLE MAP RESULTS OF THE UNDESIGNATED DIRECTORS OF COMMUNITY EDUCATION**

| Directors | | Symbols and Their Meaning | | Cultural | | Modalities of Inference |
|-----------|-----------------|--------------------------|-----------------|---------|-------------------|
|           | T(VL) | T(AL) | T(AO) | Q(CEM) | Q(CHD) | Q(CP) | Q(CES) | Q(GK) | Q(CSE) | Q(SET) | I | P | A | M | L | D | R | X |
| 1         | ++   | 0     | +     | +     | +      | +     | +      | +     | +      | +      | ++ | + | + | + | + | 0 |
| 2         | ++   | +     | +     | +     | +      | 0     | +      | +     | +      | +      | ++ | + | + | + | + | 0 |
| 3         | ++   | +     | +     | +     | +      | +     | +      | +     | +      | +      | +  | + | + | + | + | 0 |
| 4         | ++   | +     | +     | 0     | ++     | +     | ++     | +     | +      | +      | ++ | + | ++ | + | + | 0 |
| 5         | +    | +     | +     | +     | ++     | +     | +      | +     | +      | ++     | ++ | + | ++ | + | + | 0 |
| 6         | +    | ++    | +     | +     | ++     | +     | +      | +     | +      | ++     | +  | + | ++ | + | + | 0 |
| 7         | +    | +     | +     | +     | ++     | +     | +      | +     | +      | ++     | +  | + | ++ | + | + | 0 |
| 8         | ++   | +     | +     | +     | +      | +     | +      | +     | +      | ++     | +  | + | ++ | + | + | 0 |
| 9         | +    | +     | +     | +     | +      | +     | +      | +     | +      | ++     | +  | + | ++ | + | + | 0 |
| 10        | +    | +     | +     | +     | +      | +     | +      | +     | +      | ++     | +  | + | ++ | + | + | 0 |
| 11        | +    | +     | +     | +     | +      | +     | +      | +     | +      | ++     | +  | + | ++ | + | + | 0 |
| 12        | +    | +     | +     | +     | +      | +     | +      | +     | +      | ++     | +  | + | ++ | + | + | 0 |
| 13        | +    | +     | +     | +     | +      | +     | +      | +     | +      | ++     | +  | + | ++ | + | + | 0 |
| 14        | ++   | +     | +     | +     | +      | +     | +      | +     | +      | ++     | +  | + | ++ | + | + | 0 |
| 15        | +    | +     | +     | +     | +      | +     | +      | +     | +      | ++     | +  | + | ++ | + | + | 0 |
| 16        | ++   | +     | +     | +     | +      | +     | +      | +     | +      | ++     | +  | + | ++ | + | + | 0 |

**Note** — ++ major, + minor, 0 null or negligible
each element. These results were then compared to the total number of members within the group, i.e., if seven members displayed a major T(VL), theoretical visual linguistic, in a group of 15, the resultant fraction would be 7/15 major T(VL)'s. The fractions were transposed into percentages, and Flanagan's (1939) technique was used to determine to what degree each cognitive style element was present within the group's collective cognitive map. In cases where there was no clear indication of major or a minor orientation, then the element in question was interpreted to be at least a minor.

Figure 2 contains the collective cognitive style map of the most successful directors of community education. Figure 3 is the collective cognitive style map of the undesignated directors of community education. Finally, the collective cognitive style map, feature in Figure 4, includes the styles of all 32 directors of community education.

The collective cognitive style maps are to be read the same way as were the individual cognitive style maps. The capital letters indicate a major element; capital letters with a prime (') sign portray a minor element. As mentioned earlier, some minor elements had to be interpreted as being at least a minor, i.e., an element showing nine majors and seven minors from maps of 16 directors, would not automatically be classified as a major or a minor (Flanagan, 1939); yet all directors did score above a minor (26th percentile rank) in the element, so a minor can be interpreted to exist.

Determining degree of cognitive style match

The percentage of match between two cognitive styles or two
Collective Cognitive Style Map of Most Successful Directors of Community Education

Figure 2

Symbols

\[ G = \begin{align*}
T(VL)' & \quad T(AL)' & \quad T(VQ)' & \quad T(AQ)' \\
Q(CS) & \quad Q(CEM) & \quad Q(CES) & \quad Q(CT)' \\
Q(CKH)' & \quad Q(CET)' & \quad Q(CP)' & \quad Q(CH)' \\
Q(CK)' & \\
\end{align*} \]

Cultural Determinants

\( \times \)

\( F \)

\( \times \)

\( R \)

Modalities of Inference

\( A \)

\( D' \)

\( I \)

\( M' \)

Median Percentile Ranges

<table>
<thead>
<tr>
<th>Element</th>
<th>Percentile Ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>T(VL)</td>
<td>50-59</td>
</tr>
<tr>
<td>T(AL)</td>
<td>40-49</td>
</tr>
<tr>
<td>T(VQ)</td>
<td>50-59</td>
</tr>
<tr>
<td>T(AQ)</td>
<td>30-39</td>
</tr>
<tr>
<td>Q(CEM)</td>
<td>73-79</td>
</tr>
<tr>
<td>Q(CH)</td>
<td>50-59</td>
</tr>
<tr>
<td>Q(CP)</td>
<td>70-72</td>
</tr>
<tr>
<td>I</td>
<td>50-59</td>
</tr>
<tr>
<td>M</td>
<td>50-59</td>
</tr>
<tr>
<td>L</td>
<td>60-69</td>
</tr>
</tbody>
</table>

Circle K Test (K) not indicated
Figure 3
Collective Cognitive Style Map of Undesignated Directors of Community Education

Symbols

Cultural
Determinants

Modalities
of Inference

Median Percentile Ranges

<table>
<thead>
<tr>
<th>Element Percentile</th>
<th>Element Percentile</th>
<th>Element Percentile</th>
<th>Element Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>T(VL) 60-69</td>
<td>Q(CEM) 73-79</td>
<td>Q(CES) 73-79</td>
<td>Q(CET) 73-79</td>
</tr>
<tr>
<td>T(AL) 40-49</td>
<td>Q(CH) 40-49</td>
<td>Q(CK) 40-49</td>
<td>Q(CKH) 60-69</td>
</tr>
<tr>
<td>T(VQ) 50-59</td>
<td>Q(CP) 50-59</td>
<td>Q(CS) 80-89</td>
<td>Q(CT) 60-69</td>
</tr>
<tr>
<td>T(AQ) 27-29</td>
<td>I 60-69</td>
<td>A 40-49</td>
<td>F 73-79</td>
</tr>
<tr>
<td></td>
<td>M 60-69</td>
<td>D 50-59</td>
<td>R 73-79</td>
</tr>
<tr>
<td></td>
<td>L 73-79</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Circle K Test (K) not indicated
Figure 4

Collective Cognitive Style Map of All Directors of Community Education

Symbols

\[ G = \{ T(VL)' T(AL)' T(VQ)' T(AQ)' \} \]

Cultural Determinants

\[ \{ \begin{array}{c}
F \\
I' \\
A'
\end{array} \} \]

Modalities of Inference

\[ \{ \begin{array}{c}
R R \\
D' M'
\end{array} \} \]

Median Percentile Ranges

<table>
<thead>
<tr>
<th>Element Percentile</th>
<th>Element Percentile</th>
<th>Element Percentile</th>
<th>Element Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>T(VL) 60-69</td>
<td>Q(CEM) 73-79</td>
<td>Q(CES) 73-79</td>
<td>Q(CET) 70-73</td>
</tr>
<tr>
<td>T(AL) 40-45</td>
<td>Q(CH) 40-49</td>
<td>Q(CK) 50-59</td>
<td>Q(CKH) 60-69</td>
</tr>
<tr>
<td>T(VQ) 50-55</td>
<td>Q(CP) 60-69</td>
<td>Q(CS) 80-89</td>
<td>Q(CT) 70-73</td>
</tr>
<tr>
<td>T(AQ) 30-35</td>
<td>L 70-72</td>
<td>R 73-79</td>
<td></td>
</tr>
</tbody>
</table>

Circle K Test (K) not indicated
collective cognitive styles can be derived using a matching process based upon referent style. Summarizing this procedure, the referent style would be the base style to which the second style is compared. The decision of which cognitive style will be the referent style is usually not an arbitrary one. Generally, the referent style is the one most valued by the researcher or by society, i.e., when matching teacher and students' style, the teacher would normally provide the referent style.

The referent style is assigned the number "3" to each of its elements, as was done in Table 3. Elements of both cognitive styles are then compared. If the element in the second cognitive style shows the same percentile range as the referent style, then the element is assigned a "3". If the elements in both styles have the same orientations, i.e., both "majors" but do not have the same percentile ranges, a score of "2" is assigned. If both element orientations differ, i.e., "major" or "minor" but not a "null", then the number assigned to the element will be a "1". Finally, if the element is absent in either one of the cognitive maps, i.e., "null" or "negligible", a "0" is scored for the element.

Generally the matching technique has been used to compare two individual's cognitive maps or an individual's cognitive map to a particular job.¹ This paper, however, has applied the matching technique to measure the overall match between two collective cognitive styles. The two maps involved are the collective cognitive style maps of the

¹See Appendix D
most successful directors and the undesignated directors. The only modifications that were made to allow for this new application of the new matching technique were to use 73% instead of 50% as an indicator of a major orientation and to derive an average percentile range instead of using an individual map's percentile range.

Using 73% instead of 50% was a procedure consistent with Flanagan's (1939) technique and with scoring methods applied throughout the study. Deriving an average percentile range was a slight modification accomplished by calculating the median percentile range for each element from the percentile scores of the individual maps included within a collective cognitive style map. For instance, in Figure 2 the median percentile score, using the percentile scores from 16 most successful directors, calculated for the theoretical visual linguistic element, T(VL), was 55. Obviously a score of 55 is within the 50-59 percentile range, and it is this percentile range that has been obtained for the T(VL) element of Figure 2.

In matching cognitive styles, higher percentages of match are preferred. Those maps with a percentage match greater than 72% are considered to be a major match. Matching percentiles ranging from 27% to 72% indicate a minor match and percentages of match less than 27% are considered to be null or negligible. Assignments, i.e., student to teacher, can be made on a score as low as 50 percent; however, it "... is a minimum match at best, and my assignment based upon this degree of match should be monitored and subjected to rather frequent analysis (Hill, 1968, p. 13)."

Within the "symbols and their meanings" set, all numbers are scored...
as binomial combinations, using each theoretical symbol with each qualitative symbol, i.e., T(VL) - Q(CEM), T(VL) - Q(CES), etc. The binomial combinations are added together to yield a total number for each binomial combination, i.e., the binomial combinations for the referent style are usually assigned the number "6". As demonstrated in Table 3, the number "6" is the additive result of both the theoretical and qualitative symbols, "3 + 3".

The cultural determinants and modalities of inference have been scored somewhat differently than the "symbols and their meanings" set. Even though there may be no apparent major within these sets, the elements approaching nearest to a major orientation have been assigned as a major. The elements with lower percentile ranges are then arranged as minors in descending order, as can be seen in the cultural determinant set of Figure 2. Two final points should be mentioned to prevent possible confusion concerning scoring procedures. The element of deductive reasoning, (K), is never used in the matching technique, and the appraisal element, (L), though issued a score, is not listed in a collective cognitive style map unless it falls within the percentile range of 73 to 79. Furthermore, since the appraisal element, (L), is composed of a degree of three other elements, it can be assigned a number as high as "9".

1 Tables 3 and 4, and Figure 5 have been included to demonstrate the procedure used and the results obtained from the matching technique. Table 3 has shown the numbering system assigned to the elements within

\[\text{See Appendix D}\]
### Table 3

**Degree of Match Scoring for Referent Style of Most Successful Directors of Community Education**

<table>
<thead>
<tr>
<th>Symbols (Sums of Binomial Combinations)</th>
<th>Cultural Determinants</th>
<th>Modalities of Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>(3) (T(VL)) (3) (T(AL)) (3) (T(VQ)) (3) (T(AQ)) (3)</td>
<td>(F-I') ((3 + 3)) (F-A') ((3 + 3)) (F) ((3))</td>
<td>(R) ((3)) (R-M') ((3 + 3)) (R-D') ((3 + 3)) (L') ((9))</td>
</tr>
<tr>
<td>(Q(CEM)) (3) (3 + 3) (3 + 3) (3 + 3) (3 + 3)</td>
<td>(\times)</td>
<td>(\times)</td>
</tr>
<tr>
<td>(Q(CH)) (3) (3 + 3) (3 + 3) (3 + 3) (3 + 3)</td>
<td>(F-I') ((3 + 3))</td>
<td>(\times)</td>
</tr>
<tr>
<td>(Q(CP)) (3) (3 + 3) (3 + 3) (3 + 3) (3 + 3)</td>
<td>(F-A') ((3 + 3))</td>
<td>(\times)</td>
</tr>
<tr>
<td>(Q(CES)) (3) (3 + 3) (3 + 3) (3 + 3) (3 + 3)</td>
<td>(F) ((3))</td>
<td>(\times)</td>
</tr>
<tr>
<td>(Q(CK)) (3) (3 + 3) (3 + 3) (3 + 3) (3 + 3)</td>
<td>or</td>
<td>or</td>
</tr>
<tr>
<td>(Q(CS)) (3) (3 + 3) (3 + 3) (3 + 3) (3 + 3)</td>
<td>(6 + 6 + 3 = 15) points</td>
<td>(3 + 6 + 6 + 9 = 24) points</td>
</tr>
<tr>
<td>(Q(CET)) (3) (3 + 3) (3 + 3) (3 + 3) (3 + 3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Q(CKH)) (3) (3 + 3) (3 + 3) (3 + 3) (3 + 3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Q(CT)) (3) (3 + 3) (3 + 3) (3 + 3) (3 + 3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\frac{27 + 27}{54}) (\frac{27 + 27}{54}) (\frac{27 + 27}{54}) (\frac{27 + 27}{54})</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(= 216) points</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TABLE 4

DEGREE OF MATCH PROCEDURE SHOWING SCORING METHOD
(UNDESIGNATED DIALECTORS COMPARED TO MOST SUCCESSFUL DIRECTORS)

<table>
<thead>
<tr>
<th>Symbols (Sums of Binomial Combinations)</th>
<th>Cultural Determinants</th>
<th>Modalities of Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 T(VL) 3 T(AL) 3 T(VQ) 2 T(AQ)</td>
<td>F-I (3 + 2)</td>
<td>R-M (3 + 2)</td>
</tr>
<tr>
<td>3 Q(CEM) 2 + 3 3 + 3 3 + 3 2 + 3</td>
<td>F-A (3 + 2)</td>
<td>R-D (3 + 2)</td>
</tr>
<tr>
<td>2 Q(CH) 2 + 2 3 + 2 3 + 2 2 + 2</td>
<td>F (3)</td>
<td>R (3)</td>
</tr>
<tr>
<td>2 Q(CP) 2 + 2 3 + 2 3 + 2 2 + 2</td>
<td></td>
<td>L (3)</td>
</tr>
<tr>
<td>3 Q(CES) 2 + 3 3 + 3 3 + 3 2 + 3</td>
<td></td>
<td>or</td>
</tr>
<tr>
<td>2 Q(CK) 2 + 2 3 + 2 3 + 2 2 + 2</td>
<td>5 + 5 + 3 = 13 points</td>
<td>or</td>
</tr>
<tr>
<td>3 Q(CS) 2 + 3 3 + 3 3 + 3 2 + 3</td>
<td></td>
<td>5 + 5 + 3 + 3 = 16 points</td>
</tr>
<tr>
<td>1 Q(CET) 2 + 1 3 + 1 3 + 1 2 + 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Q(CKH) 2 + 3 3 + 3 3 + 3 2 + 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Q(CT) 2 + 1 3 + 1 3 + 1 2 + 1 18 + 20</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>18 + 20 27 + 20 27 + 20 18 + 20</td>
<td></td>
</tr>
<tr>
<td></td>
<td>38 + 47 47 + 38</td>
<td></td>
</tr>
<tr>
<td></td>
<td>170 points</td>
<td></td>
</tr>
</tbody>
</table>
Figure 5
Degree of Match Score
Comparing Collective Cognitive Style Maps of
Most Successful and Undesignated Directors of Community Education

<table>
<thead>
<tr>
<th>Symbols</th>
<th>Cultural Determinants</th>
<th>Modalities of Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>170</td>
<td>+</td>
<td>13</td>
</tr>
<tr>
<td>216</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>.787</td>
<td>+</td>
<td>.867</td>
</tr>
<tr>
<td></td>
<td></td>
<td>.667</td>
</tr>
<tr>
<td></td>
<td>2.321</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>=</td>
<td>.774 or .77 match</td>
</tr>
</tbody>
</table>

\[ \frac{2.321}{3} = .774 \text{ or } .77 \text{ match} \]
the referent style. Notice that each element has been assigned the highest score of "3". Table 4 has pictured the numeric values assigned to the style of the undesigned directors, as compared to the most successful directors in Table 3. The figures in Table 4 range from "1" to "3", depending upon the degree of match, as explained above. The numeric sums of each respective set (symbols, cultural determinants, and modalities of inference) in Table 4 have been compared to the point totals of the same three sets in Table 3. In Figure 5, these comparisons have been first written as fractions (170/216 for symbols, 13/15 for cultural determinants, and 16/24 for modalities of inference), and then transposed into percentages. Finally, the three percentages have been added together and then divided by the total number of sets which is three, arriving at a degree of match between most successful directors and undesigned directors of .77 or 77%.

Summary

The data analysis chapter was divided into three areas: tables of individual maps, collective cognitive style maps, and the matching technique using referent style. Questions pertaining to individual cognitive styles have been answered by presenting tables, designed to show the elements found within each sample member's cognitive style. Inspection of the tables should demonstrate the differences between cognitive styles of various directors of community education.

The second area of concern dealt with the formation of collective cognitive style maps, as demanded by questions two, four, and six posed in Chapter I. Using Flanagan's (1939) technique, collective cognitive
style maps were prepared. A total of three such maps were constructed providing for the most successful directors of community education, the undesigned directors of community education, and a combined group comprised of all 32 directors.

Question five in Chapter I asked for a comparison between collective cognitive styles of the most successful directors of community education. A modified matching technique, featuring the referent style match, was used to indicate the percentage of match between the two groups. The result from this matching technique was included in Chapter IV.
CHAPTER V

CONCLUSIONS AND IMPLICATIONS FOR FUTURE RESEARCH

Overview

Being an hypothesis-generating study, it is appropriate that the data analyzed in Chapter IV be employed to answer questions posed in Chapter I. For the sake of convenience the six questions have been re-listed below:

1. What types of cognitive styles are demonstrated by those most successful directors of community education in Michigan?

2. Is there a collective cognitive style of most successful directors of community education in Michigan?

3. What types of cognitive styles are demonstrated by those directors of community education in Michigan not designated as most successful?

4. Is there a collective cognitive style of those directors of community education in Michigan not designated as most successful?

5. How do the cognitive styles of most successful directors of community education in Michigan compare with the cognitive styles of Michigan directors of community education not designated as most successful?

6. Is there an overall collective cognitive style for all of the Michigan community school directors?

The initial portion of Chapter V has been concerned with answering the six questions posed in Chapter I. In addition to presenting each
question, sections pertaining to each question have been included under the title of "Discussion and Conclusions". The second portion of Chapter V has dealt with the various implications for future research. Answering the proposed questions has provided a basis on which relevant hypotheses have been formulated. It is hoped that future research will take upon itself the responsibility for testing the accuracy of these hypothetical treatments.

Discussion and Conclusions

Question 1: What types of cognitive styles are demonstrated by those most successful directors of community education in Michigan?

Question 3: What types of cognitive styles are demonstrated by those directors of community education in Michigan not designated as most successful?

Discussion

Both questions have been concerned with demonstrating the individual cognitive styles displayed by the various directors of community education. Table 2 and Table 3 in Chapter IV have shown each individual's cognitive style. As can be observed, the individual styles of directors represent the individuality of people in general. There was considerable diversity between directors in the most successful group, as well as in the undesignated group. Recognizing this fact should emphasize the importance of treating each director as an individual who prefers to find meaning in a unique fashion. In initiating in-service training and workshops for directors, it might be wise to map each director's cognitive
style and then utilize instructional methods most appropriate to each director. For instance, if a director has a major in theoretical audio linguistics, T(AL), he would probably prefer listening to a good speaker rather than reading a book on the same topic.

It is also suggested that each director be aware of his cognitive style, so that he be able to maximize the strengths of his cognitive style in his daily work. As revealed in Chapter II, one's effectiveness is highly dependent upon the particular environment or situation. A director experiencing problems within his present position may be able to redesign his job into a position more consistent with his cognitive style.

Conclusions

1. Each director of community education demonstrates a unique cognitive style, which he employs to derive meaning from his environment.

2. A director's understanding of his cognitive style is helpful in deriving the maximum amount of meaning from his environment.

Question 2: Is there a collective cognitive style of most successful directors of community education in Michigan?

Question 4: Is there a collective cognitive style of those directors of community education in Michigan not designated as most successful?

Discussion of differences between collective cognitive styles

The obvious answer to each question was "yes". As seen from Figures
2 and 3, each group of directors yielded a collective cognitive style. More importantly, however, was that these two collective cognitive styles differ in many respects. These differences, though often only visible in terms of one percentile range, i.e., 50-59 compared to 60-69, may be indicative of important cognitive style trends. It is also quite possible that these cognitive style differences may indicate an even greater disparity in certain skills and traits between the most successful and undesignated directors of community education.

In comparing Figure 2 with Figure 3, the findings show that the most successful directors of community education scored higher than their undesignated counterparts in the following elements. In the "symbols and their meanings" set, higher percentile ranges (the exact median percentile scores are in parentheses) were found in:

1. Theoretical audio quantitative T(AQ) (32 vs 27)
2. Qualitative code histrionics Q(CH) (50 vs 45)
3. Qualitative code kinesics Q(CK) (55 vs 45)
4. Qualitative code proxemics Q(CP) (70 vs 55)
5. Qualitative code transactional Q(CT) (75 vs 65)

Lower comparative ranges were obtained for the most successful directors in:

1. Theoretical visual linguistic T(VL) (55 vs 65)
2. Qualitative code ethics Q(CET) (65 vs 75)

Comparing both groups of directors' cultural determinant sets, it was found that the most successful directors scored higher in Associates (A) (55 vs 45) and lower in Individual (I) (55 vs 65).

Using a similar comparison method in modalities of inference, the
most successful directors exhibited a higher percentile range in Differences (D) (65 vs 55) and lower percentile ranges in:

1. Magnitude (M) (55 vs 65)
2. Appraisal (L) (65 vs 75)

Conclusions

A number of differences were found to exist in comparing the collective cognitive style map of the most successful directors of community education with the collective cognitive style map of the undesignated directors of community education. These differences suggest that there exists a separate collective cognitive style profile for each group of directors. With this point in mind, the following conclusions have been formulated:

1. The most successful directors of community education seemed to prefer deriving meaning through a balanced usage of the theoretical elements. All theoretical elements of their collective cognitive style maps fell between 30-59th percentile.

2. In comparison to the undesignated directors, the most successful directors of community education seemed to prefer deriving meaning from the theoretical audio elements. The most successful directors scored lower than their undesignated counterparts in T(VL), but higher in T(AQ).

3. In comparison to the most successful directors, the undesignated directors of community education seemed to prefer deriving meaning from the theoretical visual elements. The undesignated directors scored lower than their counterparts in T(AQ), but higher in T(VL).
4. In comparison to the undesignated directors, the most successful directors of community education seemed to prefer deriving meaning through greater use of the qualitative symbols. Witness the higher percentile ranks in favor of the most successful directors in four of the five qualitative symbols in which differences were evident.

5. In comparison to the undesignated directors, the most successful directors seemed to prefer deriving meaning through the interaction with other people. Not only have the most successful directors scored higher on theoretical audio elements, but they also scored higher on the qualitative elements of Q(CP), Q(CT), Q(CH), and on the cultural determinant of Associates (A).

6. In comparison to the most successful directors, the undesignated directors of community education seemed to prefer deriving meaning from individual interpretation of inanimate objects. Not only have the undesignated directors scored higher on the theoretical visual elements, but they have also scored higher on rule-following Q(CET) and on the cultural determinant of Individual (I).

7. In comparison to the undesignated directors of community education, the most successful directors seemed to prefer deriving meaning from finding more differences and less similarities between objects and people than did their undesignated counterparts. The most successful directors scored higher on the modalities of inference Differences (D) than the undesignated directors.

8. In comparison to the most successful directors, the undesignated directors of community education seemed to prefer deriving meaning through a greater degree of analyzation, i.e., searching for "all the
variables" within a problem. The undesignated directors scored higher than the most successful directors in the Appraisal element (L), which is a combination element composed of (R), (D), and (M).

**Discussion of similarities in collective cognitive styles**

Not all elements in the two collective cognitive style maps were different. Similarities in both director groups' collective cognitive styles were evident in certain elements. These similarities have been listed below:

1. Theoretical audio-linguistic \( T(\text{AL})' \)
2. Theoretical visual quantitative \( T(\text{VQ})' \)
3. Qualitative code empathetic \( Q(\text{CEM}) \)
4. Qualitative code kinetics \( Q(\text{CKH})' \)
5. Family (F)
6. Relationships (R)

**Conclusions**

In preparing workshops and in-service meetings for directors of community education, presentations should be adjusted to take account of these similarities within the group. This comment should be interpreted as a suggestion. On the other hand, there are at least two conclusions that can be drawn from the similarities in the directors' collective cognitive styles.

1. Although directors of community education derive meaning through physical activity, they possess only a minor orientation in their preference for using this cognitive style element. They show only
2. Directors of community education seemed to derive a great deal of meaning from empathizing with others. They show a major Qualitative code empathetic Q(CEM).

Question 6: Is there an overall collective cognitive style for all of the Michigan community school directors?

Discussion

Again the answer is "yes". A total collective cognitive style has been developed which includes the most successful and undesignated directors of community education. Figure 4 of Chapter IV has presented this combination collective cognitive style; however, only one conclusion has been drawn from this map.

Conclusion

The overall collective cognitive style map has identified common elements within both director groups' collective cognitive style maps. This combination map can be important in concluding how directors of community education derive meaning from their environment. If individual cognitive styles of directors are unavailable, director-focused in-service meetings, workshops, and classes can be programmed with the aid of information provided by the combination collective cognitive style map.

Question 5: How do the cognitive styles of most successful
directors of community education in Michigan compare with the cognitive styles of Michigan directors of community education not designated as most successful?

Discussion

The matching technique previously referred to in Chapter IV was used to answer Question 5. Tables 4 and 5 and Figure 5 have demonstrated the method by which the percentage of match between the two director groups was calculated. The matching technique yielded a score of 77%, a degree of relationship indicative of a major.

Although 77% match may not reach the 5% or 10% level of significance, it nevertheless is a substantial degree of match. The result indicated that the two groups of directors were probably well suited for deriving meaning from one another. Thus, the following conclusion has been deduced.

Conclusion

The most successful directors of community education and the undesignated directors of community education demonstrate a degree of collective cognitive style match high enough to suggest that either group could effectively assist the other in deriving meaning.

Implications for Future Research

Implications derived from the conclusions of this study have been instrumental in generating a number of relevant hypotheses. Cognitive mapping has not only been helpful in identifying an individual's
cognitive style, but it can provide insight into the person's skills, aptitudes, knowledge, and behavior (Rice, 1973; Hill, 1967). The conclusions developed from the mapping of directors of community education have therefore been used to formulate a number of relevant hypotheses. These hypotheses have been listed in the chapter, with reference to the questions from which they were inspired.

The following hypotheses have been derived from the conclusions generated from Question 1 and Question 3:

Hypothesis 1: Directors of community education will learn more effectively if their cognitive styles are similar to those of their instructors.

Hypothesis 2: Directors of community education will function more effectively if their cognitive styles match the cognitive style required by their job.

Hypothesis 3: Directors of community education receiving guidance through the use of cognitive mapping will perform more effectively in their job.

The following hypotheses have been derived from the conclusions generated from Question 2 and Question 4:

Hypothesis 4: The most successful directors of community education would prefer to communicate with others through direct contact rather than through written correspondence. The most successful directors of community education have scored higher than their counterparts in T(AQ) [speaking and listening in numbers], Q(CT) [salesmanship], and Q(CH) [role-playing], and (A) [associates orientation]. The most successful directors scored lower in T(VL) [reading and writing in words].

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Hypothesis 5: The most successful directors of community education will rate their writing skills below their oral communication skills. They scored higher than their counterparts in T(AQ) [listening and speaking in numbers], and lower in T(VL) [reading and writing in words].

Hypothesis 6: The most successful directors of community education will exhibit an above average ability in convincing others that their way is best. They scored higher than their counterparts in Q(CT) [salesmanship], Q(CH) [role-playing], and Q(CP) [judging appropriate social distance].

Hypothesis 7: The most successful directors of community education are relationship-oriented rather than task-oriented. The most successful directors of community education scored higher than their counterparts in T(AQ) [speaking in numbers], Q(CT) [salesmanship], Q(CH) [role-playing], Q(CF) [judging appropriate social distance], and (A) [associate orientation]. They scored lower in T(VL) [reading and writing in words], Q(CET) [following rules], (I) [self-reliance], and (L) [appraisal].

Hypothesis 8: The most successful directors of community education exhibit a high degree of flexibility in adapting to a variety of situations. They scored higher than their counterparts in (D) [recognizing differences]. They scored lower than their counterparts in Q(CET) [following rules] and (M) [magnitude].

Hypothesis 9: The most successful directors of community education exhibit a high degree of decision-making ability. They scored higher than their counterparts in Q(CT) [confidence in selling their
ideas], Q(CH) [role-playing], and Q(CP) [judging appropriate social distance]. They scored lower in (L) [appraisal] and T(VL) [reading and writing].

Hypothesis 10: The most successful directors often make decisions that call for constant revision and updating. They scored higher than their counterparts in Q(CT) [selling ideas] and Q(CH) [role-playing]. They scored lower in (L) [appraisal] and T(VL) [reading and writing].

Hypothesis 11: The most successful directors of community education communicate with community members instead of communicating to them. They scored higher than their counterparts in (A) [associates-orientation] and lower in T(VL) [reading and writing words], i.e., notes or pamphlets, (I) [self-reliance], and (M) [magnitude].

Hypothesis 12: Directors of community education are not primarily recreation-oriented. They exhibit only a minor Q(CKH) [deriving meaning from physical activity].

The following hypothesis has been derived from the conclusions generated from Question 6:

Hypothesis 13: Learning by directors of community education can be facilitated if in-service training meetings, workshops, or other educational meetings present information in a manner consistent with the directors' overall collective cognitive style map.

The following hypothesis has been derived from the conclusions generated from Question 5:

Hypothesis 14: Directors of community education will learn more effectively when they are taught by other directors of community education. (77% indicated a major match between the most successful
directors of community education and the other directors of community education not designated as most successful.)

Summary

The implications derived from the conclusions of this study have been responsible for helping to generate 14 hypotheses. The more general hypotheses have been presented without further explanation; however, where hypotheses have been derived from conclusions generated from a few cognitive style elements, these elements have been identified and briefly described. A concurrent dissertation, using a similar population, is presently being written in an attempt to measure directors' skill areas, such as hypothesized in the 4th and 5th hypotheses (Kliminski, 1974). Results from Kliminski's study and from the research of others may eventually provide the statistical basis necessary for producing more accurate statements, sounder judgements, and improved policy-making decisions in the field of community education.
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APPENDIX A

Problem Set on Validity of Mapping Process
The validity of an instrumentality depends upon how authentically it measures what it is designed to measure. An instrumentality is considered to be valid when the behaviors which it is designed to measure correspond to the same behaviors measured by or objectively defined by a source independent from that which created the instrumentality. An example frequently used to clarify the concepts of reliability is that of a clock being set forward 15 minutes. If the clock is "reliable," i.e., consistent, it will maintain that amount of "fast" time, but the time it displays will not be valid relative to the standard of time for the region in which it is located. The validity of any measuring instrument can be found by comparing the information which it yields with so-called "standard measures of that information." Since independent standards, i.e., criteria, are difficult to establish in mental measurement, the validity of such an instrumentality cannot be estimated as accurately as can the validity of an instrument designed to measure a physical aspect of the world.

Validity is a relative, but yet specific, term. An instrumentality is valid for a specific purpose, or a particular situation, it cannot be generally valid. This situation is exemplified in numerous ways. When industrial concerns use an individual’s performance on a general aptitude test as a predictor for successful performance in a routine clerical job, they frequently discover that this type of instrumentality does not provide a valid measure of the skills that might be necessary to satisfactory performance in that type of job.

Content and "Face" Validity

Content validity is employed in connection with standardized educational achievement tests. This type of validity is described in verbal terms and is based upon the consensus of judgments of educators regarding the degree of knowledge that an individual of a given age or given level of educational development should possess in such subjects as history, English, mathematics, or geography. For example, a test of geography is judged to be valid if it consists
of questions that cover the subject matter considered by this specialization. Content validity is appropriate for those situations in which: (1) competent professionals are available, and the items employed cover a wide spectrum of topics in the specialization to which the test pertains, and (2) adequate standardization groups are available.

"Face validity," less rigorous in terms of the standards of judgment employed in content validity, is used to describe the validity of an instrumentality that appears to measure that which it was designed to measure. Judgments of face validity are useful during the initial stages of item analysis. Face validity should be used little more than as a first step in assessing the potentiality of an item for inclusion in an instrumentality; it should not be used as the final information accorded the validity factor of an instrumentality.

Predictive Validity and Concurrent Validity

The validity of certain types of instrumentalities can be determined on the basis of the correlation of values (e.g., scores) yielded by the instrumentality and some independent criterion. A criterion may be an objective measure of performance, or a judgment of the excellence of the performance. For example, intelligence tests were first validated against performance of examinees in different levels of school grades, teachers' ratings of students' aptitudes, and other "substantial" indices of ability.

Personality, attitude, and interest inventories are usually validated by comparing their predictions to actual outcomes. A high degree of correlation between an instrumentality and a criterion is evidence of validity if: (a) the criterion was created independently from the instrumentality, and (b) both the instrumentality and the criterion are reliable.

The value of the index of reliability can be used as an approach consonant with the concept of domain sampling which must be employed in connection with the mapping of elements of a phenomenon as dynamic as "style." The value of this index of relationship indicates the degree
of correlation between scores obtained by sampling the domain in question and their theoretically "true" counterparts found in that domain.

In the context of a domain, an individual's true score can be defined as the mean (arithmetic average) of a very large number of samplings of the domain (theoretically possessed by that person) by the same instrumentality under standard conditions. The correlation between a set of obtained scores and their corresponding true counterparts can be found by employing formula (1):

\[ r_\infty = \sqrt{r_{xx}} \]  

(1)

Where \( r_\infty \) denotes the value of the correlation between obtained and true scores; and \( r_{xx} \) the value of the reliability coefficient of the test. The coefficient \( r_\infty \) is termed the index of reliability. This index indicates how well obtained scores agree with their theoretically true values. The index also indicates the highest correlation the instrumentality (domain sample) is capable of yielding in its present form.

By squaring both sides of the equation, it is found that:

\[ r_\infty^2 = r_{xx} \]

and that the value of the reliability coefficient of an instrumentality indicates the proportion of the variance of the obtained scores which is determined by the variance of the true scores of the domain. For example, if the value of the reliability coefficient for a given instrumentality (domain sample) is found to be .81, then 81 percent of the variance of the score obtained by that domain sample (the instrumentality) is attributable to their counterpart true scores in that domain. Moreover, since \( r_\infty = \sqrt{.81} = .90 \), it is known that .90 is the highest value of correlation which this instrumentality (domain sample) is capable of yielding in its present form. It should also be noted that if the value of the reliability coefficient of an instrumentality is as

*The symbol \( \infty \) (infinity) denotes true scores.*
low as .25, and, therefore: \( r_{\infty} = \sqrt{.25} = .50 \), it is undoubtedly a waste of time to use the instrumentality in its present form. Lengthening it, or otherwise improving it, is indicated.

An instrumentality whose index of reliability is only .50 is yielding poor estimates of the domain it was designed to measure. It is in this type of context that the index of reliability is considered a measure of validity.

Validity and the Length of an Instrumentality

Not only is the reliability of an instrumentality (domain sample) increased by lengthening it, or averaging the results of \( n \) parallel forms of it, but its validity is increased as well. In this context, the lengthened instrumentality provides a better sampling of the domain, i. e., it provides a better measure of its criterion, than the original form did. The value of the validity coefficient of an instrumentality lengthened \( n \) times, or the average of the results yielded by \( n \) parallel forms of it, can be found from formula (2):

\[
\text{validity coefficient} = \frac{nr_{cx}}{\sqrt{n^2+n(n-1)r_{xx}}} \tag{2}
\]

Where \( r_{cnx} \) denotes the value of the correlation between the criterion \( c \) and either \( n \) parallel forms of instrumentality \( x \), or instrumentality \( x \) lengthened \( n \) times; \( r_{cx} \) is the value of the correlation between the criterion \( c \) and the original instrumentality \( x \); \( r_{xx} \) is the value of the reliability coefficient of instrumentality \( x \); and \( n \) indicates either the number of parallel forms of instrumentality \( x \), or the number of times it is lengthened. The use of the formula is illustrated by the following example. If the value of the correlation between the instrumentality and its criterion, \( c \), i. e., its validity coefficient, is: \( r_{cx} = .50 \), the value of its reliability coefficient is: \( r_{xx} = .75 \), and the instrumentality were to be tripled in length, what would be the estimated value of the validity coefficient for the lengthened form of the instrumentality, i. e., what would be the estimated value of \( r_{cnx} \)? Substituting values appropriately in formula (2), it is found that:

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Tripling the length of the instrumentality, or averaging the results of three parallel forms of the instrumentality, or averaging the results of three administrations of the same instrumentality would increase the value of its validity coefficient from: $r_{cx} = .50$, to $r_{c3x} \approx .55$. It should be noted that the effect of tripling the length of the instrumentality on its reliability would be from $r_{xx} = .75$ to:

$$r_{3xx} = \frac{3(.75)}{1+(3-1)(.75)} = \frac{2.25}{1+1.5} = \frac{2.25}{2.50} = \frac{9}{10} = .90$$

The increase in the reliability of the instrumentality which accompanies its increase in validity demonstrates the high degree of relationship which exists between these two factors.

If it were necessary to determine how many times its original length an instrumentality had to be in order to attain a given level of validity, i.e., to attain a validity coefficient of a specified value, then formula (3) could be employed:

$$n = \frac{2(1 - r_{xx})}{r_{cx}^2 - (r_{cnx}^2)(r_{xx})}$$

(3)

where $r_{cnx}$, $r_{cx}$, $r_{xx}$, and $n$ are defined as in formula (2). To illustrate the use of formula (3), suppose that the listening test associated with the measurement of the domain of theoretical auditory linguistic, $T(AL)$, has a reliability coefficient of the value: $r_{xx} = .70$, based upon the scores of 300 individuals. The value of its correlation with its criterion (a standardized listening test) is: $r_{cx} = .80$. How many times its present length must the test be if the value of the validity coefficient for the lengthened form is to be: $r_{cnx} = .90$? Employing formula (3), it is found that:

$$n = \frac{(0.90)^2(1-.70)}{(0.80)^2 - (0.90)^2(.70)} = \frac{.81(.30)}{.64(.81)(.70)} = \frac{.243}{.567} = \frac{.243}{.073} = 3.3,$$

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or rounded upward: $n = 4$.

This result indicates that the listening test must be 4 times its present length if the value of its validity coefficient is to be increased from .80 to .90. The value of the reliability coefficient for the lengthened test would become:

$$r_{nn} = \frac{nr_{xx}}{1+(n-1)r_{xx}}$$

$$r_{nn} = \frac{4(.70)}{1+(4-1)(.70)} = \frac{2.8}{3.1} = .90.$$  

The fact that the value of the validity coefficient for the lengthened test would be: $r_{e3x} = .90$; and its reliability coefficient would be: $r_{4IV}$ is coincidental to the conditions of the problem.

In other words, the value of the validity coefficient of a lengthened test is not necessarily equal to value of its reliability coefficient. This type of result depends upon the circumstances of the values of: $r_{ex}$, $r_{xx}$ of the original test, and the "desired" value for $r_{cnox}$.

### Construct Validity

Predictive, concurrent, content, and construct validity, respectively, have somewhat different purposes and goals. These different types of validity are needed because of the kinds of questions that are raised by the different situations in which measurement is used. Although these types of validity have different purposes, they are not entirely different logically. To be sure, in meaning and in their implications they show considerable concurrence. In a general sense, predictive, concurrent, and content validity are concerned with the question: To what extent does the instrumentality measure the aspects (of the individual) it was designed to measure? On the other hand, construct validity deals with the question: What aspects are measured by the instrumentality?

It is generally agreed among test constructors that predictive, concurrent, and content
validity are but special cases of construct validity. Therefore, construct validity can be expressed in terms of the statistical descriptions of empirical relationships associated with predictive and/or concurrent validity, and in terms of the verbal judgments and descriptions associated with content validity.

Many of the elements of "style" are intellectual constructs rather than directly observable behaviors. These elements, in their respective theoretical frameworks, are considered to be related in various ways, and to various degrees, with other characteristics of the individual under consideration, and to have certain effects upon the individual's behavior; while at the same time themselves being amenable to modification by certain types of treatments. Consequently, if an instrumentality is to provide valid measures of a "style" element, i.e., of a constructed trait, it must necessarily provide information that reflects the posited "relationships," the "effects," and "modifications." Obviously, the greater the agreement between the posited and the obtained relationships, effects, and modifications, and the greater the number of these agreements, the more valid the instrumentality yielding this information is considered to be.

If the theoretical framework of an element of "style" is not sufficiently developed so that expected relationships, effects, and modifications can be specifically detailed, then possible pertinent correlates, effects, and modifications must be probed by the instrumentality. Investigation of these "observable," possibly pertinent, relationships, effects and modifications by the instrumentality provides information that can be used to further specify the "element," and to perhaps broaden the scope of the nature of the characteristics considered to be involved. The determination of construct validity, then, is a dynamic and continuous process, i.e., a program that employs information from a variety of sources. It is inductively inferential in nature rather than deductively conclusive. No single validity coefficient can demonstrate construct validity, nor can an analysis of the nature and content of the instrumentality involved provide all the
needed information. A program of information composed of predictive, concurrent, and content validity descriptions, supplemented by results from experimental and other types of systematic investigations to ascertain whether the hypothesized relationships, modifications, and effects that occur could form the construct validity of an instrumentality designed to yield data pertaining to a given element of "style." Therefore, although it is mainly based upon objective information and quantitative data, the construct validity of an instrumentality is essentially determined and evaluated by a process of subjective judgment. It should also be noted that the degree of construct validity possessed by an instrumentality cannot be expressed by any single quantitative index such as a validity coefficient, but must be presented in verbal terms.

The notion of construct validity can be illustrated by describing how one of the instrumentalities designed to measure the domain of the cognitive style element, qualitative code synnoetics, Q(CS) - knowing oneself, was developed and validated. On the basis of the definition - "knowing oneself," it was agreed that the domain was a composite one with many possible sub-domains. (In the interest of time and space the discussion will be limited to the development of an instrumentality to sample the domain "synnoetics" in terms of performances demanding the use of certain motor skills.)

A calibrated device called the "electric eel" was constructed. The "eel" was a piece of sheet metal, cut in the form of an irregular sine curve, with calibrations from 0 through 50 painted at intervals from the "tail" to the "head" of the figure. The sheet metal forming the figure was electrically charged. The individual being "tested" was given an instrument in the form of a metal loop attached to a wooden handle. Whenever the metal loop was in contact with the sheet metal, a bell-buzzer would be activated.

After the subject was given one "trial run," that individual was asked to predict the highest score (calibrated score) that he or she believed he would attain in three test trials. After the
first trial, the subject was permitted to revise his original estimate. After the second trial, the subject, once again, was permitted to revise his earlier estimate. The degree to which the predicted score was congruent with the performance score provided a first approximation to the amount of self-knowledge, regarding such matters, the individual possessed. When the nature and content of this type of performance test is examined, it is apparent that it does provide a means of assessing, in broad terms, the individual's self-knowledge of the level of the motor skills required by the instrumentality.

As a further means of validating the measurement of the "synnoetics" element construct, it was hypothesized that scores yielded by this instrumentality should be related to performance on jobs where this "style" element is important. It was found, for a relatively small sample group of examinees (airline pilots), that their scores on the electric eel were not only high (and were accompanied by highly accurate self-assessments), but when paired appropriately with scores yielded by similar items included in one of the screening examinations for pilots used by the airline which employed them, the correlation was statistically significant.

Anticipating that the degree of "synnoetics" an individual seemed to possess would have certain effects on other aspects of his behavior, it was hypothesized that individuals doing well on this type of performance test, i. e., showing a "major" in "synnoetics," would perform similar tasks associated with their occupations at a higher level of competency, and enjoy those tasks more, than would those individuals who showed less self-knowledge (minor, or negligible, orientation) regarding the types of tasks involved in the test. Based upon samples of nursing students, it was found that those with major orientations in synnoetics, based upon the "eel" test, passed the unit regarding ministrations involving the hypodermic syringe at higher levels of achievement than did those students with minor, or negligible, orientations. Generally, the students with these "majors" in "synnoetics" reported, more frequently, an
enjoyment in performing the tasks associated with these instructional units, than did those students with "minors," or "negligibles," in qualitative code synnoetics.

It was also hypothesized that practice (a treatment) should affect the performance of an individual on this instrumentality, thereby improving his self-assessments regarding the motor skills involved in the test. Allowing practice time showed clearly that the individual assessed his limitations much more accurately than he did prior to the practice session.

Examining the relationships between the scores on "synnoetics" yielded by the electric eel test, and those associated with certain tests of qualitative proprioceptiveness (e.g., the Bass test, the Nattus test) also helped to further specify and clarify the nature of the "synnoetics" elements. In a somewhat different dimension, the effect of qualitative code empathetic, Q(CEM), on that of qualitative code synnoetics, also provided helpful information. Some persons showing a major orientation in qualitative code empathetic, when confronted with a problem calling on that aspect of empathy that pertains to sympathy, demonstrate clearly that this influence tends to reduce their capability in the realm of self-knowledge, i.e., synnoetics. For example, many persons who cannot swim, when given a choice of saving a drowning child by going to the rescue (with full knowledge that this choice means that the child and person will both drown), or by trying to find a swimmer to save the child, under the constraint that the probability is high that the child will drown before help can be found, will choose the former and put his or her faith in providence.

The purpose of the example was to illustrate the program of construct validity which was employed, and is continuing to be employed in the development of instrumentalities to sample the domain qualitative code synnoetics. The inductive inferential nature (as opposed to conclusive information) of construct validity should also be evident from the example.
Concluding Remarks

Validity and reliability are, in a sense, measures of the efficiency of an instrument. Reliability measures the consistency of the results yielded by the instrumentality, and is based upon information yielded by that instrumentality itself. Validity, implies evaluation of the instrumentality in terms of external and independent criteria. One of the greatest difficulties associated with the validation of an instrumentality is that of determining authentic criteria. Of necessity, criteria must be approximate and indirect, because if authentic criteria were readily available the measurements they provide could be used instead of those yielded by the instrumentality under consideration.

In order to be valid, an instrumentality must be reliable. Thus, a highly reliable instrumentality is always a valid measuring device of some aspect or function. For example, if the value of the reliability coefficient of an instrumentality is: \( r_{xx} = .90 \), then the value of its index of reliability is: \( \sqrt{.90} = .95 \). This result means that the instrumentality correlates .95 with true measures of the domain it samples (or of itself, if the "true score, error score" concept is employed), where these true measures constitute the criterion. In this context, an instrumentality may be theoretically valid, but show little or no correlation with any other criteria. It is in consideration of such situations, that the construct validity of an instrumentality must be viewed as a continuous process involving a wide variety of possible criteria and their accompanying statistical and verbal descriptions.

Problems

1. A group of 300 students takes a test composed of 40 items designed to measure T(AL) capability. The test results correlated with those of a criterion listening test which each member of the group took yielded a validity coefficient for the test of .45, and a reliability coefficient of .75. If the test is lengthened to 120 items, find the value of: (a) the validity coefficient
of the lengthened test, and (b) the reliability coefficient of the "new" test. (Ans. (a) .49, 
(b) .90)

2. If the value of the reliability coefficient of an instrumentality is found to be .81, 
and this instrument has been found to have a concurrent validity coefficient with a standard-
dized instrument designed to measure essentially the same aspects of an individual that the 
locally constructed instrument does of: \( r_{cx} = .75 \), what is the value of another index of re-
relationship that might be used in connection with the construct validity "program" for the 
instrument? Explain.

3. How many times its original length would an instrumentality need to be increased to 
yield a validity coefficient equal in value to .90, providing the value of the reliability co-
efficient of the original form was .70, and the degree of correlation with its criterion was 
indicated by a value of .80? (Ans. 4)

4a. If the scores of a group of 30 highly trained automotive service managers (ASM) 
formed the upper 27 percent of a distribution of measurements pertaining to performance on 
an instrumentality designed to measure qualitative auditory ability, \( Q(A) \), and qualitative 
visual ability, \( Q(V) \), regarding the sounds of a variety of engines needing various types of 
repairs, and the appearance of used parts that might be, or might not be, in good enough 
condition to employ in the repair of the "diagnosed deficiencies," and if the scores of a group 
of 30 highly successful stockbrokers and bankers (B) formed the lower 27 percent of the distri-
bution of measurements, find the value of the validity coefficient of an item in which the 
results of these respective groups' performances were as shown in the table below: (Hint: 
Employ the \( \Phi \) (phi) coefficient, see instructional unit materials on Discriminative Index). 
(Ans. \( r_{cx} = \Phi \approx .77 \))

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b. Employ Table 51, (see unit on Discriminative Index) and find the value of $r_{cx}$ if the approach employing a normalized biserial correlation coefficient as the validity index is used. (Ans. $r_{bis} \approx .77$)
APPENDIX B

Sample Statements from the
Cognitive Style Mapping Interest Inventory
Appendix B

Sample Statements from the Cognitive Style Mapping Interest Inventory

1. Theoretical Auditory Linguistic
   I can make more sense out of what a person means when he speaks to me rather than when he write to me.

2. Theoretical Auditory Quantitative
   I find it comfortable to add spoken or dictated numbers mentally.

3. Theoretical Visual Linguistic
   I understand more easily when I read information rather than when I hear it.

4. Theoretical Visual Quantitative
   I find it necessary to write down a telephone number as soon as I hear it because I cannot remember it.

5. Qualitative Auditory
   I can tell the difference between two closely pitched sounds.

6. Qualitative Olfactory
   The aromas in a room determine for me whether it is a pleasant or an unpleasant place.

7. Qualitative Savory
   Blindfolded, I can taste the difference between chocolate and coffee ice cream.
8. Qualitative Tactile
   I prefer the furniture that I enjoy running my hand over.

9. Qualitative Visual
   I prefer to read articles which are illustrated by pictures or drawings.

10. Qualitative Proprioceptive
    I can play ping pong well enough to enjoy it.

11. Qualitative Code Empathetic
    I can be patient with the inability to concentrate which characterizes those who are newly "in love".

12. Qualitative Code Esthetic
    I enjoy the author's writing style as much as the story he tells.

13. Qualitative Code Ethic
    I would give up monetary gain to avoid a compromise of principles.

14. Qualitative Code Histrionic
    I am able to "play a role" anywhere if I agree to.

15. Qualitative Code Kinesics
    I "talk with my hands" more than others do.

16. Qualitative Code Kinesthetics
    I am better coordinated than most people.

17. Qualitative Code Proxemics
    I can recognize those who will welcome friendly overtures from me.

18. Qualitative Code Synnoetics
I know my strengths and weaknesses.

19. Qualitative Code Transactional
   I am able to put people at ease in tense situations.

20. Associates Determinant
   Before taking a new job, I would discuss it with my friends.

21. Family Determinant
   I make it a point not to let my work interfere with family plans.

22. Individuality Determinant
   I do not need others to help me make decisions.

23. Inference of Difference
   I "play the devil's advocate" with people to force them to look at another point of view.

24. Inference of Appraisal
   The more I know about a problem, the more I want to know about it.

25. Inference of Magnitude
   I prefer working in situations where standards and rules are stated explicitly.

26. Inference of Relationship
   I tend to see all parts of the world as being interconnected.

27. Deductive Inferential Pattern
   I find it easier to win an argument when I state a premise and give a conclusion which is inescapable: (Blank is true, therefore Blank must be true).
APPENDIX C

Problem Set on the Reliability of Mapping "Style" Elements
PROBLEM SET ON THE RELIABILITY OF MAPPING "STYLE" ELEMENTS

Under the assumption that an individual's "educational" cognitive style, teaching style, administrative style, or counseling style can be modified or augmented, i.e., these "styles" as defined in the Educational Sciences are dynamic not static in nature; the problem of determining the reliability of the instrumentalities, i.e., instruments and techniques (e.g., tests, inventories, and empirical mapping), requires a particular approach. Basically, there are three theoretical models of reliability of measurement: (1) the concept of true and error scores, (2) the eclectic concept of true scores and parallel tests, and (3) the concept of domain sampling. These three basic concepts of reliability are associated with one or more of four methods usually employed to estimate the value of the reliability coefficient of an instrumentality under consideration.*

In order to accommodate the dynamic nature of the "styles" defined in the Educational Sciences, it is necessary to employ the concept of domain sampling and the method of intercorrelations among the elements of a sample or test to determine the reliability of the instrumentalities employed to produce these "styles." In addition to the "reliability coefficient," an index of relationship, as an indicator of the reliability of a domain sample (e.g., inventory), the "standard error of measurement" also provides another means of assessing the reliability of a "sample."

Considerations Regarding Reliability Coefficients

The method of intercorrelations among items can be employed to yield a precise and exact value of the reliability coefficient associated with each domain of the orientations of each

*See pages 23-25 of chapter on mapping.

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element of the respective "styles" (e. g., cognitive, administrative) of the individual, and thereby, to yield the value of the reliability index of the mapping process employed by the diagnostician regarding the "elements" under consideration. Formula (1), the Kuder-Richardson formula, can be used to determine the value of the reliability coefficient, $r_{xx}$:

$$r_{xx} = \frac{K}{K-1} \left( 1 - \frac{\sum S_x^2}{S_{\Sigma}^2} \right)$$  \hspace{1cm} (1)$$

Where $K$ denotes the number of elements in the sample; "\(\Sigma\)" denotes "the summation of;" $S_{\Sigma}^2$ indicates the value of the variance for each element; and $S_x^2$ the value of the variance of the total number of measurements (e. g., scores, ratings) included in the sample.

The following miniature example illustrates how the value of the reliability coefficient for a sampling of the domain "qualitative code histronics, Q(CH) - ability to play a role to produce a particular effect on other persons," was determined from the ratings (0 through 9) by four diagnosticians of the behaviors of the five individuals under consideration. (Assume that the individuals were observed by the diagnosticians at the same time and in the same situations.)

(See next page.)
<table>
<thead>
<tr>
<th>Diagnosician</th>
<th>Individual (n = 5)</th>
<th>( \Sigma x^2 - (\Sigma x)^2/n )</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4 16 9 81 6</td>
<td>( S_A = \frac{207 - (31)^2}{4} = 3.7 )</td>
</tr>
<tr>
<td>B</td>
<td>5 25 5 25 4</td>
<td>( S_B = \frac{111 - (23)^2}{4} = 1.3 )</td>
</tr>
<tr>
<td>C</td>
<td>4 16 6 36 6</td>
<td>( S_C = \frac{173 - (29)^2}{4} = 1.2 )</td>
</tr>
<tr>
<td>D</td>
<td>5 25 8 64 6</td>
<td>( S_D = \frac{190 - (30)^2}{4} = 2.5 )</td>
</tr>
</tbody>
</table>

\[ K = 4 \]
\[ \Sigma x = 18 \quad 28 \quad 22 \quad 27 \quad 18 \]
\[ \Sigma (\Sigma x)^2 = 113 \]

\[ \Sigma (\Sigma x)^2 = 2645 \]

\[ S_x = \frac{\Sigma (\Sigma x)^2 - (\Sigma x)^2/n}{n-1} = \frac{2645 - (113)^2}{4} = \frac{2645 - 12,769}{4} = \frac{2645 - 2553.8}{4} = \frac{91.2}{4} = 22.8 \]

\[ \Sigma s_{xi}^2 = 3.7 + 1.3 + 1.2 + 2.5 = 8.7 \]

\[ r_{xx} = \frac{K}{K-1} \left( 1 - \frac{\Sigma s_{xi}^2}{S_x^2} \right) = \frac{4}{4-1} \left( 1 - \frac{8.7}{22.8} \right) = \frac{4}{3} \left( 1 - .382 \right) = \frac{4}{3} \left( .618 \right) \]

\[ r_{xx} = 4(.206) = .824 \]

If the elements of a domain sample are in the form of items included in an inventory designed to elicit dichotomous responses (e.g., "yes" or "no," "true" or "false"), then the value of the
reliability coefficient can be calculated by means of formula (2), a modification of formula (1) designed to accommodate those instrumentalities involving dichotomous variables in the measurement process:

\[
\hat{r}_{xx} = \frac{K}{K-1} \left( 1 - \frac{\sum_{i=1}^{n} np_i q_i}{n(n-1)S_x^2} \right)
\]

(2)

In formula (2), \( \hat{r}_{xx} \), \( K \), and \( S_x^2 \) are as previously defined in (1), \( n \) indicates the number of individuals being tested or considered, \( p \) denotes the proportion of the individuals responding to an item in terms of the "desirable characteristic," where the desirable characteristic is the response (e.g., "yes" response) associated with the characteristic (variable) under study, and \( q \) denotes the proportion of individuals responding to an item in favor of the "other characteristic" (e.g., "no" response).

Dichotomous variables are quantified by assigning a score of "1" to each response associated with the desirable characteristic and a score of "0" to each response associated with the other characteristic. To illustrate, suppose the "desirable characteristic" was a "yes" response, and that the "other characteristic" was a "no" response. If from the responses of: \( n = 100 \); individuals to a given item there were found to be 60 "yes" and 40 "no" responses, then each of the 60 "yes" responses would be assigned a score of 1, and each of the 40 "no" responses would be assigned a score of 0. The proportion \( p \) of the sample responding in favor of the desirable characteristic would be: \( p = 60/100 = .60 \); and the proportion \( q \) of the sample responding in favor of the other characteristic would be: \( q = 40/100 = .40 \). It should be noted that:

\[ p + q = 1, \]

that is:

\[ .60 + .40 = 1, \]

and therefore:

\[ q = 1 - p \]
The following miniature example illustrates how formula (2) might be applied to find the value of the reliability coefficient for an inventory composed of ten items (each of which calls for a "yes" or a "no" response, with "yes" (X = 1) being the desirable characteristic) administered to eight individuals.

<table>
<thead>
<tr>
<th>Individual (n = 8)</th>
<th>np_i(X=1)</th>
<th>nq_i(X=0)</th>
<th>(np_i)(nq_i)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1 0 1 1 0 0 0 1</td>
<td>8(3/8)=3 8(5/8)=5 15</td>
<td>8(7/8)=7 8(1/8)=1 7</td>
<td>8(7/8)=7 8(1/8)=1 7</td>
</tr>
<tr>
<td>2 1 1 1 0 0 0 0 1</td>
<td>8(7/8)=7 8(1/8)=1 7</td>
<td>8(7/8)=7 8(1/8)=1 7</td>
<td>8(7/8)=7 8(1/8)=1 7</td>
</tr>
<tr>
<td>3 0 0 1 1 0 1 0 1</td>
<td>8(6/8)=6 8(2/8)=2 12</td>
<td>8(6/8)=6 8(2/8)=2 12</td>
<td>8(6/8)=6 8(2/8)=2 12</td>
</tr>
<tr>
<td>4 1 1 0 0 0 0 0 1</td>
<td>8(5/8)=5 8(3/8)=3 15</td>
<td>8(5/8)=5 8(3/8)=3 15</td>
<td>8(5/8)=5 8(3/8)=3 15</td>
</tr>
<tr>
<td>5 1 1 1 1 1 1 0 1</td>
<td>8(6/8)=6 8(2/8)=2 12</td>
<td>8(6/8)=6 8(2/8)=2 12</td>
<td>8(6/8)=6 8(2/8)=2 12</td>
</tr>
<tr>
<td>6 0 1 1 1 1 1 1 1</td>
<td>8(7/8)=7 8(1/8)=1 7</td>
<td>8(7/8)=7 8(1/8)=1 7</td>
<td>8(7/8)=7 8(1/8)=1 7</td>
</tr>
<tr>
<td>7 0 1 1 1 1 1 1 1</td>
<td>8(7/8)=7 8(1/8)=1 7</td>
<td>8(7/8)=7 8(1/8)=1 7</td>
<td>8(7/8)=7 8(1/8)=1 7</td>
</tr>
<tr>
<td>8 0 1 1 1 1 0 1 1</td>
<td>8(6/8)=6 8(2/8)=2 12</td>
<td>8(6/8)=6 8(2/8)=2 12</td>
<td>8(6/8)=6 8(2/8)=2 12</td>
</tr>
<tr>
<td>9 1 0 1 1 0 0 1 1</td>
<td>8(5/8)=5 8(3/8)=3 15</td>
<td>8(5/8)=5 8(3/8)=3 15</td>
<td>8(5/8)=5 8(3/8)=3 15</td>
</tr>
<tr>
<td>10 0 1 1 1 0 1 1 1</td>
<td>8(6/8)=6 8(2/8)=2 12</td>
<td>8(6/8)=6 8(2/8)=2 12</td>
<td>8(6/8)=6 8(2/8)=2 12</td>
</tr>
</tbody>
</table>

\[
\begin{align*}
\sum X_k & = 53; \quad 27; \quad 123 = \Sigma (np_i)(nq_i) \\
\Sigma (\Sigma X)^2 & = 389. \\
(n-1)s^2 & = \Sigma (\Sigma X)^2 - \frac{1}{n} (\frac{\Sigma n p_i n q_i}{n(n-1)}s^2) \\
10(1) - 123 & = 10 \left( 1 - \frac{123}{(8)(37.9)} \right) = 10 \left( 1 - .406 \right) = 10 \left( .594 \right) = .66 \\
81 & = 389 - \frac{2809}{8} \\
75^2 & = 389 - 351.1 = 37.9; 
\end{align*}
\]
Estimating the Effect Upon Reliability of Lengthening an Instrumentality.

Averaging the results of five different "samplings" (e.g., observation-assessment periods, inventories) of a domain of the orientations of a given style element should lead to information that is more trustworthy than that accruing to a single sample. By the same token, the mean of 10 "assessments" should be more dependable than the mean of the results associated with the five different samplings. Increasing the length of an instrumentality or averaging the results obtained from several different applications (samplings) of the instrumentality (or samples parallel to it) will increase the reliability of the instrumentality.*

A good estimate of the effect of increasing the length of an instrumentality or repeating its application a number of times can be obtained by employing the Spearman-Brown prophecy formula:

$$r_{nn} = \frac{nr_{xx}}{1+(n-1)r_{xx}}$$

(3)

Where $r_{nn}$ denotes the correlation between "n" forms of an instrumentality and "n" alternate forms for the mean (arithmetic average) of n forms correlated with the mean of n other forms; and $r_{xx}$ indicates the value of the reliability coefficient associated with the given (or original) instrumentality.

To illustrate the use of formula (3), suppose that the value of the reliability coefficient of a team of four diagnosticians involved in mapping the orientation in qualitative code histronics, Q(CH), of each of 25 persons, based upon one set of observations, is $r_{xx} = .80$.

*In the mathematical context of the formulae involved, averaging the scores from "n" applications of an instrumentality yields the same result as increasing the length of the instrumentality "n" times. It should be noted again that the term "instrumentality" pertains to both instruments and techniques (e.g., rating of an individual by an observer). It is in this context that the phraseology "increasing the length of an instrumentality" might pertain to increasing the length of time of a given observation period, or increasing the number of periods, as well as adding items to a given instrument.
What would be the effect on the value of the reliability coefficient for the team, if instead of having the 25 individuals being mapped participate in one set of "designed" activities, they were to participate in four sets (parallel forms) of these activities. Since this approach would, in effect, quadruple the "length" of the domain sampling, i.e., base the "mappings" of the diagnostic team on four sets of observations of "designed" activities (considered to be parallel forms) instead of one set, the values of: \( n = 4 \), and \( r_{xx} = .80 \), would be substituted in formula (3), and the value of \( r_{nn} \) would become:

\[
 r_{4x} = \frac{4 \times .80}{1 + (4-1)(.80)} = \frac{3.20}{1 + 2.40} = \frac{3.20}{3.40} \approx .94
\]

Quadrupling the instrumentality's (the diagnostic team's ratings of the individuals under consideration) "length," therefore, increases the value of the reliability coefficient from .80 to .94. It should be noted here that predictions of increased reliability by the Spearman-Brown formula are valid only when the items or set of behaviors added to the instrumentality pertain to the same aspects of the variable under consideration, are of approximately the same difficulty, and are comparable in other respects of the "designed" items or set of behaviors comprising the original instrumentality. It is difficult to satisfy these conditions, not only in terms of the content or materials to be employed, but in terms of motivation, fatigue, and, sometimes, the integrity of the individual under consideration. When the conditions for prediction are satisfied, however, empirical evidence indicates that an instrumentality may be increased by five or six times its original size (length) and the prophecy formula yields a close estimate of the "expected" (experimentally determined) results. If increases greater in length than five or six are employed, the prophecy formula tends to "over predict," i.e., yield a higher estimate of the value of the reliability coefficient than those found in situations employing the actual number of items or sets of behavior involved.
Applying the Prophecy Formula to Ratings

Formula (3) may be used to estimate the value of the reliability coefficient for ratings issued by two or more diagnosticians, paired comparisons and other judgments, as well as test scores. Suppose that in rating the behaviors of 25 individuals in Q(CH) - qualitative code histrionics, the ratings (range 0 to 9) of two diagnosticians (both assumed to be of equal experience, and to be equally well-acquainted with the individuals under consideration) show a reliability coefficient (correlation) of: \( r_{xx} = .70 \). If the ratings by the two diagnosticians were averaged, how reliable would the means of these two sets of ratings be?

Employing formula (3), it is found that:

\[
\frac{2 \times .70}{1 + (2 - 1) \times .70} = \frac{1.40}{1.70} \approx .82
\]

If instead of two diagnosticians there had been three diagnosticians whose ratings showed an average correlation of: \( r_{xx} = .70 \), then the mean value of the prophecy formula estimate of the averaged ratings of the three diagnosticians would be:

\[
\frac{3 \times .70}{1 + (3 - 1) \times .70} = \frac{2.10}{2.40} = .875
\]

The confidence that can be placed in these estimates depends upon how well the assumptions

*Technically, in order to "average" correlation coefficients that are "product-moment" in form, or that are close approximations of it, each coefficient must be first translated into the form: \( Z = \frac{1}{2} \ln \frac{1 + r}{1 - r} \); where "ln" denotes the "natural logarithm," i.e., log to the base "e"; then the Z values are averaged arithmetically. The "antilog" of this mean value (Z) is found from a "natural logarithm" table, and this value is employed in the equation: \( e^{2Z} = \frac{1 + r}{1 - r} \); which in turn is solved for the average value of \( r_{xx} \). If, however, the values of the correlation coefficients to be averaged are not too widely divergent, a simple arithmetic average of the \( r_{xx} \)'s involved, provides an adequate estimate of the mean value of \( r_{xx} \).
underlying the use of the formula are met, i.e., whether the diagnosticians are "equally experienced," are "equally well-acquainted with the individuals under consideration," and are equally skilled in the observation techniques being employed. It should be noted that in most cases, increased estimates of $r_{xx}$ such as these must be taken as approximative in nature. Under these circumstances, the values of $r_{xx}$ that are found can be useful but are not exact.

Lengthening the Instrumentality to Attain a Desired Degree of Reliability

Formula (3) may also be used to determine how many times an instrumentality should be lengthened or repeated to yield a particular standard of reliability. To illustrate this point, suppose that a diagnostic team has a reliability coefficient: $r_{xx} = .80$, in mapping the orientations of qualitative code empathetic, $Q(CEM)$ - the ability to identify with the role of the other person, based upon one set of observations. How many parallel sets of observations are needed to increase the value of this reliability coefficient for the "team" to .90?

Substituting the values of $r_{xx} = .80$, and $r_{nn} = .90$ in (3), and solving for "n," it is found that:

$$0.90 = \frac{0.80n}{1+(n-1)0.80} = \frac{0.80n}{1+0.80n-0.80} = \frac{0.80n}{0.20+0.80n}$$

$$(0.20+0.80n)0.90 = 0.80n$$

$$0.18+0.72n = 0.80n$$

$$0.08n = 0.18$$

$$n = 2.25, \text{ or rounding to the next whole number, 3.}$$

If three parallel sets of observations are employed instead of one, and providing all other conditions can be satisfied, e.g., the group of individuals being observed will not become fatigued or bored, the value of the reliability coefficient for the mapping of the orientations of $Q(CEM)$ would be .90.

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The Standard Error of Measurement

Recognizing the fact that variable or chance errors are included in measurements obtained by, or assigned to, and individual from or by a given instrumentality, and that therefore these measurements are divergent from what might be termed their "true" values, the standard error of measurement provides a vehicle for reflecting the magnitude of these effects.

The magnitude of the standard error of measurement can be found by formula (4):

\[ S_{em} = S_x \sqrt{1 - r_{xx}} \] (4)

Where \( S_{em} \) denotes the standard error of measurement, \( S_x \) indicates the value of the standard deviation of the measurements yielded by the instrumentality, and \( r_{xx} \) the value of the reliability coefficient of the instrumentality. It should be noted that the standard error of measurement provides a measure of the error made in estimating the value of the "true" measurement of an individual by an "obtained" measurement.* Since the standard error of measurement takes into account the variability within the group regarding the measurements yielded by the instrumentality

*N.B. The difference between the standard error of measurement (\( S_{em} \)) and the standard error of estimate: \( S_{estY} = S_y \sqrt{1 - r_{xy}^2} \); where \( S_y \) denotes the value of the standard deviation of the distribution of \( Y \)-values (e.g., reading scores), and \( r \) the value of the coefficient of correlation between the \( X \) (e.g., history test scores) and the \( Y \) values. If \( X \) scores were to be predicted from \( Y \), the standard error of estimate would take the form: \( S_{estX} = \sqrt{1 - r_{yx}^2} \); where \( S_x \) denotes the value of the standard deviation of the distribution of \( X \)-values, and \( r \) is as previously defined.

The standard error of estimate is used with prediction, by means of the regression equation connecting the variables, the most probable values of the dependent variable (e.g., \( Y \)) which can be obtained from a given value of the independent variable (e.g., \( X \)). The standard error of estimate can be used to predict the range of "most probable" scores that an individual might attain on Test A (e.g., mathematics) when his score on Test B (e.g., reading) and the correlation between the set of paired scores (mathematics and reading) is known.

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as well as the reliability of the instrumentality itself, it is actually a better way of expressing
the reliability of the instrumentality than that provided by the reliability coefficient.

The following example illustrates how formula (4) can be employed. Suppose the reliability
coefficient on the listening test associated with the measurement of theoretical auditory linguistic
ability T(AL) is .84, the mean for the population of scores associated with the test is 75 and the
population standard deviation is 9. If an individual earns a score of 82, what is the standard
error of this measurement (score)? What is the individual's true score? According to formula (4):

\[
\text{se} = S_x \sqrt{1 - r_{xx}}
\]

\[
= 9 \sqrt{1 - .84} = 9 \sqrt{.16} = 9(.4) = 3.6
\]

and, if the population of scores associated with the test is assumed to be distributed normally,
then approximately two-thirds of the scores will occur within ± one standard deviation of the
mean. Under these circumstances, it can be expected that approximately one-third (1/3) the
total group forming the population will earn scores that are in error more than ±3.6 points,
and two-thirds (2/3) will be in error this amount (± 3.6 points) or less.

In order to find the true score of the individual, formula (5) must be employed:

\[
\bar{X}_x = r_{xx} X_1 + (1 - r_{xx}) M^*
\]

Where \( \bar{X}_x \) denotes the value of the estimated true score (measurement) on the instrumentality,
\( X_1 \) indicates the score (measurement) obtained on the instrumentality by the individual under
consideration, \( M \) indicates the value of the mean (arithmetic average) of the distribution of
measurements (e.g. scores) associated with the instrumentality, and \( r_{xx} \) denotes the value of
the reliability coefficient for the instrumentality. In this particular example, the individual's
true score would be:

\*The symbol \( \infty \) (infinity) denotes "true" scores.
\[ \bar{X} = .84(82) + (1-.84)75 = .84(82) + .16(75) \]
\[ = 68.88 + 12.00 = 80.88 \pm 81 \]

It should be noted that the individual's obtained score, 82, is within the range of one standard error of measurement (± 3.6) of the true score, 81. It should be noted that when the value of the reliability coefficient is high, or relatively (as in this example) little is gained from computing the value of the estimated true score, i.e., the obtained score is sufficiently accurate for use in the mapping process. When the value of the reliability coefficient is relatively low (e.g., \[ .40 \leq r_{xx} \leq .50 \]), then the value of the estimated true score should be calculated.

**Concluding Remarks**

A question that is frequently raised is: How large, or of what magnitude, should the value of the reliability coefficient be in order to be considered satisfactory? The required magnitude of a reliability coefficient depends upon the nature of the instrumentality, the size and variability of the group being measured, and the purpose for which the instrumentality was administered.

For example, if the problem to be solved is that of differentiating between the mean scores of two school grades of children, where a relatively narrow range (highest score less the lowest score) of values probably exist, a reliability coefficient of: \[ .50 \leq r_{xx} \leq .60 \], is satisfactory. If, on the other hand, the instrumentality is to be used to yield data from which individual diagnoses are to be made, i.e., to distinguish one person from another in a relatively precise manner, then the value of its reliability coefficient should be at least .80, and preferably .90 or higher. It is in this context that most constructors of standardized intelligence, aptitude, or educational achievement examinations strive to develop values of reliability coefficients of at least .90 between alternate forms of their tests.

The value of the reliability coefficient of an instrumentality is also affected by the variability of the group, and it is in this context that the value of the standard deviation of the
distribution of scores yielded by the instrumentality should be given along with the value of its reliability coefficient. The method employed (e.g., split-halves) to calculate the value of the reliability coefficient should always be reported (in the case of mapping "style" elements it is the "intercorrelation among sample elements," i.e., the Kuder-Richardson approach), as well as information about the group and that which pertains to the procedures that were employed in administering the instrumentality. Without this information comparisons of results are difficult if not impossible.

It should be re-emphasized that the value of a reliability coefficient of an instrumentality administered to a group that is wide in its range of development (e.g., a mathematics test designed for a particular level of educational development administered to a group of students from several school grades) cannot be compared directly with that of a reliability coefficient of a relatively "parallel" instrument administered to a group of students covering a relatively narrow range of educational development. In short, the reliability of an instrumentality is influenced by the variability of the group in terms of the aspect(s) which the instrumentality was designed to measure. In a statistical sense, the greater the heterogeneity of the group, the greater the variability of the measurements yielded by the instrumentality, and the higher the value of the reliability coefficient.

If the value of the reliability coefficient of an instrumentality, based upon data yielded by a group of individuals showing a wide range of development in the dimensions covered by that instrumentality, is known, the value of the reliability coefficient of the same instrumentality can be estimated for a group showing a narrow range of development, assuming the instrumentality is considered to be approximately equally effective over both (the wide and the narrow) ranges. Formula (6) shows the relationship among standard deviations and reliability coefficients obtained during different stages when the instrumentality is considered to be equally effective.
throughout both ranges:

\[
\frac{S_n}{S_w} = \frac{\sqrt{1 - r_{ww}}}{\sqrt{1 - r_{nn}}}
\]

(6)

Where \(S_n\) and \(S_w\) denote the standard deviations of the measurements yielded by the instrumentality for the group of students of narrow range and group of wide range, respectively; and \(r_{nn}\) and \(r_{ww}\) denote the values of the reliability coefficients for the instrumentality based upon the measurements yielded by the instrumentality for the narrow range group and the wide range group. To illustrate how this formula might be used in mapping orientations of "style" elements, suppose that the instrumentality (e.g., listening test) designed to measure theoretical auditory quantitative, T(AQ), ability (and eventually "orientation") is administered to a group of individuals covering a range of levels of educational development from 6 through 12, inclusively.

The value of the reliability coefficient based upon the measurements yielded by the instrumentality for this group is found to be: \(r_{ww} = .91\), and the standard deviation is: \(S_w = 12.00\).

If, when the instrumentality is administered to a group of individuals showing a level of educational development of 9, the standard deviation of the group's measurements is found to be: \(S_n = 4.00\); assuming the instrumentality is just as effective in measuring individuals at the single level of educational development (9) as it is throughout the range of 6-12, estimate the value of the reliability coefficient of the instrumentality for the "narrow range" group.

Applying formula (6):

\[
\frac{S_n}{S_w} = \frac{\sqrt{1 - r_{ww}}}{\sqrt{1 - r_{nn}}}
\]

\[
\frac{4.00}{12.00} = \frac{\sqrt{1 - .91}}{\sqrt{1 - r_{nn}}}
\]
squared both sides of the equation:

\[ 1 - r_{nn} = 0.81 \]

\[ r_{nn} = 0.19 \]

Under these conditions, i.e., \( r_{ww} = 0.91 \), \( S_w = 12.00 \), and \( S_n = 4.00 \), a reliability coefficient of \( r_{xx} = 0.19 \), based upon data yielded by the group of narrow range in the dimensions covered by the instrumentality, indicates as much measurement (e.g., score) dependability as an \( r_{xx} = 0.91 \) for a group in which the range of development is six times as wide.

Although this condition, estimating reliability of an instrumentality administered to a group of narrow range from data yielded by the instrumentality when administered to a group reflecting a much greater range, is the one usually found to exist, it is possible, providing the assumption of equal effectiveness can be made, to estimate the value of the reliability coefficient for the wide range group from data yielded by a group showing a narrow range of development in the dimensions covered by the instrumentality. In short, formula (6) can be used to make estimates for the value of the reliability coefficient for either group.

Other factors affecting the reliability of an instrumentality are: timed sequences (e.g., speed tests), objectivity, item difficulty, and differing discriminative power of items included in the instrumentality. The topics of discriminative power and item difficulty must be taken into account by procedures designed to consider these matters (see problem set on "discriminative power of selected items"). If these problem areas are monitored appropriately, the reliability of an instrumentality is increased. In similar fashion, the problem area of objectivity must be
covered by procedures designed to take this factor into account (see problem set on objectivity).

The important relationship between reliability and timed sequences (e.g., speed tests) to be taken into account is that in many cases, the examinees will not attempt all the items, and since the items included in speed tests are usually of a lower level of difficulty, frequently a spuriously high value of a reliability coefficient for odd-even halves of an instrumentality will be found.

Problems

1. In this miniature example, suppose that each of the responses of the five individuals taking a listening examination to provide data for mapping their orientations in the theoretical auditory linguistic domain are marked either "right" (X = 1), or "wrong" (X = 0). Suppose further that the examination is composed of only six items. If individual A gets a correct ("right") answer on questions 1 and 5, and a wrong answer on each of the other four questions; individual B gets "right" answers for all the questions except number 5 which he gets "wrong;" individuals C and D each get "right" answers on all the six questions; and individual E gets "right" answers on each of the first three questions, but gets "wrong" answers on each of the last three items, find the value of the reliability coefficient for this instrumentality if it is based upon the performance of this group. (Ans. r_{xx} = 0.73)

2. If a group of six students responded to a request to scale each of eight items, 0 through 5 (as an indication of their self-assessments regarding qualitative code ethics), as shown below; find the value of the reliability coefficient for this instrumentality (the set of eight items), and the value of its standard error of measurement.

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3. Suppose that a set of five items designed to measure the domain of the "individuality (I) determinant" of an individual has a reliability coefficient of: $r_{xx} = .70$. If ten items are added to this set (assume that each of these items has undergone extensive
analysis and has been found satisfactory for inclusion), thus forming a new set of 15 items, what value is expected for the reliability coefficient of this new instrumentality?

4. Suppose that instead of adding these ten items to the original five, they were arranged in two forms of five items each, thus yielding (counting the original set of five) three parallel forms of the original instrumentality. If these three forms were administered to each examinee instead of the "new" instrumentality of 15 items, what would be the expected value of the reliability coefficient for this configuration?

5. Suppose that the ratings of individuals for qualitative proprioceptive ability issued by four diagnosticians showed an average correlation of .60. Assuming the diagnosticians are equally experienced and are equally well acquainted with the individuals being rated, what would be the estimated mean value of the reliability coefficient for the average ratings of individuals produced by this diagnostic team?

6. If it is known, from performances included in its training program, that a team of three diagnosticians, based upon data from one set of observations, has a reliability coefficient of: \( r_{xx} = .75 \) (regarding the mapping of "orientations" of individuals in the domain qualitative code transactional), how many parallel sets of observations would be needed to increase the value of the reliability coefficient to .90? (Assume all conditions for the use of the formula are satisfied).

7. If the value of the reliability coefficient of a given instrumentality is .91, the mean of the population of values (e. g., scores) which it has generated is 79, and the value of the population standard deviation is 7, what is the value of the standard error of measurement for this instrumentality?
8. If an individual received a score of 80 on the instrumentality, what is the value of his true score?

9. Suppose that the value of the standard deviation of a distribution of scores yielded by a given instrumentality was 16.00, and the value of the reliability coefficient for the instrumentality was: \( r_{xx} = .84 \). After administering the instrumentality, it was discovered that the group of individuals to whom the instrumentality was administered varied in levels of educational development from 8 through 12, inclusively. It was decided that in the future the groups would be formed on the basis of level of educational development. If the instrumentality were administered to a group whose level of educational development was (10), and the value of the standard deviation of this group's distribution of scores was found to be 8.00, estimate the value of the reliability coefficient of the instrumentality for this group. Interpret the results.
APPENDIX D

A Suggested Technique for Determining Degree of Match
Between "Styles" and Between "Styles" and
"Modes of Understanding"
A SUGGESTED TECHNIQUE FOR DETERMINING DEGREE OF MATCH BETWEEN "STYLES" AND BETWEEN "STYLES" AND "MODES OF UNDERSTANDING"

In the application of the conceptual framework called "the Educational Sciences," the educator is encouraged to participate personally in the processes of observation, assessment, interpretation, and mapping. Techniques which the individual may employ to improve his abilities and outputs in these activities have been presented in connection with such considerations as: reliability, validity, objectivity, and discriminative power of instrumentalities, scaling, item analysis, item construction, and the diagnostic, prescriptive, and clinical aspects of mapping "styles," as well as mapping of modes of understanding required by "tasks." For example, the three Principles for determining either a major, or a minor, or a negligible orientation of a "style" element invokes an approach in which the objectivity, the reliability, the validity, and the discriminative power of both the mathematical and the empirical mapping processes employed by the "mapper" are improved or increased relative to an approach that did not include these Principles.

Although the instrumentalities employed to yield information for the mapping of elements of "styles" are not, by intention, designed to be predictive of an individual's performance in any given system, once the tentative mode of understanding required by the system (e.g., a unit of instruction) with which the individual must interact is "determined," a technique for determining the degree of match between the "style" of the individual and the "mode" required by that system has proven to be most beneficial, not only in diagnostic, prescriptive, and clinical practices, but in the realms of student motivation and achievement, as well. This technique has also been found to be contributory, by determining the degree of match between the "styles" of individuals, in the areas of instruction, administration, counseling, and the reduction of dissonance being witnessed by an individual in connection with certain persons, or processes, or properties, or any combination of these elements in the system with which he
is interacting.

The "matching" technique suggested here is illustrated in terms of a step-by-step procedure for determining the degree of match between the cognitive styles of Individual A and Individual B, respectively. Although the procedure is illustrated in terms of "matching" the cognitive styles of two individuals, it can be used equally effectively to match the "style" of an individual with a mode of understanding required by a given "task," to determine the match between the administrative style of an individual and the role expectancy, expressed in "style" elements, of the administrative position he holds; and a variety of other matches involving teaching style, counseling style, "preferred" teaching style, and "preferred" administrative style to mention but a few of the possibilities. The step-by-step procedure is as follows:

Step 1. Determine which "style" or "mode" is the one to be used as the referent in the "matching" process. This decision is not an arbitrary one. For example, in determining the degree of match between the cognitive style of a student and the cognitive style of the teacher, unless some type of exceptional circumstance exists, the teacher's "style" would be selected as the referent. In this example, it is assumed that the cognitive style map of Individual A will be the referent.

Step 2. Basically the system of matching suggested here is one of assigning a value of 3, 2, 1, or 0, to each element in the "style" of the individual being matched with the referent "style." The referent style is scored by assigning the value of 3, only, to each of its elements, except that of L, the "appraisal modality

*It should be recalled here that a score is defined to be a value assigned to an act or quality. In this context, assigning values to the elements of "style" is an act of scoring that style.
of inference," which, when it occurs in the "referent," or in the "style" being matched with the referent, should be assigned the value 9. To illustrate this point, suppose that the cognitive style map of Individual A, the referent "style," is as shown below:

\[
\begin{array}{ccc}
(12)-3 & (10)-3 & (12)-3 \\
T(AL)-3 & T'(AQ)-3 & T(VL)-3 \\
Q(CET)-3 & -- & -- \\
Q(CEM)-3 & -- & -- \\
Q(CES)-3 & -- & -- \\
Q(CP)-3 & -- & -- \\
Q'(CH)-3 & -- & -- \\
\end{array}
\]

---|---|---|---|---|---|---|---|---
1 | T(VL) | 70-79 | Q(CEM) | 70-79 | Q(CES) | 60-69 | Q(CET) | 80-89
2 | T(AL) | 60-69 | Q(CH) | 30-39 | Q(CK) | 20-25 | Q(CKH) | 20-25
3 | T(VQ) | 10-19 | Q(CP) | 60-69 | Q(CS) | 10-19 | Q(CT) | 20-25
4 | T(VL) | 70-79 | I | 40-49 | A | 30-39 | F | 60-69
5 | T(AQ) | 40-49 | M | 40-49 | D | 30-39 | R | 60-69
6 | T(VL) | 80-89 | L | 70-79

It should be noted that each of the respective levels of educational development, 12 for T(AL) and for T(VL), and 10 for T'(AQ), along with reading level - 12.2, is assigned a value of "3" as well as each of the other elements in the "referent style."

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Step 3. Assign a value of 3, 2, 1, or 0 to each "element" of the "style" map of Individual B, according to the following rules of assignment (algorithms).

I. If the Level of Educational Development to be scored is: (a) one level below, (b) the same, or (c) higher than its counterpart "level" in the referent style, then assign a value of "3" to this element.

II. Apply Rule I to Reading Level.

III. If the Level of Educational Development to be scored is: (a) two levels below, or (b) three levels below its counterpart level in the referent style, then assign a value of "2" to this element.

IV. If Rule I does not apply to Reading Level, then apply Rule III to it.

V. If the Level of Educational Development to be scored is: (a) four levels below, or (b) five levels below its counterpart level in the referent style, then assign a value of "1" to this element.

VI. If Rule I and Rule III do not apply to Reading Level, then apply Rule V to it.

VII. If the Level of Educational Development to be scored is more than five levels below its "counterpart" in the referent style, then assign a value of "0" to it.

VIII. If the Reading Level to be scored is more than five levels below its counterpart in the referent style, then assign a value of "0" to it.

IX. With the exception of the elements of: Level of Educational Development, Reading Level, and the Appraisal (L) Modality of Inference, if the element to be scored shows the same percentile range, or in the case of composite elements, the same "average" percentile range, as its counterpart element

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in the referent style, then assign a value of "3" to it. In the case of an element such as T(VL), a composite variable, the midpoint value of each percentile range included in the "composite" is used to calculate an average percentile value which then is used to establish an appropriate "average" percentile range which can be compared with its counterpart "average" percentile range in the referent style. If the condition covered by this Rule holds for the "Appraisal (L)" element to be scored, then assign a value of "9" to it. The elements of Level of Educational Development and Reading Level, respectively, are covered by Rules I-VIII.

X. If the orientation of the element, i.e., a "major," or a "minor," but not a "negligible," to be scored is the same as its counterpart element in the referent style, but its percentile range, or in the case of composite elements, its "average" percentile range is not the same as its counterpart element in the "referent," then assign a value of "2" to it. If this condition holds for the "Appraisal (L)" element to be scored, then assign a value of "6" to it.

XI. If the orientation of the element, i.e., a "major," or a "minor," but not a "negligible," to be scored is different from its counterpart element in the referent style, then assign a value of "1" to it. Since minor and negligible orientations in the "Appraisal (L)" element are not shown in the cognitive style map, this Rule does not pertain to it. In this context, if an element has a negligible orientation, it is not shown in the map and therefore this Rule would not apply to it as well.
XII. Except for the "Appraisal (L)" element, if the element to be scored does not have a counterpart element in the referent style, then assign a value of "0" to it. In the case of the "Appraisal (L)" element, if its counterpart "L" does not occur in the referent style, but a "double-eigen" involving the other "modalities" does occur, then assign a value of "6" to it. If the counterpart "L" does not occur in the referent style, but a "single-eigen" condition exists, then assign a value of "3" to it.

To illustrate how these Rules are employed, the elements in the cognitive style map of Individual B are scored accordingly:

\[
\begin{align*}
T'(V_L)-1 & \quad T'(A_L)-2 & \quad T'(A_Q)-2 \\
Q(CEM)-3 & \quad -- & \quad -- \\
Q(CP)-3 & \quad -- & \quad -- \\
Q(CET)-2 & \quad -- & \quad -- \\
Q(CS)-0 & \quad -- & \quad -- \\
Q(CES)-2 & \quad -- & \quad -- \\
Q'(CK)-0 & \quad -- & \quad -- \\
Q'(CH)-3 & \quad -- & \quad -- \\
\end{align*}
\]

\[
\begin{align*}
D-1 & \quad L-6 \\
F-3 & \quad A-1 \\
M'-2 & \quad R'-1 \\
\end{align*}
\]

\[
= g \text{ of Individual B}
\]

RDLVL – 8.6-2

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Since the Level of Educational Development for the $T(VL)$ eigen in the referent style is (12), while in Individual B's map the "Level" for the $T(VL)$ eigen is (9), Rule III applies and the value of "2" is assigned to that "Level." Since the "Level" of (10) is associated with the $T(AL)$ eigen of Individual B's map, while the "Level" of that eigen in the referent style is (12), Rule III applies once again, and the value of "2" is assigned to that "Level." The Level of Educational Development (6) associated with the $T(AQ)$ eigen in Individual B's map is four levels below the $T(AQ)$ eigen in the referent style. Under these circumstances, Rule V applies, and a value of "1" is assigned to this "Level." Since Reading Level 9 is defined by Levels from 8.5 through 9.49, respectively, the "Level" 8.6 shown in B's map is defined to be at "Level" 9. In this context, B's Reading Level is three levels below the 12.2 Reading Level shown in the referent style. Accordingly, Rule IV (which applies Rule III to Reading Level) pertains to this situation, and a value of "2" is assigned to the Reading Level of 8.6.

Noting that the element theoretical visual linguistic is a minor orientation, $T'(VL)$, while in the referent style it is a major orientation, $T(VL)$, Rule $>$1 applies, and a value of "1" is assigned to that element in B's map. If $T(VL)$, a "composite," had been a minor orientation in the referent, then it would have been necessary to find the value of the arithmetic average (the mean) of the midpoints of the percentile ranges associated with the $T(VL)$ measures, Tests 1, 4, and 6, respectively, included in the composite, found in B's map. Had this been the situation, the midpoint values would have been 34.5 for the range 30-39 associated with Test 1, 4.5 for Test 4, and 44.5 for Test 6. The average of the midpoints would have been:

$$\frac{34.5 + 4.5 + 44.5}{3} = \frac{83.5}{3} = 27.8.$$  
This value, by definition, would be associated with the "average" percentile range of: 26-29. The value of the "average" percentile range of the supposed $T'(VL)$ in the referent style would then have been calculated in the same fashion. If the "average" percentile ranges had been the same, then by Rule IX, a value of "3" would
have been assigned to $T'(VL)$ in B's map. If these "ranges" were found to be different from each other, then according to Rule X, a value of "2" would have been assigned to $T'(VL)$ in B's map.

Since $T(AL)$ in B's map is the same orientation, a "major," as that of the $T(AL)$ element in the referent style, but the percentile range, 50-59, for $T(AL)$ in B's map is different from the range, 60-69, for $T(AL)$ in the referent style, Rule X applies and this element in B's map is assigned a value of "2." It was not necessary to calculate an "average" percentile range for $T(AL)$ in this case, because this element is not a composite variable as measured by the particular battery employed to produce the referent style (Individual A's map) and Individual B's map shown in this example. Had $T(AL)$ been a composite variable, it would have been noted as such in the map, and the procedure for determining "average" percentile ranges for this element in the referent style and in B's map would have been employed.

In the case of the element, theoretical auditory quantitative, a minor orientation, $T'(AQ)$, occurs in B's map and also in the referent style. The percentile ranges of these elements, however, are different from each other. Therefore, Rule X applies, and a value of "2" is assigned $T'(AQ)$ in B's map. Since $T(AQ)$ is not indicated to be a composite variable, there is no need to determine an "average" percentile range for this element.

Assuming that none of the other elements in the respective "styles," i. e., in the "referent" and in Individual B's, is a composite variable, the following table shows the element, the Rule, and the value assigned to that element in Individual B's map:

<table>
<thead>
<tr>
<th>Element</th>
<th>Rule</th>
<th>Value</th>
<th>Element</th>
<th>Rule</th>
<th>Value</th>
<th>Element</th>
<th>Rule</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q(CEM)</td>
<td>IX</td>
<td>3</td>
<td>Q(CP)</td>
<td>IX</td>
<td>3</td>
<td>D</td>
<td>XI</td>
<td>1</td>
</tr>
<tr>
<td>Q(CES)</td>
<td>X</td>
<td>2</td>
<td>Q(CS)</td>
<td>XII</td>
<td>0</td>
<td>M</td>
<td>X</td>
<td>2</td>
</tr>
<tr>
<td>Q(CET)</td>
<td>X</td>
<td>2</td>
<td>A</td>
<td>XI</td>
<td>1</td>
<td>R</td>
<td>XI</td>
<td>1</td>
</tr>
<tr>
<td>Q(CH)</td>
<td>IX</td>
<td>3</td>
<td>F</td>
<td>IX</td>
<td>3</td>
<td>L</td>
<td>X</td>
<td>6</td>
</tr>
<tr>
<td>Q(CK)</td>
<td>XII</td>
<td>0</td>
<td></td>
<td>1</td>
<td>0</td>
<td>(Does not appear in B's map)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Step 4. After the elements in the map being matched with the referent are scored, the total number of points associated with each of the following sets of elements, in both the referent style and in the map being matched to it, must be determined: (a) the Levels of Educational Development and the Reading Level, (b) the combinations of elements in the set Symbols and their Meanings, (c) the "combinations" in the set Cultural Determinants of the Meanings of Symbols, and (d) the combinations in the set Modalities of Inference. To illustrate this procedure, (a) the total points associated with the Levels of Educational Development and the Reading Level in the referent style would be: Eigen T(AL)(12)-3; Eigen T(VL)(12)-3; Eigen T'(AQ)(10)-3; and RDLVL (12.2)-3; or 3+3+3+3 = 12 points. While in Individual B's map, the total number of points associated with these "Levels" would be: Eigen T(AL)(10)-2; Eigen T'(VL)(9)-2; Eigen T'(AQ)(6)-1; and RDLVL (8.6)-2; or 2+2+1+2 = 7 points.

(b) Since all the elements in the set Symbols and their Meanings are binomial combinations of the form: (T-Q), or (T-Q'), or (Q-T'), or (T'-Q'), where the symbol (') denotes a minor orientation, the points for the theoretical symbol (T) involved in the combination are added to those for the qualitative symbol in that "binomial," unless the value assigned to either the theoretical (T) or the qualitative (Q) is "0." In this latter case, but only in the set Symbols and their Meanings, the total number of points associated with such a binomial is defined to be "0." This approach avoids a spuriously high total number of points in this set of an Individual's map, deriving from the repeated addition of a particular theoretical symbolic orientation (T) in combination with a series of qualitative orientations (Q's) that may have been assigned the value of "0." The values of
the binomial combinations are then tallied for each eigen, and these values, in turn, are added together to find the total number of points associated with the set Symbols and their Meanings. To illustrate, in the referent style, for the T(AL) eigen, each of the five binomial combinations: \[[T(\text{AL}) - Q(\text{CET})], [T(\text{AL}) - Q(\text{CEM})], [T(\text{AL}) - Q(\text{CES})], [T(\text{AL}) - Q(\text{CP})],\]

and \([T(\text{AL}) - Q'(\text{CH})]\) equal: \(3 + 3 = 6\) points. Since there are five of these "combinations" and each one yields 6 points, the total for the T(AL) eigen becomes, 5 x 6 points = 30 points. In similar fashion, the T'(AQ) eigen yields 30 points, as does the T(VL) eigen. Consequently, the total number of points for the set Symbols and their Meanings, in the referent style, is: 3 x 30 points = 90 points. In Individual B's map, the "combinations" of:

\([T'(\text{VL}) - Q(\text{CEM})], [T'(\text{VL}) - Q(\text{CP})],\)

and \([T'(\text{VL}) - Q'(\text{CH})]\) yield: \(1+3 = 4\) points each, or a total of: 3 x 4 points = 12 points; while each of the "combinations" of:

\([T'(\text{VL}) - Q(\text{CET})] and [T'(\text{VL}) - Q'(\text{CH})]\) yields: \(1+2 = 3\) points, or a total of: 2 x 3 points = 6 points. It should be particularly noted that each of the "combinations" of:

\([T'(\text{VL}) - Q(\text{CS})] and [T'(\text{VL}) - Q'(\text{CK})]\), although ostensibly yielding the value: \(1+0 = 1\) point, is defined to yield "0" points in order to avoid a spuriously high accumulation of points based upon the repeated use of the same element, in this case \(T'(\text{VL})\). In the case of the T(AL) eigen, each of the combinations of: \([T(\text{AL}) - Q(\text{CEM})], [T(\text{AL}) - Q(\text{CP})],\)

and \([T(\text{AL}) - Q'(\text{CH})]\) yields: \(2+3 = 5\) points, or a total of: 3 x 5 points = 15 points; while each of the "binomials" of: \([T(\text{AL}) - Q(\text{CET})] and [T(\text{AL}) - Q(\text{CES})]\) yields: \(2+2 = 4\) points, or a total of: 2 x 4 points = 8 points. Each of the "combinations" of: \([T(\text{AL}) - Q(\text{CS})] and [T(\text{AL}) - Q'(\text{CK})]\) is defined to yield "0" points for the reasons given in the cases of \([T'(\text{VL}) - Q(\text{CS})]\) and \([T'(\text{VL}) - Q'(\text{CK})]\), respectively. Since the element \(T'(\text{AQ})\) was assigned the

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same value, "2," that the element T(AL) was in B's map, the total points yielded by the T'(AQ) eigen will be equal to the total number of points yielded by the T(AL) eigen in B's map; i.e., \(15 + 8 = 23\) points, each. The total number of points yielded by the three eigens in the set Symbols and their Meanings of B's map is: \(T'(VL)\) eigen = 18; \(T(AL)\) eigen = 23; \(T'(AQ)\) eigen = 23, or: \(18 + 23 + 23 = 64\) points.

(c) The total number of points yielded by the (F) eigen in the "Cultural Determinants" set of the referent style is: \(F = 3\) points, \((F - I') = 3 + 3 = 6\) points, \((F - A') = 3 + 3 = 6\) points; or \(3 + 6 + 6 = 15\) points. The total number of points yielded by the double-eigen array in the "Cultural Determinants" set of B's map is: \(F = 3\) points, and \(A = 1\) point; or \(3 + 1 = 4\) points.

(d) In the third set, Modalities of Inference, the total number of points yielded by the (R) eigen and the (L) eigen, in the referent style, is: \(R = 3\) points, \((R - M') = 3 + 3 = 6\) points, and \((R - D') = 3 + 3 = 6\) points; or: \(3 + 3 + 6 = 15\) points; while \(L = 9\) points; and the grand total number of points for this set of elements is: \(15 + 9 = 24\) points. The (D) eigen and the (L) eigen in B's map yield: \(D = 1\) point; \((D - M') = 1 + 2 = 3\) points; \((D - R') = 1 + 1 = 2\) points; or a total of: \(1 + 3 + 2 = 6\) points, while \(L = 6\) points, so that the grand total number of points for this set is: \(6 + 6 = 12\) points.

**Step 5.** With the total number of points determined for: (a) the "Levels," (b) "Symbols and their Meanings," (c) "Cultural Determinants," and (d) the "Modalities," for the referent style, and for Individual B's map, it is now possible to determine the percent of "agreement," or the "match" between each set of the referent style and its counterpart set in Individual B's "style." The values of these percent indices are calculated by
dividing the total number of points associated with a given set in B's map by the total number of points associated with the counterpart of that set found in the referent style. The following calculations illustrate the discussion:

a) "Levels" - Percent of Agreement = \( \frac{\text{Total Points for "Levels" in B's Map}}{\text{Total Points for "Levels" in "Referent"}} \)

b) "Symbols" - Percent of Agreement = \( \frac{\text{Total Points for "Symbols" Set in B's Map}}{\text{Total Points for "Symbols" Set in "Referent"}} \)

c) "Determinants" - Percent of Agreement = \( \frac{\text{Total Points for "Determinants" Set in B's Map}}{\text{Total Points for "Determinants" Set in "Referent"}} \)

d) "Modalities" - Percent of Agreement = \( \frac{\text{Total Points for "Modalities" Set in B's Map}}{\text{Total Points for "Modalities" Set in "Referent"}} \)

Step 6. In order to determine the general percent of agreement, or degree of match, between Individual B's "style" and the Referent Style, Individual A in this example, the arithmetic average or the mean of the percents of agreement found in Step 5 is calculated. In this example:

\[
\text{Degree of Match} = \frac{.583 + .711 + .266 + .50}{4} = \frac{2.060}{4} = .515
\]

It should be noted that each percent of agreement is given an equal "weighting" in this process. Through this approach, Levels of Educational Development and Reading Level, as one set of information, is accorded one-quarter of the overall degree of match. Obviously, the same "weighting" pertains to each of the other three sets of information involved in the "match," as well.

Step 7. Applying Principle I, II, or III associated with the process of mapping styles, determine the "orientation," i.e., a "major," or a "minor," or a "negligible," of the Degree of Match. In this example with the value of the match being .515, Principle I would be applied and the "match" would be classified as:
"a Major." It should be noted that a 51.5 percent "match" is a minimum match at best, and any assignment based upon this degree of match should be monitored and subjected to rather frequent analysis.

The seven-step procedure presented here has evolved from a number of doctoral studies and project efforts. Many other approaches (e.g., multiplicative models) have been employed, but this procedure, the latest at this point in time of many additive models, has proven, empirically, to be the most effective one developed to date.