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CHAPTER I

INTRODUCTION

Why is man so unhappy he wants to change his world? I would never attempt to improve an environment--my personal preference I suppose would be a preliterate milieu, but I want to study change to gain power over it. - Marshall McLuhan

Change in education is inevitable. The question is whether change is to be planned or fortuitous. If planned change is desirable, it is imperative to have the best possible understanding of the variables which account for it. Given the hierarchical ordering of the organization of American schools, it is reasonable to assume that the superintendent of schools is a crucial figure in the change process in education. Theories of personality indicate that behavior is a function of the individual's personality and the situation. The purpose of this study was to investigate the relationship between personality factors of superintendents of schools and the adoption of certain practices in education.

---

Background of the Study

Unless it can be assumed that a school's objectives remain absolute and that no improved organizations or processes for reaching those objectives are possible, schools must change if they are to function effectively. An effective school is one that is accomplishing objectives that are appropriate or valid for a dynamic society. While broadly-stated goals may remain relatively constant, specific objectives are likely to change. Thus the goal of a manufacturer may constantly be to make a profit, but the specific objective of making buggy whips in a day of horses and carriages gives way to a more appropriate objective in the day of horseless carriages. Similarly, schools may aim broadly at educating the populace, but specific objectives with respect to mathematics, science, or homemaking in the nineteenth century change as a result of new knowledge and technology in the age of computers, nuclear physics, and pre-cooked foods.

Organizations and processes also need to change. Handcraftsmanship in an agrarian society succumbs to assembly line techniques in an age of technology. The hornbook is replaced by the programmed text. Small owner operated shops are succeeded by complex corporations while the one room school is supplanted by the modular scheduled high school.
Schools that fail to adjust to the changing needs of society or fail to adopt better organizations and processes are not likely to be effective.

While it seems apparent that change is essential, it is equally obvious that some schools change readily while others change slowly or hardly at all. It would not be difficult to find schools today in which the curriculum, organization, and methods are not remarkably different from those employed years ago. On the other hand, one may find schools housed in startlingly different buildings, with new curricula, novel organizations, and changed philosophies.

Of course, not all change is for the better. A change may or may not be appropriate, but, in a dynamic society, failure to change at all may be taken as prima facie evidence of failure to be effective.

If, in a dynamic society, change is desirable, then it is necessary to have better understanding of the process by which change is effected. Investigation of the variables affecting change has produced some knowledge, but no single variable appears to account for change; rather, a whole galaxy of variables may be required to explain the process. At the present time there appear to be some gaps in knowledge about the factors which comprise that galaxy. One of these gaps is knowledge about the superintendent of schools and the place he occupies in change in education.
There is reason to believe that, given the hierarchical ordering of American schools, the superintendent of schools plays an important role in the change process in education. Studying educational change in New York state, Brickell concluded:

Instructional changes which call for significant new ways of using professional talent, drawing upon instructional resources, allotting physical facilities, scheduling instructional time or altering physical space—rearrangements of the structural elements of the institution—depend almost exclusively upon administrative initiative. Even in the best of circumstances for the expression of new ideas—in schools where administrative authority is exercised with a light hand and faculty prerogative is strong—teachers seldom suggest distinctly new types of working patterns for themselves.²

Griffiths believed that persons lower in the administrative hierarchy seldom introduce new ideas into the school system. "The initiative for change," he said, "must come from the top."³

Miles wrote:

…it seems very clear that administrators, as authority figures, are crucial in introducing innovations, particularly those which involve structural change. Administrators have more power, since institutions are hierarchically ordered, and thus can


handle the system problems ordinarily associated with the introduction of an innovation more effectively than other system members. 4

There appears to be ample support for the contention that the superintendent of schools, as an authority figure, is in a crucial position to promote or thwart change, but relatively little research has dealt with this factor. Carlson attributed to Paul Mort and his colleagues at Teachers College, Columbia University much of the responsibility for stymieing such research. He wrote:

Mort and his students have displayed considerable ingenuity in the isolation of variables—usually relating to the economic base, ranging from expenditure per pupil to teachers' salaries—and in fitting the variables into accounting schemes. But they have seemed steadfast in their refusal to deviate from the implicit assumption that the chief school official is simply a victim of the local school budget and is therefore not relevant as an explanatory element in the adoption process. The lack of attention given to the chief school official is even more noticeable when coupled with the awareness that the common procedure for the adoption of a new practice involves his approval. 5

Rationale for the Study and Statement of the Problem

If the superintendent of schools is a crucial factor in the change process, it would be reasonable to expect some differences between


superintendents in schools that are highly adoptive of change and those that are not. One might also expect to find similarities among superintendents in highly adoptive districts. Indeed, there is some evidence to support this contention. There are several ways in which the superintendent may behave with respect to change. He may strive for the adoption of new practices in the district or he may react passively with respect to change. On the other hand, he may resist change or reject the attempts of others to bring about change. In any event, the prospect of change is met with some behavior on the part of the superintendent.

What accounts for differences in the behavior of superintendents with respect to change? Raymond B. Cattell has theorized that individual behavior is a function of an individual's personality in a given situation. He has described personality in terms of traits which he says are abstract structures inferred from many instances of behavior. These traits are a product both of constitutional factors and of environmental conditions. The behavior of a superintendent of schools with respect to adoption of new practices would, in terms of Cattell's theory, be a function of his personality in that situation. To

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the extent that situations are similar, one might expect to find similarities in the personality factors of superintendents in highly adoptive school districts. The probability that adoption occurs in a variety of situations would suggest the possibility of varying personality structures associated with adoptiveness.

The present study was designed to answer the following questions:

1. Are there differences in the personality factors of superintendents of highly adoptive school districts and the personality factors of superintendents of less adoptive school districts?

2. Is there a relationship between the personality factors of superintendents of schools and the adoptiveness of school districts?

Definition of Terms

A number of terms used in this study need to be defined to facilitate common understanding.

"Adoption" as used in this study refers to the incorporation of a new procedure or organizational pattern into some part of the operation or structure of the school system.

"Adoptiveness" refers to the propensity of a school district for adoption.

"Highly adoptive district" is one which, on a continuum, adopts more practices, earlier.
"Less adoptive district" is one which, on a continuum, adopts fewer practices, later.

"Personality" is defined as "the dynamic organization within the individual of those need-dispositions and abilities that determine his unique interaction with the environment." 7

Assumptions of the Study

This study was conducted on the basis of a number of assumptions which are stated as follows:

1. In a dynamic society it is necessary and desirable for schools to change both their specific objectives and their processes.

2. Adoption of new practices is a form of change.

3. In a hierarchically ordered school system, the superintendent of schools is a crucial figure in the adoption of new practices.

4. The personality of the superintendent significantly affects his behavior.

Hypotheses to be Tested

Two hypotheses were posed for this study. They have been stated as follows in the null form for convenience in applying statistical tests:

1. There are no differences in the personality factors of superintendents of highly adoptive

school districts and the personality factors of superintendents of less adoptive school districts.

2. There is no relationship between personality factors of superintendents of schools and the adoptiveness of school districts.

Design of the Study

Rationale for determining adoptiveness

Two criteria were applied to determine the relative adoptiveness of school districts included in the study. The first criterion was number of practices adopted. It was assumed that those districts adopting more new practices were more adoptive than those adopting fewer practices.

The second criterion employed was time of adoption. It was assumed that those districts adopting new practices early were more adoptive than those adopting late. Rogers concluded from past investigations that "adopter distributions follow a bell-shaped curve over time and approach normality." According to Rogers, two methods of classifying adopters have been used. Some investigators have asked a number of judges to classify adopters. Most researchers, however, have placed adopters into categories on the basis of time

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of adoption. Based upon normality of distribution of adopters over time, Rogers identified the earliest 2-1/2 per cent of adopters as "innovators," the next 13-1/2 per cent were called "early adopters," the next 34 per cent he called the "early majority," the next 34 per cent were identified as "late majority," and the last 16 per cent to adopt were labeled "laggards." From his review of the research on innovation diffusion and adoption, Rogers was able to discern important differences in (1) personal characteristics, (2) communication behavior, and (3) social relationships of adopters in the five categories. It would seem reasonable to designate early adopters as more highly adoptive than later adopters. Combining number of new practices adopted with recency of adoption should adequately differentiate the more highly adoptive from the less adoptive schools.

An instrument which was to be called the Adoptiveness Scale was devised to measure adoptiveness in this study. The Adoptiveness Scale consisted of a list of 16 practices in education which, in the view of a panel of experts, were representative of those in the forefront of educational practice at the time. The list included:

1. Educational Television
2. Non-Graded Organization
3. Team Teaching

---

Ibid., pp. 160-163.
4. Initial Teaching Alphabet
5. Modern Mathematics
6. Teaching Machines
7. Modular Scheduling
8. Individualized Reading
9. Physical Science Study Committee Physics
10. Biological Science Curriculum Study Biology
11. Foreign Language in Elementary School
12. Advanced Placement Program
13. Teacher Aides
14. Language Laboratory
15. Middle School
16. Pre-Kindergarten

Conduct of the study

Data for the study were collected from a stratified random sample of superintendents of Ohio school districts which met criteria of size, organization, and tenure of superintendent. Only superintendents of districts operating both elementary and secondary schools having at least 1,000 but less than 10,000 average daily membership in the 1965-66 school year, who in the 1965-66 school year were in at least their fifth year of tenure were included in the population to be studied.

Approximately 220 Ohio school districts met the size, organization, and tenure criteria. Using a table of random numbers a sample of 50 districts, stratified according to valuation per pupil, was drawn.

Superintendents of districts in the sample were surveyed to determine the adoption and time of adoption of a list of new
practices. The superintendent's statement that the practice had been tried somewhere in the district was accepted as evidence of adoption. No distinction was made between experimental and complete adoption, or between one-school and more-than-one-school or system-wide adoption. The superintendent was simply presented with the list of practices and asked to indicate the school year in which any of the practices were first tried.

By means of an index devised to give greater weight to earlier adoption, the districts were ranked on adoptiveness. Those districts adopting more of the listed practices earlier were ranked more adoptive than those districts adopting fewer practices later.

Superintendents in the sample who had completed the Adoptiveness Scale were asked to complete the Cattell Sixteen Personality Factor Questionnaire. This instrument measures sixteen dimensions of personality purported to be "unitary, independent, and practically important 'source traits,' i.e. traits affecting much of the overt personality, such as intelligence, emotional stability, super-ego strength, surgency, and dominance."\textsuperscript{10}

Finally, the data on adoptiveness and personality were treated by statistical means to test the null hypotheses.

Limitations of the Study

This study was intended to determine if there were similarities in personality factors among superintendents of highly adoptive school districts and if there are differences in personality factors between superintendents of highly adoptive districts and those in less adoptive districts. It was not suggested that the personality of the superintendent is the only or the principal factor accounting for adoption of new practices. On the contrary, it was assumed that a number of variables, taken together, account for the phenomenon.

The study was not expected to show the relative importance of the superintendent's personality to other variables responsible for adoption of new practices. It could only have indicated whether or not a relationship between personality and adoption exists.

A finding that certain personality factors are associated with adoptiveness may indicate that these factors, in part, account for adoption. On the other hand, it may be that other variables are at work that result in the selection of superintendents with these particular personality characteristics in highly adoptive districts. Given Cattell's definition of personality as "that which permits a prediction of what a person will do in a given situation"\(^\text{11}\) and the

contention that in hierarchically organized schools the superintendent plays a crucial role in the adoption of new practices, it would appear to be more than coincidental, however, if certain personality factors were found to be associated with highly adoptive school districts.

The study dealt only with the adoption of selected practices so that it is possible to generalize to the adoption of other practices only to the extent that the selected practices are representative of other practices. Since the selected practices are in the forefront of new practices in education today, it is reasonable to assume that some degree of generalizability is possible. This is the measure of adoptiveness employed by Mort and Pierce in the adaptability studies in New York and Pennsylvania and by Carlson in West Virginia and Pennsylvania as well as by other investigators in other fields. A better measure does not appear to be available at the present time.

**Significance of the Study**

A finding that there are measurable and significant personality differences between superintendents in schools which adopt the selected practices and superintendents in those which do not adopt them would have important implications for the selection of persons to fill administrative positions in the schools. Hemphill,
Griffiths, and Fredericksen have concluded, for example, that although there appeared to be no ideal personality for administrators, it is possible to identify traits associated with persons with propensities for particular endeavors.\(^\text{12}\) If it can be assumed that change is necessary for schools to be effective in a dynamic society, then, among other things, schools need to be led by those people who are most likely in their personal make-up to facilitate change.

Similarly, persons being recruited and selected for preparation programs in educational administration could be examined against the criterion of propensity for facilitating change as implied by measurable personality factors. Personality tests are already included in some screening procedures for students entering advanced graduate preparation programs.

Finally, and perhaps more importantly, knowledge of the relationship between personality characteristics and the adoption of new practices provides one additional variable to be fit into the configuration of variables that together account for change. Clearly,

no single factor accounts for the phenomenon, yet no theory can be tested until knowledge of a great many variables is available. The personality of the superintendent of schools would appear to be one of those variables.

**Organization of the Report**

This report is organized into five chapters. Chapter I is an introduction to the study. It has presented the rationale for the study, a statement of the problem to be investigated, a definition of terms, some assumptions underlying the study, the hypotheses to be tested, a brief statement of the design of the study, some limitations, and the possible significance of the study. Chapter II is a review of the literature and research related to the diffusion and adoption of innovations. It also includes a discussion of some of the theoretical approaches to personality. The design and instrumentation for the study are presented in Chapter III. The basic findings of the study are reported in Chapter IV. Chapter V is a summary of the study and includes the conclusions and implications drawn from the findings.
CHAPTER II

REVIEW OF RELATED LITERATURE AND RESEARCH

The function of this chapter is to provide a background for an understanding of the context within which this study was undertaken. Two topics are treated. The first topic is the diffusion and adoption of innovations. Through a review of the literature an attempt is made to provide a survey of knowledge relative to this phenomenon. The second topic is personality. As the independent variable in this investigation, it was thought that at least a cursory look should be taken at personality theory in general and at the theory employed in this inquiry in particular.

Diffusion and Adoption of Innovations

Research on the diffusion and adoption of innovations has been extensive. Everett Rogers reviewed more than 500 publications on the diffusion of innovations.\(^1\) Ross synthesized over 150 studies related to the adoption of innovations in education.\(^2\) More


recently, Miles compiled and summarized a number of papers dealing with innovation in education. These summaries provide a comprehensive review of the innovation diffusion and adoption literature up to the time of their publication. Most of what has been written about the diffusion and adoption of innovations since the appearance of these summaries has dealt with theoretical formulations. Relatively little field study has been done to test the theories. The following review is based largely upon the summaries of Rogers, Ross, Miles, and others. Most of the primary sources cited are those appearing since these summaries were published.

Innovation Theory

An intensive search of the literature on innovation diffusion led Harbans Bhola to conclude that no satisfactory theory of change and innovation existed. Of extant models, Bhola said:

These available formulations have indeed clarified the process of change, have identified the stages of innovation-adoption, and suggested taxonomies and categories of tasks that must be performed to make change more or less certain.

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rather than merely random and accidental. But they are often descriptive, contextual, or much too global. 4

Among the available formulations considered by Bhola was the force-field model of Kurt Lewin which has been ably and succinctly described by Crookston and Blaesser as follows:

Change takes place when an imbalance occurs between the sum of the driving forces and the sum of the restraining forces. Such an imbalance "unfreezes" the pattern and the level [of behavior] changes until the opposing forces are again brought into equilibrium. An imbalance may occur through a change in the magnitude of any force, a change in the direction of a force, and/or an addition of a new force. 5

From an anthropological point of view, Gallaher believed that change results from attempts to manage the tension produced by gaps between ideal and actual patterns of behavior. 6

The adoption of innovations was seen by Rogers as a "mental process through which an individual passes from first


hearing about an innovation to final adoption." Both Rogers and Lionberger recognized five stages in the adoption process which they defined as follows:

**Awareness**—the first knowledge about a new idea, product, or practice;

**Interest**—the active seeking of extensive and detailed information about the idea, to determine its possible usefulness and applicability;

**Evaluation**—weighing and sifting the acquired information and evidence in the light of the existing conditions into which the practice would have to fit;

**Trial**—the tentative trying out of the practice or idea, accompanied by acquisition of information on how to do it;

**Adoption**—the full-scale integration of the practice into the on-going operation.®

Miles suggested a series of stages in the adoption process much like those of Rogers and Lionberger but adding "design" as the first stage and considering "awareness-interest" as one stage.®

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7Rogers, *op. cit.*, p. 17.


Brickell proposed three phases of innovation: (1) **design** or invention, (2) **evaluation** of the approach, and (3) **dissemination**. ¹⁰

A four-phase model for change which includes (1) research, (2) development, (3) diffusion, and (4) adoption has been proposed by Guba and Clark. ¹¹

According to Bhola's configurational theory of innovation diffusion:

> Diffusion (D) of an innovation is a function of the Configurational relationship (C) between the Initiator (i) from a class of such initiators, and the Target (j) from a class of such targets; the extent and nature of Linkage (L) between and within configurations; the Environment (E) in which the configurations are located; and the Resources (R) of both the initiator and target configurations. ¹²


Diffusion was defined by Bhola as:

The process involving information consumption, social interaction, and behavioral change through which an innovation is incorporated into a configuration, tending toward a socio-psychologically stable and integrated relationship with the cognitive-affective-motor structure of that configuration. 13

Rogers defined diffusion more simply as "the spread of a new idea from its source of invention or creation to its ultimate users or adopters." 14 The consummation of the diffusion process, then, in Bhola's terms, is the "incorporation" and final "integration" of an innovation in the target system, or, in Rogers' terms, the "adoption" of the innovation.

The adoption of innovations is a decision-making process according to Rogers, which involves "(1) observing the problem, (2) making an analysis of it, (3) deciding the available course of action, (4) taking one course, and (5) accepting the consequences of the decision." 15

13 Ibid., p. 47.
14 Rogers, op. cit., p. 76.
15 Ibid., p. 78.
Lionberger pointed out that not every decision follows the five-stage sequence and that many decisions are made simply on the basis of habit or tradition. He further stated that "the decision sequence may be truncated at any point, or stages may be so blended that it is impossible to distinguish where one begins and the other ends." The time interval from one stage of the adoption process to the next may vary from a few hours to days or years.

A well-known finding of diffusion research reported by Rogers is that the adoption of an innovation follows a bell-shaped curve when plotted over time. Early adoptions of innovations require a relatively longer period of time than the middle majority; late adoptions are similarly spaced over a relatively long time span at the end of the adoption period. Mort and Cornell found that "on the average, it takes seven times as long for the first 10 per cent of diffusion as for the second, third, fourth, or fifth 10 per cent."
Innovation Research

For convenience in presentation the remainder of this re-
view of background material on adoption of innovations will be
organized around Bhola's classification of variables in the
diffusion process. In addition to the four variables in Bhola's
formulation (Initiator-Target Configuration, Linkage, Environment,
and Resources) a fifth category of variables, the Innovation it-
self, will be included. Although Bhola believed the innovation
itself was not a significant variable in diffusion and could be
subsumed under the other classifications, it often is treated
separately in the literature. A final section will review litera-
ture relative to the superintendent of schools in the adoption
process. While in Bhola's scheme this topic would properly be
included in the Initiator-Target Configuration, because of the
particular focus of the present study, it is treated separately
here.

The Initiator-Target Configuration

Individuals as adopters.—Much of the research on inno-
vation diffusion, particularly that done in the rural sociology
tradition, focused on characteristics of individual adopters.
From a comprehensive survey of the literature on innovation diffusion, Rogers characterized innovators as follows:

Innovators generally are young.

Innovators have relatively high social status, in terms of amount of education, prestige ratings, and income.

Impersonal and cosmopolite sources of information are important to innovators.

Innovators are cosmopolite.

Innovators exert opinion leadership.

Innovators are likely to be viewed as deviants by their peers and by themselves.\textsuperscript{19}

From a study of Michigan junior high school principals, Jacobs reported that more highly innovative principals scored significantly higher than did principals in less innovative schools on (1) initiating structure, (2) predictive accuracy, (3) representation, (4) integration, (5) persuasion, and (6) consideration on the Leader Behavior Description Questionnaire. In general, he found principals in schools with larger numbers of innovations to display a significantly different type of leadership behavior from those in low innovative schools.\textsuperscript{20}

\textsuperscript{19}Everett Rogers, "What are innovators like?" Theory Into Practice, 2. (December, 1963), pp. 252-254.

Miles summarized the personal characteristics of innovators by stating:

Strong, benevolent persons often find themselves in an important and central role in utopian change efforts. In addition, intelligence and verbal ability seem important; the innovator also appears to be less bound by local group norms, more individualistic and creative. . . . Authenticity and enthusiasm. . . also seem to be important.

[Innovative persons] are said to be rebellious, alienated, excessively idealistic, . . . emotionally unstable, and prone to resentment and rebellion in the face of adversity or disillusionment.21

Organizations as adopters.—It is not surprising that inquiry into the adoption of farm innovations often focused on the individual as the adopter since the decision to adopt new farm practices usually rested with the individual farmer. Adoption in organizations, however, presented other considerations, many of which centered around the Weberian model of bureaucratic organizations. On this point Abbott argued that the hierarchical ordering of bureaucratic organizations made it unreasonable to expect radical departure from traditional practice.22

21 Miles, op. cit., p. 642.

Miles believed that organizational health could predict better than anything else the probable success of a particular change effort. The dimensions of organizational health were said to be (1) goal focus, (2) communication adequacy, (3) optimal power equalization, (4) resource utilization, (5) cohesiveness, (6) morale, (7) innovativeness, (8) autonomy, (9) adaptation, and (10) problem-solving adequacy.  

Hughes investigated organizational climate as manifested by central office staffs of schools. He concluded that a more open climate was associated with innovative school districts while a closed climate was associated with non-innovative districts. The staffs of innovative districts were found to evidence higher esprit (good morale, sense of accomplishment) and were less disengaged.

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23 Matthew B. Miles, "Planned Change and Organizational Health: Figure and Ground," in Richard O. Carlson, et al., Change Processes in the Public Schools (Eugene, Oregon: The Center for the Advanced Study of Educational Administration, University of Oregon, 1965), pp. 18–21.

(pride in achievement, personal enthusiasm, and involvement in work). 25

Carlson cited as barriers to change in educational organizations (1) the absence of a change agent, (2) a weak knowledge base, and (3) "domestication" of public schools (their inability to select their clients). 26

Two crucial variables in effecting change in organizations were discussed by Gallaher. Authority--where it resides and how it is employed--is one of these variables; the expectation of change shared by members of the organization is the other. 27 Gallaher believed that "people will more readily accept innovations that they had a hand in planning." 28 He pointed out that informal relationships and unofficial norms are also important in organizations since they provide another set of sanctions and controls affecting


26 Richard O. Carlson, "Barriers to Change in Public Schools," in Richard O. Carlson, et.al., op.cit., pp. 3-10.


28 Ibid., pp. 41-42.
behavior with respect to change. Change is more probable, he believed, in settings where change is valued and expected. Contrary to the view that change is inhibited by those individuals who derive security from an organization, Gallaher suggested that:

In formal organizations of a service variety, such as educational systems are, the opposite might well be true—those who are secure can sustain the threat of examining alternatives, whereas those whose margin of security is low will resist changing a system that has accommodated to them.29

Miles concluded that local autonomy in American education is a myth and that there is a de facto national system of education which, while it may brake local innovation attempts, may, nevertheless, increase the potential for innovation. Teacher turnover and mobility are factors which Miles believed affect innovation adoption in education. He suggested that diffusion rates in educational systems may be slower than those in other systems because of the absence of valid scientific research findings, lack of change agents, and lack of economic incentives. He further proposed that certain ideological beliefs such as concepts of local control, teacher autonomy and the inability to measure teaching effectively are protective myths which inhibit change. Existing educational

29 Ibid., p. 43.
product specifications, as manifested in state or national examinations, serve to inhibit change, according to Miles. Other aspects of educational systems which he believed inhibit change are: vulnerability to outside influence, use of persons rather than physical technology as primary instruments of change, and lay control. 30

Linkage

The first of five stages in the adoption process described by Rogers is awareness, followed, in order, by interest, evaluation, trial, and adoption. 31

Prerequisite to awareness is some communication, or linkage, between the adopter and the initiator of an innovation. Communication may be on a personal, face-to-face basis or it may be by means of impersonal mass media. The importance of mass media as a powerful influence in the adoption of innovations has been vitiated by the "Two-step Flow of Communications" hypothesis which states that influences from mass media first reach "opinion leaders" who

30 Miles, Innovation in Education, pp. 632-634.
31 Rogers, op. cit., p. 81.
in turn pass on information to those with whom they are in frequent contact and for whom they are influential.  

Rogers concluded that "impersonal information sources are most important at the awareness stage, and personal sources are most important at the evaluation stage in the adoption process." He believed that people become aware of innovations from mass media but that, as they evaluate an idea, they discuss it with their peers.

Much has been written about those who influence the decisions of others. Variously referred to as "opinion leaders," "influentials," "key communicators," and by other terms, "opinion leaders" are defined by Rogers as those individuals from whom others seek advice and information.  

Rogers identified the following characteristics of opinion leaders:

Opinion leaders are more cosmopolite than their followers.

33 Rogers, op. cit., p. 102.
34 Ibid., p. 208.
Opinion leaders have more social participation than their followers.

Opinion leaders have higher social status than their followers.

Opinion leaders are more innovative than their followers.

Opinion leaders use more impersonal, technically accurate, and cosmopolitan sources of information than do their followers.35

Carlson noted that although there is ample documentation that advice and information are usually sought from other persons in the same occupation in the same locality, this was not true of the West Virginia school superintendents studied by him. Allegheny County superintendents, however, did follow the more common pattern of seeking advice from other superintendents. They also typically turned for advice to those higher in status than themselves.36

It has been pointed out by Katz that "opinion leaders and the people whom they influence are very much alike and typically


36Richard O. Carlson, Adoption of Educational Innovations (Eugene, Oregon: The Center for the Advanced Study of Educational Administration, University of Oregon, 1965).
belong to the same primary groups of family, friends, and co-workers. 37

Rogers reported that opinion leaders in one area of interest are not likely to be opinion leaders in another sphere. 38 Katz suggested that while opinion leaders may be more interested in the particular sphere in which they are influential, those whom they influence will not be far behind and these people, in turn, may be influential in another area of interest. 39

Carlson questioned whether or not opinion leaders are equally influential with all potential adopters. Evidence from his own research indicated that "while local opinion leaders were indeed influential their influence consistently decreased with men who were lower and lower in the status structure." 40

The tendency for individuals to expose themselves to communications that agree with their existing opinions, to interpret


38Rogers, op.cit., p. 236.

39Katz, op.cit., p. 77.

new ideas in terms of their past experiences and existing opinions, and to remember ideas that agree with their existing opinions is thought by Rogers to explain why personal influence is more effective than mass media in overcoming resistance to change.  

Environment

Environment has been defined by Bhola as "the system of physical, social, and intellectual forces and conditions in which configuration(s) are located." Bhola viewed environment along two dimensions: (1) objective-subjective, and (2) instantaneous-persistent. Instantaneous environments are so transitory as to be difficult to conceptualize whether objective or subjective, and subjective environments are unique to individuals. Bhola thus concerned himself largely with persistent-objective environments which he said may be supportive, neutral, or inhibiting with respect to the adoption of innovations.

Environment, as Bhola pointed out, has physical, social, and intellectual (or psychological) components. It is perhaps the

\[41\text{Rogers, op.cit., p. 252.}\]

\[42\text{Bhola, op.cit., p. 48.}\]
social/psychological, rather than the physical, aspect of environment that provides the greater interest. The importance of cultural values to the diffusion and adoption of ideas was given considerable attention by Rogers. He pointed out, for example, that whereas the norms of some cultures facilitated adoption of new ideas, the norms of other cultures tend to perpetuate the status quo. Cultural norms may also delimit what innovations may be adopted. The following case cited by Rogers makes the point:

An intensive campaign by a public health worker in a Peruvian town of 200 families to secure the boiling of drinking water was largely unsuccessful. The reasons for the failure of the water-boiling campaign can be traced largely to the cultural beliefs of the Los Molinos people, particularly their customs dealing with hot and cold foods and illness. Boiling water makes it less "cold" and, hence, appropriate only for ill persons. But if one is not ill, he is prohibited by the cultural norms from drinking boiled water. Only the least integrated individuals could afford to defy the community norm on water-boiling. An important factor affecting the adoption rate of an innovation is the cultural value of the potential adopters.

Miles suggested that innovations in education may be blocked by certain ideological beliefs which he called "protective

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43 Rogers, op. cit., pp. 57-75.

44 Ibid., pp. 11-12.
myths." Among the "myths" are local control of education, the belief that the teacher is an autonomous professional, and the contention that teaching cannot be effectively measured.

Sometimes a new force in the environment may serve as a catalyst with respect to the climate for change. The Soviet Sputnik has been viewed as such an element. According to Brickell: "The rate of instructional innovation in New York State public elementary and secondary schools more than doubled within 15 months after the firing of the Soviet Sputnik I on October 4, 1957."46

Relationships between subsystems in an environment may affect the adoption of change. Miles said "any innovation attempt will be conditioned by forces working within or between subsystems falling in the general categories of educational agencies, government systems, and commercial and nonprofit organizations" which are interdependently connected.47

Resources

The fourth variable in the diffusion process described by Bhola is resources. Resources may be classified as:

1. Material Resources
2. Resources of Conceptual Skills

45Miles, op.cit., p. 633.
46Henry M Brickell, Organizing New York State for Educational Change (Albany, New York: State Education Department, 1961),
47Miles, loc.cit.
3. Resources of Personnel
4. Resources of Influence\(^48\)

The availability of resources, particularly material resources is such an obviously controlling variable that it has been credited by some as being the single most potent factor in adoption. From the Columbia University adaptability studies of adoption of innovations in education, Ross concluded: "If but one question can be asked, on the basis of the response to which a prediction of adaptability is to be made, the question is: 'How much is spent per pupil?'.\(^49\)

There is some evidence that it is not simply the availability of resources that is associated with adoption of innovations but the utilization of those resources. Hughes found that innovative school districts expend a greater amount of money per pupil but do not have greater financial resources.\(^50\) This finding coincided with Mort's earlier conclusion that wealth is not predictive of adaptability

\(^{48}\) Bhola, \textit{op. cit.}, p. 77.

\(^{49}\) Ross, \textit{op. cit.}, p. 15.

\(^{50}\) Hughes, \textit{op. cit.}, p. 117.
but that a high expenditure level is related to early adoption.  

Rogers noted the lower incomes of later adopters and suggested that lack of resources "may either prevent adoption or cause discontinuance because the ideas do not fit their limited financial position."  

Miles concluded that innovations requiring inordinate outlays of money, energy, or time are likely to move slowly.  

From their investigations Mort and Cornell concluded that there is no critical expenditure level below which introduction or later diffusion fails to take place but that there is a stronger possibility it will take place in high expenditure communities than in low expenditure communities.  

Bhola referred to a salience ratio which represents the relationship between expected return and investment. On this point he wrote:  

The availability of resources within an adopter system does not mean that they will be 

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52 Rogers, *op. cit.*, p. 91.  

53 Miles, *op. cit.*, p. 635.  

used for the adoption effort. Resources will tend to be conserved and will be utilized if the investment will bring sufficient material, social, or psychological rewards.

The nature and extent of investment and the type and amount of return will determine the probability of diffusion of an innovation. 55

Bhola developed the concept of visibility of costs and returns. Costs may be quite visible, as in the case of purchasing a piece of equipment, or invisible, as with the cost accruing from indirect taxation. Similarly, returns may be visible, such as an increase in production, or they may be invisible, as, in Bhola's example, "the opportunity of living in a better, safer, enriching community through a comprehensive and permanent adult education program." 56

Adoption is most likely where costs are visibly low and returns are visibly high. Adoption is least likely where costs are visibly high and returns are visibly low.

The Innovation Itself

Bhola determined that "the characteristics of an innovation were not primary in determining the probability of the diffusion of an

55Bhola, op.cit., p. 80.

56Ibid., p. 81.
innovation." He, therefore, did not include the innovation itself as a variable in his diffusion theory. Much of the literature, on the other hand, does include references to characteristics of innovations which investigators have looked at in relation to adoption. For this reason, some of these findings will be mentioned here.

Bhola believed that the adoption of any innovation could be achieved in due course of time if "all the needed resources were available and deployed." 58

Five characteristics of innovations were proposed by Rogers as relevant to adoption:

1. Relative advantage is the degree to which an innovation is superior to ideas it supersedes.

2. Compatibility is the degree to which an innovation is consistent with existing values and past experiences of the adopters.

3. Complexity is the degree to which an innovation is relatively difficult to understand and use.

4. Divisibility is the degree to which an innovation may be tried on a limited basis.


58 Ibid.
5. Communicability is the degree to which the results of an innovation may be diffused to others.\textsuperscript{59}

Rogers found that "innovations that are relatively simple in nature, divisable for trial, and compatible with previous experiences may have a shorter adoption period than innovations without these characteristics."\textsuperscript{60}

Lionberger believed that "the more complex a practice, and the more change it requires in existing operations, the more slowly it will be adopted."\textsuperscript{61} Practices which are compatible with existing operations, that are readily communicated by conventional methods, and that can be tried a little at a time were thought by Lionberger to be more quickly adopted. Practices involving large capital outlay and decisions that are difficult to retract are adopted more slowly.

Mort reported no difference in diffusion rates for complex and simple innovations but suggested that those that increase costs move more slowly than those that do not.\textsuperscript{62}

\textsuperscript{59}Rogers, op.cit., pp. 124-133.

\textsuperscript{60}Ibid., p. 108.

\textsuperscript{61}Lionberger, op.cit., p. 104.

Miles summarized the properties of innovations affecting adoption under five categories: (1) cost, (2) technological factors, (3) associated materials, (4) implementation supports, and (5) innovation/system congruence. He reported that innovations requiring inordinate outlays of money, energy or time are likely to move slowly but if the innovation can be adopted on a partial, flexible basis, the obstacle of cost may be less formidable. He concluded that in America widespread diffusion was unlikely unless there were profit making possibilities. Among technological factors he found that not only were technological innovations comparatively easy to adopt but they are also easy to reject or discontinue. Relatively small technical decisions and the opinions of a relatively small technological elite may block innovations according to Miles. He found that devices which rely on associated materials (such as a film projector) may be hampered in adoption. Other technological factors affecting adoption were said to be feasibility, ease of availability, and convenience of use.

Direct experience with a particular device seems essential for adoption. Miles' evidence indicated that adoption by teachers

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63 Miles, op. cit., pp. 635-639.
becomes more likely if "the materials are comprehensive, and designed as complete units." Difficult of use or implementation of an innovation was found to be a barrier to adoption and continued use. Innovations perceived as threats to existing practice, rather than mere additions to it, are believed to be less likely to be accepted; innovations which can be added to an existing program without seriously disturbing parts of it are likely to be adopted.

Referring to the properties of innovations as a factor in adoption, Miles wrote:

A kind of axiom seems visible in almost any of the studies reported in this book: educational innovations are almost never installed on their merits. Characteristics of the local system, of the innovating person or group, and of other relevant groups often outweigh the impact of what the innovation is.

Rogers observed:

The characteristics of an innovation have a great deal to do with its rate of adoption. It is the characteristic of a new product not as seen by experts but as perceived by the potential adopters that really matters.

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64 Ibid., pp. 636-637.
65 Ibid., p. 635.
66 Rogers, op.cit., p. 123.
The superintendent of schools

Some inquiry has dealt specifically with the superintendent of schools as a variable in the change process. Mort and Cornell, investigating "adaptability," or the capacity for schools to change, found that in more than half of the cases in their study, the administrator had assumed the role of leadership in the introduction of new practices; in only one of 183 possibilities had he opposed the adoption; in only six cases had he been ignorant of its presence; and in only 23 cases had he assumed a neutral or negative role. They also reported that teachers in the communities studied thought that from five to thirty-seven per cent of the changes that were needed were changes in administrative personnel, thus, perhaps, suggesting the importance of administrators in facilitating or hindering change. Teachers in rural schools least frequently reported administration as an obstacle to needed change.

Administration was viewed as an obstacle to change most often in districts where the most adaptation had taken place. Administrative officers were found to have greater awareness of current needs than teachers and far greater awareness than school board members or members of the public at large. Administrative patterns and policies were cited as frequently reducing adaptability.\(^6^7\)

\(^6^7\)Mort and Cornell, op. cit., pp. 224-225.
Skogsberg found superintendents of adaptable schools to be more alike than different both as administrators and as people.

These superintendents think of the whole staff . . . as a team . . . They tend to view lay people as team members or potential members. They are not jealous of power. They delegate responsibility and authority freely . . . Their attitude induces the feeling among their co-workers that personal prestige of the team members comes best from the accomplishment of the whole group. They were willing to learn from co-workers. They rely on the give and take of democratic discussion . . . The peculiar abilities of co-workers are freely recognized . . . Personally they are vigorous, highly trained and self-critical men. They give others an impression of personal integrity and professional competence.68

The superintendent's position in the social structure was found by Carlson to be a useful variable in explaining the rate of adoption of modern math. Early adopters had more social network involvement and higher status than late adopters as measured by education, professionalism, prestige, and opinion leadership.69


69 Carlson, Adoption of Educational Innovations, pp. 22-28.
Summary

Theories of change include those which explain change as resulting from an imbalance between driving and restraining forces (Lewin) and those which see it as resulting from attempts to manage the disparity between ideal and actual behavior patterns (Gallaher). Bhola conceptualized the diffusion of innovative ideas and practices as a function of target and initiator configurations, the linkage (communications) between and among those configurations, the environment in which they are located, and their resources. The steps in the diffusion process are generally thought to be (1) awareness, (2) interest, (3) evaluation, (4) trial, and (5) adoption. Change occurs in many forms and contexts. The focus of research reported in the literature surveyed for this report is on change in the form of adoption of new practices, processes, techniques, and devices. The principal criteria for adoptiveness (or innovativeness) are (1) frequent adoption and (2) early adoption.

Research has focused both on individuals as adopters and organizations as adopters. Early individual adopters have been characterized as cosmopolite, opinion leaders, deviants, prestigious, and young. Change in organizations appears to be related to their bureaucratic structure and hierarchical ordering. The extent of involvement of people who are affected by changes and the extent to
which they perceive change to threaten them seem to be important variables in organizational change.

The status of information sources is vital to the effectiveness of communications between and within initiator and target configurations. Impersonal communication sources are more important at the awareness stage; personal sources are more important at later stages.

The social/psychological environment is no less important (perhaps more important) than the physical environment in effecting change. The dominant values of the culture in which adopters reside place significant constraints upon change in that culture. Education is surrounded by protective myths which inhibit change efforts.

The availability of required resources is essential but not sufficient for change. Equally important as availability of resources is their utilization.

Characteristics of the innovation itself are important as a variable in adoption to the extent that they are perceived by potential adopters as relevant to their concerns and feasible in terms of cost and utility.

**Personality**

It was not thought to be necessary or desirable to engage in a detailed treatment of personality theory in this report. An attempt has been made to provide in a summary way a look at some of the
variety in definitions and theories of personality. A brief, but more
detailed description is given of the theory of personality used in
this study. Finally, some of the research on relationships between
personality and administrative behavior is cited.

Definitions of personality

Guilford placed definitions of personality into five groups
according to various core ideas. In one group of definitions, per­
personality was seen as a stimulus. In this group, personality is
known through its effects upon others. Omnibus definitions state
that personality is the sum total of certain dispositions, impulses,
appetites, instincts, tendencies, and habits. Integrative defini-
tions emphasize the organization of personality which is viewed as
more than the sum of its parts. Totality definitions emphasize in­
tegration to such an extent as almost to ignore parts entirely.
References are made to the "general characterization, or pattern,
of an individual's total behavior," and to "the field property or form
of the individual's total behavior pattern." When defined in terms
of adjustment, personality is an individual's characteristic pattern
of behavior. 70

Co., Inc., 1959), pp. 3-5.
Bonner mentioned three approaches to personality. According to the behavioristic approach:

One personality differed from another one only as the habit systems of each differed, and personality itself was conceived as nothing more than the sum total of all the habit systems or hierarchies of an individual.\(^7\)

A second view presented by Bonner is of personality as an adjustive mechanism. This approach is concerned with "mechanisms by which the person tries to cope with the problems of his experience, and the means by which he may preserve his integrity."\(^7\)

The holistic-dynamic view of personality, which Bonner himself embraced, rejects what he called the "mechanical models" of personality in favor of the "integrated and creative features of human personality."\(^7\)

Hilgard considered personality theories in four basic groups. Type theories are exemplified by Carl G. Jung's "extravert" and "introvert" personality types and attempt to classify personali
ties into a few inclusive categories. Trait theories describe personality


\(^7\)Ibid., p. 29.

\(^7\)Ibid., p. 41.
in terms of a number of characteristic traits. Developmental theories stress continuities and suggest that individual behavior in a given situation is best predicted by what the individual has done previously in similar situations. Developmental history or past experience provides the key to this group of theories.

Theories of personality dynamics look at personality according to:

Various strands that are in unstable equilibrium, so that present behavior is a result of the interplay of various dispositions, often in conflict; these conflicts always take place in the present, no matter what their origins in the past may have been, so that theories of personality dynamics—the theories concerned with these present conflicts—are inevitably interactive theories rather than developmental ones.74

Personality is defined by Guilford as an individual's unique pattern of traits and he defines a trait as "any distinguishable, relatively enduring way in which one individual differs from others."75

Allport considered helpful "those conceptions that ascribe to personality a solid organization of dispositions and sentiments."76


75 Guilford, op. cit., pp. 5 and 6.

He also considered valuable "definitions that refer to the style of life, modes of adaptation to one's surroundings, to progressive growth and development and to distinctiveness."77 Allport defined personality as "the dynamic organization within the individual of those psychophysical systems that determine his unique adjustments to his environment."78

According to Cattell, "the personality of an individual is that which enables us to predict what he will do in a given situation."79 The components of personality, according to Cattell, are traits which are abstractions inferred from actual behavior.80

Determiners of personality

There appears to be general agreement among theories that the determiners of personality are both constitutional and environmental. The relative importance of these determiners varies with the theory. Bonner believed that personality is a "dynamic structure

77Ibid.
78Ibid., p. 48.
80Ibid., p. 24.
of biological factors, interpersonal contacts, and cultural values."  

Kluckhohn and Murray believed that four classes of determinants account for personality formation; these are (1) constitutional determinants, (2) group-membership determinants, (3) role determinants, and (4) situational determinants.  

Stimulus-response theory and the morphological approach of William Sheldon emphasize constitutional factors in determining personality. The views of Kurt Lewin, H. A. Murray, and Carl Rogers, on the other hand, emphasize environmental determiners.  

Guilford wrote of the "bewildering variations" in treatment of personality. He pointed out that to some schools of psychology (for example, extreme behaviorism) personality is of no importance as a concept, while in others it is a key concept. He went so far as to describe the situation as "confusion bordering on chaos." The explanation for this state of affairs may be attributed, in part,  

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81 Bonner, op. cit., p. 493.  


according to Guilford, to the special interests different groups have in the subject and to the different theoretical points of view in psychology. Bonner concluded that the choice of theory "depends largely on systematic preferences."  

The foregoing indicates some of the variety in points of view regarding the concept, personality. Obviously with such divergence it is not likely that the question of which, if any, viewpoint is correct will be resolved here. Doubtlessly, much of the apparent confusion results, as Guilford and Bonner have suggested, from different purposes and different systematic approaches. All but the most extreme views accept personality as a concept which not only distinguishes one individual from another (that is, as being descriptive) but which also accounts for the particular way in which an individual reacts to or interacts with his environment (or, as being predictive). In terms nearly identical with Allport's definition, Getzells and Guba defined personality as "the dynamic organization within the individual of those need-dispositions and abilities

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85 Bonner, *op. cit.*, p. 31.
that determine his unique interaction with the environment."\textsuperscript{86}

Cattell said that personality is that which enables prediction of what an individual will do in a given situation.\textsuperscript{87} While other positions are acknowledged, the positions of Cattell and of Getzells and Guba are subscribed to here.

\textbf{Cattell's theory}

Raymond B. Cattell defined personality as that which makes it possible to predict what an individual will do in a given situation. He referred to personality as "the habits of the individual."\textsuperscript{88} The elements of personality are traits which Cattell says are abstract structures "inferred from many instances of behavior."\textsuperscript{89} A trait is "an inferred mental structure set up to account for a man repeatedly reacting in a certain fashion."\textsuperscript{90} Traits may be sorted into three divisions:

\begin{enumerate}
  \item Dynamic traits, which have to do with motivation, action and purpose,
  \item temperament traits, which deal with pervasive, unchanging
\end{enumerate}


\textsuperscript{87}Cattell, \textit{op. cit.}

\textsuperscript{88}\textit{Ibid.}, p. 46.

\textsuperscript{89}\textit{Ibid.}, p. 24.

\textsuperscript{90}\textit{Ibid.}, p. 46.
qualities and tempos in our actions, and
(3) ability or "cognitive" traits which concern
how well a person can do anything.\textsuperscript{91}

Personality is determined both by heredity and environment
and Cattell has suggested a nature-nurture ratio to express the
relative efficacy of each.\textsuperscript{92} While all three trait classifications
have both hereditary and environmental determiners, dynamic
traits--those having to do with reactions to particular stimuli and
interests in particular goals--are said to be most capable of modi-
fication by experience or learning. Unlearned dynamic traits are
called "ergs" (a term generally equivalent to "instinct" or "pro-
pensity"). Traits which have been derived from ergs and modified
by experience are called "metanergs."

Surface traits and source traits comprise an important aspect
of Cattell's personality theory. When a number of behaviors, or
trait elements are highly correlated with each other, they are said
to form a surface trait. Source traits are "deeper independent
sources of variation."\textsuperscript{93} A surface trait usually results from two or

\textsuperscript{91}Ibid., p. 21.
\textsuperscript{92}Ibid., p. 29.
\textsuperscript{93}Ibid., p. 149.
more source traits operating simultaneously to cause marked common variation. Source traits are derived by factor analysis, a process by which the "common thread" which accounts for elements varying together is discovered. Source traits, or factors, were considered by Cattell not only to provide an economical means of describing personality but, more importantly, they are the "real structural elements in personality."  

**Personality in administrative behavior**

Personality has not been ignored as a factor in administrative behavior. Campbell, et al., proposed that it is "the inner structure" of "the man in the situation" that accounts for differences in the behavior of two administrators holding the same post at different times.

Researchers have engaged in considerable study and speculation in attempting to discover patterns of personality characteristics which would identify the ideal administrator. Stogdill placed

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traits associated with leadership in five groups: (1) capacity, including intelligence, originality, alertness, verbal facility, and judgment; (2) achievement, including knowledge, scholarship, and athletic accomplishments, (3) responsibility, including dependability, persistence, initiative, self-confidence, desire to excel, and aggressiveness, (4) participation, or cooperation, adaptability, sociability, activity, and energy, and (5) status, or socioeconomic position, and popularity. 97

In a study of elementary school principals, Lipham found significant differences in the personal construct of effective and ineffective principals. Among the variables which he identified were: activity drive, achievement drive, mobility drive, social ability, feelings of security, and emotional control. 98

Pierce and Merrill wrote:

Most of the traits and attributes which are significantly related to leader behavior appear to be those which are associated with the personality of the leader as opposed to position. They seem to be more closely allied to the interaction of persons


in social situations than with status. The burden of the evidence seems to suggest that there are a number of characteristics which seem to be required for leaders in most situations. There is evidence also that these traits will vary in quantity and quality with the individual and with the leadership situation. The possession of these traits does not guarantee successful leadership by the possessor nor are they found universally in all leaders. It is inconceivable, however, that a person could be a successful leader without the possession of at least several of these traits in some combination.99

While the importance of personality in accounting for differences in behavior is widely recognized, and although some characteristics associated with leadership behavior, executive behavior, or administrative behavior, such as those cited, have been found, it must be admitted that the ideal personality for administrators has eluded investigators. One must conclude with Gibb that "numerous studies of the personalities of leaders have failed to find any consistent pattern of traits which characterize leaders."100 This failure may be attributed to one or more of three factors according to


Gibb: (1) inadequacy in description and measurement of personality, (2) differences in groups studied, and (3) the fact that leadership itself is a complex and probably not a consistent pattern of functional roles.

The inability of personality tests to correlate highly with a general "success" criterion was also encountered by Hemphill et al. in their study of elementary school principals. The highest correlation they found when superiors' and teachers' ratings of principals were correlated with personality test scores was .18. \(^{101}\) When the unique components of eight administrative performance factors were used as criterion measures, however, a different result was obtained. By analyzing the factor loadings of fifteen of the personality factors in the Cattell Sixteen Personality Factor Questionnaire on each of the eight administrative performance factors, these investigators were able to discern the personality characteristics that were most closely associated with each type of administrative performance. They suggested that in the selection of candidates for administrative positions a two-step procedure might be used in which the first step...

would be to screen candidates on the basis of general knowledge and ability and the second step would involve screening on the basis of possession of particular personality characteristics which were known to be related to specific kinds of administrative performance required by the particular job. 102

Attempts to find important correlations with "success" criteria in any field almost invariably result in pursuit of a will-o'-the-wisp. Hemphill, Griffiths, and Frederiksen cite the lack of suitable success criteria as one difficulty in studies of personality tests for use in administrator selection. 103 The possibility of finding relationships between personality characteristics and particular kinds of behavior, however, appeared to offer more promise, particularly in light of these recent findings.

Summary

Personality theories vary widely and the choice of a particular theory depends largely upon the preferences of individual investigators. For purposes of this study Getzell and Guba's definition of personality was chosen. They defined personality as "the

102 Ibid., p. 337.

103 Ibid., p. 336.
dynamic organization within the individual of those need-dispositions and abilities that determine his unique interaction with his environment." Cattell's assertion that personality is that which enables prediction of behavior in particular situations appeared to be appropriate for the present research. Source traits, which could be measured in terms of 16 primary personality factors, are said to underlie individual behavior.

Although research aimed at uncovering relationships between personality characteristics and general success criteria have notoriously failed, some recent inquiry has found relationships between personality factors and particular kinds of behavior. This finding appeared to offer promise of fruitful inquiry into possible relationships between personality factors of superintendents of schools and the adoption of innovations in school districts.

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Getzell and Guba, loc. cit.
CHAPTER III

DESIGN AND INSTRUMENTATION OF THE STUDY

Basically two kinds of data were required to test the hypotheses posed for this study: (1) a measure of personality factors of superintendents of schools and (2) a measure of the adoptiveness of the school districts. In addition, data were gathered relative to the superintendent's age, experience, and training and the enrollment and valuation per pupil of the school district. In the following pages discussion centers around the population about which data were gathered, the sample from whom data were gathered, the instruments employed in gathering the data, and the statistical procedures used in analyzing the data.

**The Population Studied**

The population for this study was composed of the superintendents of Ohio school districts which met size, organization, and tenure criteria. Only superintendents of districts operating both elementary and secondary schools, having at least 1,000 but less than 10,000 average daily membership in the 1965-66
school year, who in the 1965-66 school year were in at least their fifth year of tenure in their present position were included in the population to be studied. Although no attempt was made to control all of the variables in the complex adoption process, it was felt that as much rigor as feasible should be incorporated into the design of the study. The criteria imposed in selecting superintendents and school districts for the study were intended to provide some control over these other variables.

The size criterion was applied to achieve a degree of homogeneity in the population. It was assumed that although the personality of the superintendent may be as important a variable in adoption in very large and very small districts as it is in other districts, there are obvious differences in both which are not so likely to be found among districts of 1,000 to 10,000 enrollment. Very large districts have more schools, thus providing a greater opportunity for adoption. A district with 25 elementary schools, might for example, find it easier to adopt a non-graded organization in a single school than would a district with only five elementary schools. Very large districts are also more likely to have administrative personnel within the hierarchy between the superintendent and the teachers, thus altering the manner in which the superintendent affects adoption. In small local school districts in Ohio,
on the other hand, the effect of the county superintendent on adoption is a factor to be reckoned with. While the local superintendent in a small district may function quite autonomously, it was assumed that the influence of the county superintendent was more likely to be felt in local districts under 1,000 than in those over 1,000 enrollment. Elimination from the population of extremes in size provided a degree of control over this variable.

Districts not operating both elementary and secondary schools were eliminated since some of the practices included on the instrument used to measure adoptiveness are applicable to one level of organization but not to the other. Hence, a district not having both levels lacked opportunity to adopt some of the practices.

Inasmuch as the key variable in the study was the personality of the superintendent in relation to the adoption of new practices, it was felt (1) that superintendents in the study should have a minimum comparable period of tenure and (2) that most, if not all, of the adoptions should have taken place during the tenure of the present incumbent. A five-year period was believed to be sufficient to cover earliest adoptions of most practices on the adoptiveness instrument. More than five years might have unduly restricted the size of the sample since only about half of the school districts in Ohio had the same superintendents in 1965-66 that they had in 1961-62.
Although it was not possible in this study to isolate the effect of the superintendent’s personality from all other possible variables affecting adoption of new practices, one additional control on the variability of other factors was provided by stratifying the sample on the basis of valuation per pupil. Valuation per pupil was determined by dividing the total assessed valuation of real property in the school district by the average daily membership of the district. Thus, a comparable measure of resources available from local taxation was obtained for each district. It was assumed, for example, that a district with $15,000 per pupil in assessed valuation had greater resources from local taxes than a district with $8,000 per pupil. This, of course, does not take into account sources other than local taxes, such as the state foundation program or funds from the federal government.

The Educational Directory of the Department of Education, State of Ohio, for the school years 1961-62 and 1965-66 were compared to determine those school districts in Ohio whose incumbent superintendents in 1965-66 were in at least their fifth year in office. Using enrollment and financial data of the Department of Education, State of Ohio, those districts were identified which not only met the tenure criterion for superintendents but which also met the criteria of organization and enrollment. On the basis of information available,
227 Ohio school districts were found to meet all of the criteria established for inclusion in the population to be studied.

Each of the 227 districts was classified on the basis of valuation per pupil and placed into one of five categories. The categories and the number of districts in each category are shown in Table 1.

### TABLE 1

**DISTRIBUTION OF SCHOOL DISTRICTS IN THE POPULATION BY VALUATION PER PUPIL**

<table>
<thead>
<tr>
<th>Valuation Per Pupil</th>
<th>Number of Districts</th>
</tr>
</thead>
<tbody>
<tr>
<td>$4,000 - 7,999</td>
<td>40</td>
</tr>
<tr>
<td>8,000 - 8,999</td>
<td>44</td>
</tr>
<tr>
<td>10,000 - 12,999</td>
<td>65</td>
</tr>
<tr>
<td>13,000 - 15,999</td>
<td>41</td>
</tr>
<tr>
<td>16,000 - and above</td>
<td>37</td>
</tr>
<tr>
<td>Total districts</td>
<td>227</td>
</tr>
</tbody>
</table>

**The Sample**

It was determined that a sample of fifty school districts, stratified on the basis of valuation per pupil, would be drawn from the total population of 227 districts. Using a table of random numbers a number approximately equal to 50/227 of the number in each valuation-per-pupil category was drawn to be included in the the
sample. The sample, stratified on the basis of valuation per pupil, then appeared as shown in Table 2.

**TABLE 2**

**DISTRIBUTION OF SCHOOL DISTRICTS IN THE SAMPLE BY VALUATION PER PUPIL**

<table>
<thead>
<tr>
<th>Valuation Per Pupil</th>
<th>Number in Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ 4,000 - 7,999</td>
<td>9</td>
</tr>
<tr>
<td>8,000 - 9,999</td>
<td>10</td>
</tr>
<tr>
<td>10,000 - 12,999</td>
<td>14</td>
</tr>
<tr>
<td>13,000 - 15,999</td>
<td>9</td>
</tr>
<tr>
<td>16,000 and above</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total districts</strong></td>
<td><strong>50</strong></td>
</tr>
</tbody>
</table>

**Gathering the Data**

To test the hypotheses posed for this study data were required relative to the adoptiveness of the school districts in the sample and the personality factors of the superintendents of the school districts. These data were obtained by administration of the Adoptiveness Scale and the Sixteen Personality Factor Questionnaire. In addition to adoptiveness and personality data, other information about the superintendent's age, training, and experience was obtained from a Personal Data Questionnaire. Each of the three instruments employed is described in detail in subsequent sections of this chapter.
In the first phase of the study the Adoptiveness Scale was mailed to the superintendents of the fifty school districts in the sample. Forty-eight of the superintendents completed and returned the scale. One of the superintendents not responding had retired and thus failed to meet the tenure criterion; the other superintendent simply did not respond either to the initial mailing or a follow-up letter.

In the second phase of the study the Sixteen Personality Factor Questionnaire and the Personal Data Questionnaire were mailed to each of the 48 superintendents who completed and returned the Adoptiveness Scale. Because of the nature of the Sixteen Personality Factor Questionnaire, its length, the time required to complete it, and the fact that it was mailed during the summer months when many superintendents could be expected to be taking vacations, it was anticipated that these questionnaires might be returned slowly and that a high percentage of returns might be difficult to obtain. Persistent follow-up by mail and telephone, however, netted a return of 41 of the 48 questionnaires. Of the seven superintendents from whom returns were not received, it developed that five no longer held the position reported in the Educational Directory of the State Department of Education for 1965-66, hence failed to meet the five-years tenure criterion for inclusion in the study. The other two superintendents
indicated that they were unwilling to complete the Sixteen Personality Factor Questionnaire.

**Instrumentation**

Three instruments were used in collecting the data for this study. These were (1) the Adoptiveness Scale, (2) the Sixteen Personality Factor Questionnaire, and (3) the Personal Data Questionnaire. The Adoptiveness Scale was developed especially for this study to rank school districts in the sample on a criterion of propensity for adoption of innovations. The Sixteen Personality Factor Questionnaire is an instrument developed by Raymond P. Cattell to provide measures of 16 primary and four second-order personality factors. The Personal Data Questionnaire was a very simple instrument devised to obtain information relative to the age, training, and experience of the superintendents in the study. In the following paragraphs each of these instruments is described in detail. Copies of the instruments appear as Appendixes C, D, and E.

**The Adoptiveness Scale**

**Development of the Adoptiveness Scale.** In determining the adoptiveness of school districts, it was thought that a more sophisticated scaling of adoptiveness was required than would be obtained, for example, by simply counting the number of innovations
a district had adopted. Rogers reported two methods for classifying adopters. One method utilizes the ratings of judges who are asked to place individuals into adopter categories. The other method, which most researchers have used, classifies adopters on the basis of time of adoption.

A general finding of the research on adoption of innovations reported by Rogers is that, when plotted over time, the adoption of innovations follows a normal distribution. This phenomenon led him to devise a categorization of adopters based upon time of adoption. Those adopters who fell under the normal distribution curve to the left of an ordinate erected at the mean year of adoption minus two standard deviations from the mean \((M - 2\sigma)\), that is, the first 2-1/2 per cent of adopters, were categorized as "Innovators." The next 13-1/2 per cent of adopters, those falling under the curve between the mean minus two standard deviations and the mean minus one standard deviation \((M - 2\sigma \text{ and } M - \sigma)\), were labeled "Early Adopters." The next 34 per cent, those who fell under the

\[1\text{Rogers, op.cit., p. 160.}\]

\[2\text{Ibid., p. 152.}\]
curve between the mean minus one standard deviation and the mean
(M - 1 \( \sigma \) and M), were called the "Early Majority." The "Late
Majority" was the 34 per cent of adopters found under the normal
curve between the mean and the mean plus one standard deviation
(M and M + 1 \( \sigma \)). The last 16 per cent to adopt, those falling under
the curve beyond the mean plus one standard deviation (M + 1 \( \sigma \)), were
classified as "Laggards." (See Figure 1.)

Figure 1. Adopter Categorization on the
Basis of Relative Time of Adoption of
Innovations

Mort and Pierce employed both time of adoption and number
adoptions as factors in determining the adaptability of schools. The

\[3\text{Ibid., p. 162.}\]

Paul R. Mort and Truman M. Pierce, A Time Scale for
Measuring the Adaptability of School Systems (New York: Metro-
politan School Study Council, 1947).
term "adaptability," as they used it, had approximately the same meaning as "innovativeness" or "adoptiveness." A list of 22 adaptations, or innovations, was used in the "Time Scale" in rating schools on adaptability. Scores obtained on the "Time Scale" were related to time of adoption and number of adoptions. Schools were scored on each of the 22 adaptations, receiving a higher score for earlier adoption of a practice and a lower score for later adoption or non-adoption. The total adaptability score was the sum of the scores on each of the 22 adaptations in the "Time Scale."

For the present study the method of Mort and Pierce was emulated and a list of educational practices was developed which were considered to be innovative by a group of expert judges. A preliminary list of fourteen practices was developed from such sources as the Ohio Educational Innovations Survey, the report of an Ohio Education Association survey, and general knowledge of new practices in education. This preliminary list was presented to each of

5 The panel of judges was composed of Professors Elsie J. Alberty, James B. Burr, Alexander Frazier, Jack Frymier, and Loren Tomlinson, all of whom are members of the faculty of the College of Education, The Ohio State University.

6 Ohio Educational Innovations Survey, Catalog of Educational Changes in Ohio Public Schools (Columbus, Ohio: College of Education, The Ohio State University, 1966).

five judges who were asked to rate each practice as either (1) highly
innovative, (2) moderately innovative, (3) slightly innovative, or
(4) not innovative. As a guide, the judges were asked to consider
innovative those practices which departed significantly from the
common or ordinary. Nine of the practices were considered at least
"slightly innovative" by all five judges; four of the judges considered
all fourteen of the practices at least "slightly innovative." (One
judge, however, did not rank one practice with which he was not
familiar.) Because of this high degree of consensus among the judges,
no practice was deleted from the list. In addition to rating each of
the fourteen practices, judges were also asked to add to the list any
practice not included which, in their judgment, they would rate as at
least "slightly innovative." As a result of this procedure, two
practices were added to the original group to form a final list of six­
teen practices. This list of sixteen practices comprised the Adoptive­
ness Scale.

Superintendents to whom the Adoptiveness Scale was mailed
were asked to report the school year in which any of the sixteen
practices was first tried in their school district. The superintendent's
statement that the practice had been tried somewhere in the district
was accepted as evidence of adoption. No distinction was made be­
tween experimental and complete adoption, or between one-school and
more-than-one-school or system-wide adoption.
The term "first tried" rather than "adopted" was used to avoid complications of ambiguity arising from definitions of the term "adoption." Trial and adoption obviously are not the same thing. Several of the authorities cited in Chapter II of the present study indicate steps in the adoption process which include both trial and adoption as separate steps. Both Rogers and Lionberger, for example, define trial as a tentative trying out of a practice and adoption as the full-scale integration of the practice into an operation. Although Lionberger pointed out that every adopter does not necessarily go through every step of the adoption process and that steps may be skipped or truncated, it is logically impossible for trial to follow adoption. If the trial stage is present, it must precede adoption. If the trial is omitted, then adoption becomes, in effect, first trial. Furthermore, Rogers has reported that earlier adopters not only adopt earlier than later adopters but that they also try innovative practices much earlier than later adopters. Thus a ranking of school districts based upon date of first trial of a practice would likely be the same as a ranking based upon date of adoption. While defining the year in which a practice became institutionalized and thoroughly integrated into a school system would often be extremely difficult, it is

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relatively easy for a superintendent to recall the year in which a practice which had not previously been incorporated into the system was tried for the first time. Although there is the possibility of error in ranking schools on adoptiveness when first trial is used as the criterion, it was felt that the logic as well as the evidence provided in the literature supported such a procedure.

**Scoring the Adoptiveness Scale.**--In determining an overall adoptiveness score for each school district the first step was to determine for each district an adoptiveness score on each of the sixteen individual practices on the Adoptiveness Scale. This was accomplished by determining for each year the number of school districts in the sample having tried a practice up to that time. This number was taken as a percentage of the total number of school districts in the sample and an ordinate erected at a point along the base line of a hypothetical normal distribution curve to the left of which that percentage of the total distribution would be found assuming normality of distribution. Based upon that assumption, the standard deviation at that point from the hypothetical mean year of adoption was determined. So that high adoptiveness scores would be associated with more adoptive districts and low scores with less adoptive districts signs for the standard deviations were reversed. Thus a positive standard deviation became negative and a negative
standard deviation became positive. To this standard deviation, with sign reversed, a constant of four was added to eliminate negative numbers. The standard deviation plus four then became the adoptiveness score for that practice for each school district adopting the practice that year.

To illustrate how the scoring was effected the procedure followed in scoring districts on the adoption of language laboratories may be cited as an example. The first reported trial of language laboratories by school districts in the sample was in 1958. Two districts tried language laboratories that year. Taking two as a percentage of 41 (the total number of districts in the sample) it was determined that these two schools were among the first 2.44 per cent of potential adopters. The point along the base line of a normal distribution curve to the left of which lies 2.44 per cent of the total distribution is -1.66 standard deviations from the mean. Reversing the sign of the standard deviation and adding the constant four produces an adoptiveness score of 5.66 for each of the two schools trying language laboratories in 1958. In 1957 one additional district tried language laboratories bringing the total number of trials up to that time to three districts. Three is 4.88 per cent of 41 so that the single district trying language laboratories in 1959 was among the first 4.88 per cent of potential adopters. The point
along the base line of a normal distribution curve to the left of which lies 4.88 per cent of the total distribution is -1.45 standard deviations from the mean. Reversing the sign of the standard deviation and adding the constant four provides a score of 5.45 for the district trying language laboratories in 1959. This procedure was continued until a score was determined for each year in which any district tried the practice.

It was deemed necessary to assign an adoptiveness score on a practice even though a district had not tried that practice since failure to do so would have had the effect of giving a score of zero. This would have given the same score to a district which had not tried a practice whether the practice had previously been tried by 90 per cent of the districts in the sample, for example, or by 10 per cent of the districts. A score, then, was assigned based upon the year by which one-half of the heretofore non-adopting districts would have tried the practice assuming normal distribution of adoptions over time. This provided an average adoptiveness score for non-adopters which bore some relationship to the date at which a district might potentially try the practice. It also provided a score which was relative to that district's position among other districts which had tried the practice earlier. An adoptiveness score, then, on a practice for schools not trying that particular practice was determined by taking
the number of schools not trying the practice as a percentage of the total number of schools in the sample and adding half of this percentage to the percentage of schools trying the practice. An ordinate was erected along the base line of a normal distribution curve to the left of which would lie that percentage of the total distribution assuming normality of distribution. The standard deviation from the mean at that point was taken and, reversing the sign, to it was added the constant four producing an adoptiveness score for that practice for districts which had not tried the practice.

Again using the example of trial of language laboratories, it was found that 22 of the 41 districts had not tried language laboratories up through the 1965-66 school year. It was assumed that all of these districts were potential adopters. Since it was impossible to predict in what year any particular district would try the practice each district was given a score as though trial had occurred in the year by which one-half of the non-adopting districts had tried the practice. Thus, one-half of 22 was added to the number of districts having tried language laboratories (19) for a total of 30. Thirty is 73.17 per cent of 41. The point along the base line of a normal distribution curve to the left of which lies 73.17 per cent of the total distribution is +.62 standard deviations from the mean. Reversing the sign of the standard deviation and adding four produces an
adoptiveness score of 3.38. This score was assigned to each
district which had not tried language laboratories.

The total adoptiveness score was determined by summing the
scores on individual practices. This score was affected not only by
number of practices tried but also by time of trial. Districts trying
many practices early scored higher than districts trying few practices
late.

The Sixteen Personality
Factor Questionnaire

The Sixteen Personality Factor Questionnaire is an instrument
developed by Raymond B. Cattell to measure all the main dimensions
of personality along which people can differ, according to basic
factor analytic research. Each of the sixteen factors, according
to Cattell, is a unitary, independent, and practically important
"source trait" which affects much of the overt personality. In addi-
tion to the sixteen primary personality factors, four second-order
factors may be derived by weighting and combining scores on certain
of the primary factors. Each of the 187 items on the questionnaire

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9 Raymond B. Cattell and Herbert W. Eber, *Handbook for the
Sixteen Personality Factor Questionnaire*, 1957 ed. (Champaign,
possesses a demonstrated saturation with respect to each of the factors it is intended to measure. Each factor on the questionnaire corresponds to a primary personality factor found in ratings other than questionnaires, for example, in real-life behavior situations, in social response patterns, and in abnormal pathological behavior. Most of the questions on the Sixteen Personality Factor Questionnaire are indirect and would not be perceived by the subject as related to the trait being measured. Factors are not interpreted from the nature of statements the subject makes about himself but from known correlations between the "mental interiors" found in questionnaire factors and the factors established in behavior. The responses to questions are not treated as self-ratings but as behavior from which the personality factor is inferred.

There are six forms of the Sixteen Personality Factor Questionnaire. Forms A and B each contain 187 items and require approximately 35 minutes to administer. These forms are intended for use with persons in the seventeen year old through mature adult age range. Forms C, D, E, and F are designed for adults of limited education, literacy, or intelligence. Form A was employed in the present study. It was self-administered by superintendents in the sample who read and followed the instructions printed on the front of the test booklet. Three alternative responses are provided
for each item on the questionnaire. Responses were marked on a separate answer sheet and hand scored using scoring masks provided by the publishers of the test. In addition to raw scores, standard *sten* scores were obtained using tables established by the authors of the questionnaire.

A brief description of each of the factors measured by the Sixteen Personality Factor Questionnaire follows.\(^\text{10}\)

**Factor A. Sizothymia, previously Schizothymia** (Detached, Critical, Cool) versus Affectothymia, previously Cyclothymia (Warmhearted, Easy-going, Participating). Persons low on Factor A are likely to be stiff, cool, skeptical, and aloof. They prefer things to people. They like working alone and avoid compromises of viewpoints. Precision and rigidity in manner of doing things and in personal standards are common characteristics. Sometimes such people tend to be critical, obstructive, or hard. Individuals who score high on Factor A tend to be good natured, easy-going, emotionally

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\(^{10}\) The descriptions are paraphrased from Cattell and Eber, *op. cit.*, and from Cattell and Eber, "Manual for Forms A and B, Sixteen Personality Factor Questionnaire" (Champaign, Illinois: Institute for Personality and Ability Testing).
expressive, ready to cooperate, attentive to people, soft-hearted, kindly, and adaptable. They prefer occupations dealing with people and socially-impressive situations. They readily form into active groups, are generous in personal relations, less afraid of criticism, and better able to remember names of people.

**Factor B. Lower scholastic mental capacity (Less Intelligent, Concrete-thinking) versus Higher scholastic mental capacity (More Intelligent, Abstract-thinking).** The author has pointed out that this factor is measured not so much to add personality information as to provide a good general ability measure which is needed to complete the measurement of factors important in predictions. Persons low in Factor B tend to be slow to learn and grasp, dull, and inclined to concrete and literal interpretation. High scorers are likely to grasp ideas quickly, learn faster, and be more intelligent.
**Factor C.** Lower Ego Strength (emotionally less stable, easily upset) versus Higher Ego Strength (emotionally stable, faces reality, calm, mature). A low score on Factor C is associated with individuals who have low frustration tolerance for unsatisfactory conditions. Such individuals tend to be changeable and plastic, neurotically fatigued, fretful, easily emotional and annoyed, and active in dissatisfaction. They evade the necessary demands of reality and may have neurotic symptoms. High scores indicate emotional maturity and stability. These persons are better able to maintain solid group morale and tend to be more realistic about life.

**Factor E.** Submissiveness (humble, mild, accommodating, conforming) versus Dominance (assertive, independent, aggressive, stubborn). Persons who are low on Factor E are likely to be docile and conforming and tend to give in to others. They are often dependent, confessing, and may be obsessive in their anxiety over correctness. Those who score high on this factor are likely to be
assertive, self-assured, and independent-minded. They may be austere, hostile or extrapunitiv​e, and authoritarian. Disregard for convention and authority are characteristics found in individuals who score high on Factor E.

**Factor F.** Desurgency (sober, prudent, serious, taciturn) versus Surgency (happy-go-lucky, impulsively lively, gay, enthusiastic). Restraint, reticence and introspection are characteristic of individuals who score low on Factor F. They are sometimes dour, pessimistic, and unduly deliberate. Sometimes viewed as smug and primly correct, they tend to be sober and dependable. High scorers are often cheerful, active, talkative, frank, expressive, effervescent, and carefree. They are frequently elected leaders and may be impulsive and mercurial.

**Factor G.** Weaker Superego Strength (expedient, evades rules, feels few obligations) versus Stronger Superego Strength (conscientious, persevering, staid, rulebound). Low scores on
Factor G are associated with persons who tend to be unsteady in purpose and who are casual and lacking in effort for group undertaking and cultural demands. Although lack of concern for group purposes may result in anti-social acts, it may also permit more effective action. Persons who score high on this factor are likely to be exacting in character and have a highly developed sense of duty. They are usually conscientious and moralistic, and prefer hardworking people to witty companions.

Factor H. Threctia (shy, restrained, diffident, timid) versus Parmia (venturesome, socially-bold, uninhibited, spontaneous). Individuals who score low on Factor H may be described as shy, withdrawing, cautious, or a "wallflower." They may be retiring in their relations with the opposite sex. They tend to be careful, considerate, and quick to see dangers. Those who score high on this factor are more adventurous, active, and overt in their interests in the opposite sex. They may be
described as friendly, impulsive, frivolous, or carefree. They are sociable, bold, and willing to try new things.

**Factor I.** Harria (tough-minded, self-reliant, realistic, no-nonsense) versus Premsia (tender-minded, dependent, over-protected, sensitive). Low scores on this factor are indicative of individuals who are practical, realistic, masculine, independent, and responsible. They tend to be self-sufficient, hard to the point of cynicism, and smug. Persons who score high on Factor I may be demanding, subjective, impatient, dependent, kindly, gentle. They are sometimes artistically fastidious, and may be affected and effeminate. They dislike crude people and rough occupations. Their unrealistic fussiness may impede group activity and adversely affect group morale.

**Factor L.** Alaxia (trusting, adaptable; free of jealousy, easy to get on with) versus Protension (suspicious, self-opinionated, hard to fool). Individuals who score low on Factor L tend to be
accepting, outgoing, trustful, and open. They are willing to take risks, understanding permissive and tolerant. They may be soft-hearted and tend to be composed and cheerful. High scores on this factor are associated with persons who are jealous, self-sufficient, and suspicious. Such individuals may be withdrawn and brooding. They are sometimes tyrannical, hard, and irritable.

**Factor M.** Praxernia (practical, careful, conventional, regulated by external realities, proper) versus Autia (wrapped up in inner urgencies, careless of practical matters, Bohemian). Individuals who score low on Factor M tend to be conventional, practical, and anxious to do the right thing. They are likely to possess sound, realistic, dependable, practical judgment. They tend to be earnest, concerned, even worried, but very steady. They are concerned over detail, tend to remain calm in emergencies, but are sometimes unimaginative. High scores are found among people who are
creative, imaginative, unconventional, and frivolous. They are generally cheerful, unconcerned over everyday matters, Bohemian. They tend to be interested in art, theory and basic beliefs.

**Factor N. Artlessness** (forthright, natural, artless, sentimental) versus **Shrewdness** (shrewd, calculating, worldly, penetrating). Individuals who score low on this factor are simple and unpretentious. They tend to be socially clumsy, vague, and sentimental. They are warm, gregarious, and spontaneous. Their tastes are simple and they are content with what comes. They often lack self insight, lack skill in analyzing motives, and trust in accepted values.

People who score high on Factor N are sophisticated, polished, and socially alert. They are insightful regarding self and others. They tend to be exact and of a calculating mind and may be aloof and emotionally disciplined. They are often expedient, ambitious, and insecure. Such individuals have an intellectual, unsentimental approach to situations.
**Factor O.** Untroubled Adequacy (self-assured, confident, serene) versus Guilt Proneness (apprehensive, worrying depressive, troubled). Those who score low on Factor O are confident and self-secure. They tend to be placid, with unshakable nerve. They are tough, expedient, rudely vigorous, fearless, and given to simple action. High scorers on this factor are timid, insecure, worrying, and anxious. They are sensitive, tender, easily upset, and depressed. They may be moody, lonely, brooding, and given to hypochondria and phobic symptoms. They do not feel accepted in groups and often have a tendency to anxiety in difficulties.

**Factor Q1.** Conservatism (conservative, respecting established ideas, tolerant of traditional difficulties) versus Radicalism (experimenting, critical, liberal, analytical, free-thinking). Low scores on this factor are associated with persons who are confident in what they have been taught to believe. They tend to accept the "tried and true," even though new approaches would be better. When it comes to new ideas they are cautious and compromising. They
tend to oppose and postpone change and are inclined to go along with tradition. Individuals who score high on Factor Q1 are more interested in intellectual matters and are more likely to have doubts on fundamental issues. They are inquiring and skeptical of ideas, old or new. They tend to be better informed, less inclined to moralize, more inclined to experiment, and more tolerant of inconvenience and change.

**Factor Q2.** Group Adherence (group-dependent, a "joiner" and sound follower) versus Self-Sufficiency (self-sufficient, prefers own decisions, resourceful). Persons who score low on this factor prefer to work and make decisions with other people. Although they are not necessarily gregarious by choice, they like and need social approval and admiration. They have a tendency to go along with the group and often lack individual resolve. People who score high on Factor Q2 are resolute and accustomed to making their own decisions. While not necessarily dominant in their relations with other people they tend to discount public opinion. They
do not dislike people but feel that they do not need their agreement or support.

**Factor Q3.** Low Integration (undisciplined self-conflict, careless of protocol, follows own urges) versus High Self-Concept Control (controlled, socially-precise, following self-image). Persons who score low on Factor Q3 have little will power and care little for social demands. They are not overly considerate, careful, or painstaking and may feel maladjusted. High scores are found among individuals who have more strongly controlled emotions and who are more inclined to be socially aware and careful. They exhibit self-respect and highly regard social reputation. Sometimes they tend to be obstinate. Effective leadership is frequently associated with high Q3 scores.

**Factor Q4.** Low Ergic Tension (relaxed, tranquil, torpid, unfrustrated) versus High Ergic Tension (tense, frustrated, driven, overwrought). Low scores on Factor Q4 are indicative of persons who are sedate, relaxed, composed, and satisfied.
High scores are associated with individuals who are tense, excitable, restless, fretful, and impatient. Even though fatigued, they may not be able to remain inactive. They seldom are leaders and often take a poor view of the degree of group unity, orderliness, and the existing leadership quality.

In addition to the sixteen primary personality factors, four second-order factors may be derived from the Sixteen Personality Factor Questionnaire by following procedures developed by its author. The second-order factors are (I) Low versus High Anxiety, (II) Introversion versus Extraversion, (III) Tender-minded Emotionality versus Alert Poise, and (IV) Subduedness versus Independence. Descriptions of these factors follow.

**Factor I. Low Anxiety versus High Anxiety.** Low scores on Factor I are found among people who find life generally satisfying and who are able to accomplish the things they feel are important. Extremely low scores may indicate a lack of motivation for difficult tasks. People who score high on this factor may be to some extent dissatisfied with their ability to meet the demands of life and to achieve what they want.
Factor II. Introversion versus Extraversion.

Persons who score low on this factor tend to be shy, self-sufficient, and inhibited. High scores are associated with people who are socially outgoing, uninhibited, and good at making and maintaining interpersonal contacts.

Factor III. Tenderminded Emotionality versus Alert Poise. Low scores on Factor III indicate persons who tend to be sensitive to life's subtleties, artistic, and rather gentle. They may be troubled by a pervasive emotionality and sometimes are discouraged and frustrated. Persons who score high on this factor tend to be enterprising, decisive, and resilient. They may miss the subtle relationships of life, being oriented more toward the obvious. Rapid action with insufficient consideration and thought may lead such individuals into difficulty.

Factor IV. Subduedness versus Independence.

Individuals who score low on Factor IV are group-dependent, chastened, and passive. They tend
to need and desire the support of other people and are likely to orient their behavior toward people who give such support. High scores are indicative of persons who are aggressive, independent, daring, and incisive. They look for situations where this kind of behavior is at least tolerated and may be rewarded. They tend to show considerable initiative.

**Personal Data Questionnaire**

Because of the limits within which this study had to be conducted it was not possible to control all of the variables that might possibly affect adoptiveness. It was believed, however, that some control could be exercised by collecting personal data about the superintendent of schools other than the personality data provided by the Sixteen Personality Factor Questionnaire. To this end a Personal Data Questionnaire was developed and employed. This was a simple questionnaire on which superintendents reported their age, their experience, and their training. They were asked to report (1) their total years of experience as a teacher, (2) their total years of experience as an administrator, and (3) their total years of experience in their present position.
They were also asked to report the year in which they received each college degree they held and the year in which they last did graduate study.

**Statistical Procedures**

The two hypotheses posed for this study required two basic kinds of statistical tests. The first hypothesis suggested differences in personality characteristics between superintendents of more adoptive and less adoptive school districts. To test this hypothesis a statistical test of the significance of the differences between means was required. Differences in mean personality factor scores between superintendents in more adoptive and less adoptive districts might be expected. A statistical test of the significance of these differences was needed to determine the probability that differences found in the sample also existed in the population. For this purpose a "t" test was used.

The second hypothesis suggested relationships between personality factors and adoptiveness. The statistic required to test this hypothesis was the coefficient of correlation. A simple coefficient of correlation would reveal relationships between single independent variables and the dependent variable (adoptiveness). Another statistic was required to test for multiple relationships
between several independent variables taken together and adoptiveness. For this test the coefficient of multiple correlation was selected. Tests of significance of these statistics were required to determine the confidence with which the correlations obtained in the sample could be expected to be found in the population. For this purpose the "F" test was used.

Most of the statistical computations were made by use of computer programs and the 7094 computer located in the Computer Center, The Ohio State University. Two programs provided practically all of the computations required. They were the MR90 - Multiple Regression program\(^\text{11}\) and the BMD02R Stepwise Regression program.\(^\text{12}\)

**Multiple Regression Analysis**

The first analysis of the data was performed through use of the MR90 - Multiple Regression program by means of which a


\(^\text{12}\) W. J. Dixon, editor, BMD, Biomedical Computer Programs, Health Sciences Computing Facility, Department of Preventive Medicine and Public Health (Los Angeles: School of Medicine, University of California, January 1, 1964, revised September 1, 1965), p. 233.
multiple regression analysis is performed under the hypothesis

\[ y = b_0 + b_1x_1 + b_2x_2 + \ldots + b_ix_i \]

where the \( x_i \) are the observable independent variables, \( y \) is the observable dependent variable and the \( b_i \) (regression coefficients) are the constants to be estimated.\(^{13}\) In the present case the superintendent's personality factor scores and other personal characteristics and characteristics of the school districts for which data were obtained were the independent \((x_i)\) variables. School district adoptiveness scores were the dependent \((y)\) variable.

In addition to the multiple regression analysis the MR90 program also provided means and standard deviations on all variables both for the entire sample of 41 school districts as well as separately for the 20 highest and 21 lowest scoring districts on the Adoptiveness Scale. It also provided coefficients of correlation between each independent variable and the dependent variable. The mathematical formulas used in the MR90 Regression analysis appear in Appendix J.

\(^{13}\)OSU, op. cit.
Stepwise regression

In addition to other statistical tests employed it was thought to be desirable to attempt to determine combinations of variables—personality factors and other variables for which data were collected—which might significantly relate to adoptiveness. Rather than arbitrarily selecting combinations of variables in an effort to find those which were most predictive of adoptiveness it seemed more appropriate to follow a systematic approach. The BMDO2R Stepwise Regression program provided such a systematic approach. The program is described as follows:

This program computes a sequence of multiple linear regression equations in a stepwise manner. At each step one variable is added to the regression equation. The variable added is the one which makes the greatest reduction in the error sum of squares. Equivalently it is the variable which has highest partial correlation with the dependent variable partialed on the variables which have already been added, and equivalently it is the variable which, if it were added, would have the highest F value. In addition variables are automatically removed when their F values become too low.14

Through use of this program it was possible to determine the three variables of the 27 for which data were available which would

make the best prediction of adoptiveness. The computational procedure used in the Stepwise Regression program appears in Appendix K.

Summary

The population for this study consisted of school districts in Ohio which met criteria of size, organization, and tenure of superintendent. A random sample of 50 districts was chosen from the population for study. Three instruments were employed in collecting data. The Adoptiveness Scale was developed especially for this study to rate school districts on an adoptiveness criterion. The superintendent's personality was measured in terms of 16 primary and four second-order personality factors by means of the Sixteen Personality Factor Questionnaire. A Personal Data Questionnaire provided data relative to the superintendent's age, experience, and preparation. School district organization, enrollment, and per-pupil-valuation data were obtained from State Department of Education records. The questionnaires were mailed to the superintendents of schools in the sample who provided the data.

A statistical test of the significance of differences between mean personality factor scores of high and low adoptive school districts was used to test the hypothesis that there are no
differences between the personality factors of superintendents of highly adoptive school districts and the personality factors of superintendents of less adoptive school districts. Coefficients of correlation and multiple correlation were obtained to test the hypothesis that there is no relationship between personality factors of superintendents of schools and the adoptiveness of school districts. Combinations of variables which would be predictive of adoptiveness were sought through use of a computer program known as "Stepwise Regression."
CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

Following the procedures outlined in Chapter III data were collected from forty-one school districts in Ohio ranging in enrollment from 1,022 pupils to 7,096 pupils, whose incumbent superintendents had been in their present positions at least five years. All of the districts operated both elementary and secondary schools. The basic data obtained from administration of the Adoptiveness Scale, the Sixteen Personality Factor Questionnaire, and the Personal Data Questionnaire are reported in the paragraphs which follow.

Presentation of Basic Data

Adoptiveness

Adoptiveness scores were obtained for each school district in the sample by administering the Adoptiveness Scale and scoring it following procedures described in Chapter III. Adoptiveness scores for each district are shown in Table 3. Throughout the report of this study school districts in the sample and their superintendents are identified only by number so that their anonymity will be maintained.
## TABLE 3
ADOPTIVENESS SCORES OF THE FORTY-ONE SCHOOL DISTRICTS IN THE SAMPLE

<table>
<thead>
<tr>
<th>District</th>
<th>Score</th>
<th>District</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>68.47</td>
<td>27</td>
<td>71.40</td>
</tr>
<tr>
<td>3</td>
<td>67.96</td>
<td>28</td>
<td>61.98</td>
</tr>
<tr>
<td>4</td>
<td>58.70</td>
<td>29</td>
<td>68.50</td>
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<tr>
<td>5</td>
<td>65.59</td>
<td>30</td>
<td>58.19</td>
</tr>
<tr>
<td>6</td>
<td>57.47</td>
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<tr>
<td>7</td>
<td>57.47</td>
<td>32</td>
<td>67.17</td>
</tr>
<tr>
<td>8</td>
<td>66.21</td>
<td>33</td>
<td>63.32</td>
</tr>
<tr>
<td>9</td>
<td>65.00</td>
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<tr>
<td>11</td>
<td>63.52</td>
<td>35</td>
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</tr>
<tr>
<td>12</td>
<td>66.73</td>
<td>36</td>
<td>59.82</td>
</tr>
<tr>
<td>14</td>
<td>61.08</td>
<td>37</td>
<td>63.43</td>
</tr>
<tr>
<td>16</td>
<td>57.47</td>
<td>38</td>
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<td></td>
<td></td>
<td>49</td>
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</table>
Adoptiveness scores ranged from 57.47 to 71.40 with a mean score of 63.99 and a standard deviation of 3.98. This range and distribution of scores indicated that the Adoptiveness Scale was able to discriminate among the school districts on the adoption, or trial, criterion.

The number of schools reporting trial of each practice on the Adoptiveness Scale may be seen by reference to Table 4. The most tried practice was modern mathematics which 32 districts reported having tried. Television was reported to have been tried by 21 districts and was second in popularity. Least tried were the Initial Teaching Alphabet, which only two districts reported trying, and modular scheduling, reported to have been tried by five districts. Three schools had tried none of the practices included in the Adoptiveness Scale. No school had tried all of them.

These findings are very similar to those of an Ohio Education Association survey of school districts in Ohio which also found modern mathematics and educational television the two most popular practices in their survey and Initial Teaching Alphabet least employed of the practices listed.¹ Modular scheduling was not included in the O.E.A. study.

### Table 4

**NUMBER OF SCHOOL DISTRICTS ADOPTING EACH OF SIXTEEN PRACTICES BY YEAR OF ADOPTION**

<table>
<thead>
<tr>
<th>Practice</th>
<th>Before 57</th>
<th>57</th>
<th>58</th>
<th>59</th>
<th>60</th>
<th>61</th>
<th>62</th>
<th>63</th>
<th>64</th>
<th>65</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Television</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>1</td>
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<td></td>
<td>21</td>
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<tr>
<td>Nongraded organization</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Modern mathematics</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td></td>
<td>5</td>
<td>11</td>
<td>6</td>
<td>4</td>
<td></td>
<td></td>
<td>32</td>
</tr>
<tr>
<td>Team teaching</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>13</td>
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<tr>
<td>Programmed instruction</td>
<td>2</td>
<td>8</td>
<td>4</td>
<td>2</td>
<td>3</td>
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<td>1</td>
<td>1</td>
<td>2</td>
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<td>BSCS Biology</td>
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<td>3</td>
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<tr>
<td>Initial Teaching Alphabet</td>
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<td></td>
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<tr>
<td>Modular scheduling</td>
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<tr>
<td>Foreign language/elementary</td>
<td>2</td>
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<td>Teacher aides</td>
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<td></td>
<td></td>
<td></td>
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<td>Middle School</td>
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</tr>
<tr>
<td>Totals</td>
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<td>0</td>
<td>8</td>
<td>10</td>
<td>21</td>
<td>12</td>
<td>34</td>
<td>40</td>
<td>43</td>
<td>31</td>
<td>202</td>
</tr>
</tbody>
</table>

Table 4 also shows the number of districts reporting trying each practice by years. Greatest activity among the school districts in the sample in trial of the listed practices occurred in the 1964-65 school year. Twenty per cent of the total number of trials occurred that year. Earliest trials occurred in 1952, 1953, and 1955. Nongraded organization, the use of teacher aides, and modern mathematics had trials in those years according to reporting superintendents.
Many of the innovations included in the Adoptiveness Scale can be related to specific dates which often reflect the date of inception of the innovation nationally. A comparison of these dates with the earliest adoption by school districts in the sample for this study reveals a remarkable relationship. The first use of television by schools in the sample for this study was in 1957. The National Education Association Project on Instruction, in a survey they conducted, found that 12 per cent of the elementary school principals and 17 per cent of the secondary school principals in the survey reported the use of television in instruction in 1955-56. The use of television in instruction became widely available in some parts of Ohio when the Midwest Program for Airborne Television Instruction (MPATI) got underway in 1961.

The first non-graded organizational plan in the sample in this study was reported to have been tried in 1952. According to Heathers, the movement to reorganize the schools developed almost entirely after 1957 but many non-graded programs were established earlier.\footnote{Glen Heathers, "School Organization: Nongrading, Dual Progress, and Team Teaching," in John I. Goodlad, ed., The Changing American School, The Sixty-fifth Yearbook of the National Society for the Study of Education, Part II (Chicago: The University of Chicago Press, 1966), p. 127.} \footnote{The Principals Look at the Schools, The Project on the Instructional Program of the Public Schools, National Education Association. (Washington: 1962), p. 21.}
Curriculum reform in mathematics began in 1951, according to Goodlad, with the University of Illinois Committee on School Mathematics. Ohio schools appear to have followed quickly the Committee's work with one school reporting the use of modern mathematics in 1955.

Team teaching first appeared in the schools in this study in 1961 but the Project on Instruction found that as early as 1956 five per cent of the schools in their study were using team teaching.

Programmed instruction may date from 1954, the year B. F. Skinner's teaching machine appeared, according to Miles. By 1961, the year in which the first two schools in the sample for the present study reported trial of programmed instruction, Gotkins and Goldstein reported 11 per cent of the schools they sampled using that innovation.

The Physical Sciences Study Committee physics program was in operation in 1957-58, two years before the first school in the Ohio

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5 The Principals Look at the Schools, op. cit., p. 17.


7 Ibid., p. 6.
sample reported trying it. In 1959 the Biological Sciences Curriculum Study launched its program and two years later the first Ohio school in the sample tried it. 8

The Initial Teaching Alphabet (ITA) developed in England by Sir James Pitman first appeared in an American version in 1963, although the original English material may have been used earlier. 9 First use of ITA by a district in the Ohio sample was in 1963.

Modular scheduling was one of several innovative ideas to come out of and be popularized by the report of the Commission on the Experimental Study of the Utilization of the Staff in the Secondary School. The Commission was created by the National Association of Secondary School Principals in 1956 and its report, popularly referred to as the "Trump Report" after its director, J. Lloyd Trump, appeared in 1961. 10 The first reported trial of modular scheduling by a district included in the present study was in 1961.


The NEA Project on Instruction found that 22 per cent of the school districts in their survey offered some foreign language instruction in the elementary school in 1960-61. Almost 30 per cent of the districts in the Ohio sample had tried this practice by 1960. It is noteworthy of this particular innovation that after an initial flurry of activity in 1958, 1959, and 1960, the number of new trials diminished and that between 1958 and 1960 over 70 per cent of the districts which would try this practice up to 1966 had already done so.

Advanced Placement Programs were inaugurated through the School and College Study of Admission with Advanced Standing in 1952. Originally sponsored by the Fund for the Advancement of Education, the program was continued in 1955 under the auspices of the College Entrance Examination Board. The first trial of Advanced Placement Programs by a district in this study was in 1958.

According to Miles, the first introduction of the teacher aide innovation occurred in Bay City, Michigan, in 1952. The Project on

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13 Miles, op. cit., p. 6.
Instruction study found nine per cent of the elementary schools and 18 per cent of the secondary schools in their survey reporting use of teacher aides in 1961. Teacher aides appeared in 1953 for the first time in a district reporting for the present study.

The problem of dating the inception of individualized reading as an innovative practice is pointed up by this paragraph from a text by Nila Banton Smith:

Teaching children individually in the 1600's!
Individual progression in the 1920's and 1930's!
Individualized instruction in the 1950's and 1960's!
Thus the historical cycle has repeated itself twice in American history, but with widely differing concepts, materials, and procedures.15

The current individualized reading movement is widely associated with the concepts of "seeking behavior," "self-selection," and "pacing" advanced by Willard Olsen about 1952.16 The earliest reported trial of individualized reading by a district in the present sample was in 1958.

14The Principals Look..., op.cit., p. 20.
Seven per cent of the elementary school principals and six per cent of the secondary school principals responding to the NEA Project on Instruction survey reported use of language laboratories in their schools in 1955-56. In 1958 the National Defense Education Act provided support in the form of matching funds for, among other things, the teaching of foreign languages. The first two districts in the sample for the present study reporting use of language laboratories tried them in 1958.

Middle Schools have been defined as "the middle grades in schools organized on the 4-4-4 or 5-3-4 plan." Attention was drawn to this concept late in 1965 when it was announced that the plan was being considered for adoption in the New York City school system. Pearl Brod reported in 1966 a survey by Educational Research Service which indicated that five of 344 school systems reporting followed a 5-3-4 plan. Data which she obtained from 40 per cent of the nation's schools indicated that ten per cent were functioning either on a 5-3-4 or a 4-4-4 plan or were in the process of changing to one.

17 The Principals Look..., op.cit., p. 21.


Among the six school districts in the sample for the present study reporting having tried the Middle School plan, the first trial occurred in 1960.

Pre-kindergarten classes made their first appearance in the Ohio sample in 1965. Six districts reported trying this innovation that year. The practice is undoubtedly related to passage of the Elementary and Secondary Education Act of 1965 which supported programs of this type through provisions of Title I.

It can be seen from the foregoing paragraphs that the trial of these innovative practices by Ohio schools included in this study has followed closely the appearance of the practices or the events associated with them nationally.

**Personality**

Personality data were obtained from the superintendents of the 41 school districts included in the sample who completed the Sixteen Personality Factor Questionnaire. Separate answer sheets were used in responding to the questionnaire and by employing scoring masks provided by the test publishers raw scores were obtained on each of 16 primary personality factors. Four additional second-order personality factor scores were derived from the 16 primary factors by means of formulas developed by the author of the test. (See Appendix F.) Scores
on each factor for each superintendent appear in Appendix G. Group mean scores and standard deviations on each factor appear in Table 5. Table 5 also shows the mean scores converted to Sten ("standard ten") scores from a table provided by the author of the test. In Sten scores the mean for the population of adult males in general is 5.5 so that scores for the sample may easily be compared with norms for the general population.

Analysis of these scores indicates that the superintendents in the sample for this study scored somewhat higher, on the average, than the general population on primary personality factors A, C, G, I, M, N, and Q4 and somewhat lower than the general population on Second-order Factor IV. They were significantly higher on Factor B (i.e., more than one standard deviation above the mean for the general population). This would indicate that, on the average, superintendents of schools in this study were somewhat more outgoing (Factor A), emotionally stable (Factor C), conscientious (Factor G), tender-minded (Factor I), imaginative (Factor M), shrewd (Factor N), and tense (Factor Q4) than adult males in the general population. As a group they were significantly more intelligent (Factor B) than the general population of adult males. On the average they were slightly more subdued and less independent (Second-order Factor IV) than the general adult male population.
TABLE 5

MEAN SCORES AND STANDARD DEVIATIONS ON SIXTEEN PRIMARY AND FOUR SECOND-ORDER PERSONALITY FACTORS FOR 41 SUPERINTENDENTS

<table>
<thead>
<tr>
<th>Personality Factors</th>
<th>Mean Raw Score</th>
<th>Mean Sten Score</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Factors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>11.6</td>
<td>7</td>
<td>3.5</td>
</tr>
<tr>
<td>B</td>
<td>8.4</td>
<td>8</td>
<td>1.6</td>
</tr>
<tr>
<td>C</td>
<td>16.5</td>
<td>6</td>
<td>3.5</td>
</tr>
<tr>
<td>E</td>
<td>12.0</td>
<td>5</td>
<td>3.7</td>
</tr>
<tr>
<td>F</td>
<td>11.7</td>
<td>5</td>
<td>3.9</td>
</tr>
<tr>
<td>G</td>
<td>15.8</td>
<td>7</td>
<td>2.7</td>
</tr>
<tr>
<td>H</td>
<td>13.5</td>
<td>5</td>
<td>5.1</td>
</tr>
<tr>
<td>I</td>
<td>9.5</td>
<td>6</td>
<td>3.0</td>
</tr>
<tr>
<td>L</td>
<td>8.2</td>
<td>5</td>
<td>3.1</td>
</tr>
<tr>
<td>M</td>
<td>11.5</td>
<td>6</td>
<td>2.9</td>
</tr>
<tr>
<td>N</td>
<td>11.6</td>
<td>6</td>
<td>2.3</td>
</tr>
<tr>
<td>O</td>
<td>7.8</td>
<td>5</td>
<td>3.0</td>
</tr>
<tr>
<td>Q1</td>
<td>9.4</td>
<td>5</td>
<td>2.4</td>
</tr>
<tr>
<td>Q2</td>
<td>9.5</td>
<td>5</td>
<td>3.8</td>
</tr>
<tr>
<td>Q3</td>
<td>10.0</td>
<td>5</td>
<td>4.8</td>
</tr>
<tr>
<td>Q4</td>
<td>13.2</td>
<td>7</td>
<td>3.0</td>
</tr>
<tr>
<td><strong>Second-order Factors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>48.1</td>
<td>5</td>
<td>18.9</td>
</tr>
<tr>
<td>II</td>
<td>52.2</td>
<td>5</td>
<td>21.6</td>
</tr>
<tr>
<td>III</td>
<td>45.5</td>
<td>5</td>
<td>13.3</td>
</tr>
<tr>
<td>IV</td>
<td>41.0</td>
<td>4</td>
<td>16.6</td>
</tr>
</tbody>
</table>

**Personal Characteristics**

Data were collected relative to the age, training, and experience of the superintendent of schools in the sample. Table 6 shows the high, low, and mean age, years of teaching experience, years of
administrative experience, years in present position, and year of last
graduate study for superintendents in the study.

**TABLE 6**

**HIGH, LOW, AND MEAN AGE, EXPERIENCE, AND RECENCY OF GRADUATE STUDY FOR SUPERINTENDENTS IN THE STUDY**

<table>
<thead>
<tr>
<th></th>
<th>High</th>
<th>Low</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>64</td>
<td>37</td>
<td>51.4</td>
<td>7.7</td>
</tr>
<tr>
<td>Years of Teaching Experience</td>
<td>17</td>
<td>0</td>
<td>8.2</td>
<td>4.6</td>
</tr>
<tr>
<td>Years of Administrative Experience</td>
<td>37</td>
<td>8</td>
<td>19.4</td>
<td>7.9</td>
</tr>
<tr>
<td>Years in Present Position</td>
<td>30</td>
<td>5</td>
<td>11.8</td>
<td>6.4</td>
</tr>
<tr>
<td>Year of Last Graduate Study</td>
<td>1966</td>
<td>1938</td>
<td>1955</td>
<td>7.7</td>
</tr>
</tbody>
</table>

On the average the superintendents of schools in the study were
51 years old, had taught for eight years, had been administrators for
19 years, and had been in their present position for 11 years. One
superintendent in the sample had a Ph.D. degree; all of the others had
masters degrees. All of the superintendents were male.

Any interpretation of these data should be made in the knowledge
that several criteria were used in the selection of the sample so that
extensive generalization to the total population of school superintend-
ents would be quite inappropriate. One criterion for superintendents to
be included in the sample was a minimum of five years' tenure in their
present position. Hence, every superintendent in the sample had
longer tenure than approximately half of the superintendents in Ohio in
general. Other limiting criteria were district enrollment and organization.

**Testing the Hypotheses**

The purpose of this investigation was to test two hypotheses.

1. There are no differences in the personality factors of superintendents of highly adoptive school districts and the personality factors of superintendents of less adoptive school districts.

2. There is no relationship between personality factors of superintendents of schools and the adoptiveness of school districts.

To test the first hypothesis, the superintendents of school districts in the sample were placed in two groups on the basis of school district scores on the Adoptiveness Scale. The superintendents of the twenty districts with the highest adoptiveness scores were placed in one group and the superintendents of the twenty-one districts with the lowest adoptiveness scores were placed in a second group. Scores of the twenty districts with highest adoptiveness scores ranged from 65.00 to 71.40. Scores of the twenty-one districts with lowest adoptiveness scores ranged from 57.47 to 63.52. The mean scores for each group on each of the 16 primary and four second-order personality factors were then determined. Finally, a statistical test of the significance of the difference between mean scores was made. Table 7 shows the mean scores of each group on each personality factor and
## TABLE 7
MEAN PERSONALITY FACTOR SCORES FOR SUPERINTENDENTS OF HIGH AND LOW ADOPTIVE SCHOOL DISTRICTS

<table>
<thead>
<tr>
<th>Personality Factor</th>
<th>Mean Score</th>
<th>High Adoptive</th>
<th>Low Adoptive</th>
<th>t test of Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>12.20</td>
<td>11.09</td>
<td>1.01</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>8.35</td>
<td>8.52</td>
<td>.33</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>17.60</td>
<td>15.52</td>
<td>1.94</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>12.15</td>
<td>11.81</td>
<td>.29</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>12.55</td>
<td>10.81</td>
<td>1.45</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>15.90</td>
<td>15.71</td>
<td>.22</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>14.50</td>
<td>12.62</td>
<td>1.18</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>8.95</td>
<td>10.05</td>
<td>1.17</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>7.90</td>
<td>8.52</td>
<td>.64</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>11.80</td>
<td>11.29</td>
<td>.56</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>11.60</td>
<td>11.67</td>
<td>.09</td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>7.45</td>
<td>8.09</td>
<td>.67</td>
<td></td>
</tr>
<tr>
<td>Q1</td>
<td>9.55</td>
<td>9.33</td>
<td>.29</td>
<td></td>
</tr>
<tr>
<td>Q2</td>
<td>8.60</td>
<td>10.33</td>
<td>1.51</td>
<td></td>
</tr>
<tr>
<td>Q3</td>
<td>10.00</td>
<td>10.00</td>
<td>.00</td>
<td></td>
</tr>
<tr>
<td>Q4</td>
<td>13.20</td>
<td>13.24</td>
<td>.04</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>45.40</td>
<td>50.76</td>
<td>.91</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>57.60</td>
<td>47.05</td>
<td>1.60</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>47.80</td>
<td>43.38</td>
<td>1.07</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>39.20</td>
<td>42.81</td>
<td>.69</td>
<td></td>
</tr>
</tbody>
</table>

To be significant at the .05 level, t must be 2.02 or higher with 39 degrees of freedom.
the value of the "t" ratio determined to test the significance of the
difference between means. With 39 degrees of freedom (N - 2) "t"
must be 2.02 to be significant at the .05 level. None of the differences
was found to be significant. On the basis of this test the null hypothe­
sis must be accepted and it may be assumed that there are no statisti­
cally significant differences in the personality factors of superintendents
of highly adoptive school districts and the personality factors of super­
intendents of less adoptive school districts.

To test the second hypothesis coefficients of correlation be­
tween superintendents' scores on each of the 16 primary personality
factors and the four second-order factors and the adoptiveness scores
for the forty-one school districts were determined. These correlations
appear in Table 8. With 39 degrees of freedom (N - 2) the coefficient
of correlation must be .321 to be significant at the .05 level. No
correlation was large enough to be significant at this level and on the
basis of this test the null hypothesis must be accepted. It may be
assumed that there is no statistically significant relationship between
personality factors of superintendents of schools and the adoptiveness
of school districts.

To further test the hypothesis that there is no relationship be­
tween the personality factors of superintendents of schools and
adoptiveness, a multiple correlation coefficient was determined
### TABLE 8

**COEFFICIENTS OF CORRELATION BETWEEN ADOPTIVENESS AND PERSONALITY FACTORS**

<table>
<thead>
<tr>
<th>Personality Factor</th>
<th>Correlation</th>
<th>Personality Factor</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>.234</td>
<td>N</td>
<td>-.083</td>
</tr>
<tr>
<td>B</td>
<td>-.039</td>
<td>O</td>
<td>-.130</td>
</tr>
<tr>
<td>C</td>
<td>.091</td>
<td>Q1</td>
<td>-.005</td>
</tr>
<tr>
<td>E</td>
<td>-.026</td>
<td>Q2</td>
<td>-.235</td>
</tr>
<tr>
<td>F</td>
<td>.202</td>
<td>Q3</td>
<td>.135</td>
</tr>
<tr>
<td>G</td>
<td>.103</td>
<td>Q4</td>
<td>-.071</td>
</tr>
<tr>
<td>H</td>
<td>.121</td>
<td>I</td>
<td>.034</td>
</tr>
<tr>
<td>I</td>
<td>-.092</td>
<td>II</td>
<td>.219</td>
</tr>
<tr>
<td>L</td>
<td>-.082</td>
<td>III</td>
<td>-.043</td>
</tr>
<tr>
<td>M</td>
<td>.056</td>
<td>IV</td>
<td>-.217</td>
</tr>
</tbody>
</table>

With 39 degrees of freedom (N - 2) correlation must be .32 to be significant at the .05 level or .413 to be significant at the .01 level.

between the 16 primary personality factor scores on the Sixteen Personality Factor Questionnaire and scores on the Adoptiveness Scale. A multiple correlation of .54 was found with an F ratio of .62 which was insufficient to reach significance at the .05 level.

Using the scores on the four second-order personality factors as independent variables, a multiple correlation coefficient of .28 was obtained with adoptiveness scores. The F ratio was .77 which was not sufficient to reach the .05 level of confidence.
Although not stated as hypotheses to be tested, the possible existence of relationships between adoptiveness and other factors for which data were obtained in this study was investigated. Specifically, coefficients of correlation between adoptiveness scores and the superintendent's age, teaching experience, administrative experience, years in present position, and year of last graduate work; and the school district enrollment, and valuation per pupil were determined. These coefficients of correlation appear in Table 9. To be significant with 39 degrees of freedom, a correlation must be .321 at the .05 level and .413 at the .01 level. The correlation of .436 between enrollment and adoptiveness is significant beyond the .01 level and the negative correlation of -.357 between teaching experience and adoptiveness is significant beyond the .05 level. Correlations between the other variables and adoptiveness scores failed to reach the .05 level of significance. Thus it appears that school districts with higher adoptiveness scores tend to have higher enrollments and superintendents who have had less teaching experience.

While they were not statistically significant, small negative correlations were obtained between adoptiveness scores and the superintendent's age, administrative experience, and years in present position. This finding suggests the possibility that superintendents in more adoptive districts may be younger, have less total administrative
TABLE 9

COEFFICIENTS OF CORRELATION BETWEEN ADOPTIVENESS SCORES AND OTHER VARIABLES

<table>
<thead>
<tr>
<th>Variable</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-.266</td>
</tr>
<tr>
<td>Teaching Experience</td>
<td>-.357*</td>
</tr>
<tr>
<td>Administrative Experience</td>
<td>-.020</td>
</tr>
<tr>
<td>Years in Present Position</td>
<td>-.159</td>
</tr>
<tr>
<td>Recency of Graduate Work</td>
<td>.168</td>
</tr>
<tr>
<td>Valuation Per Pupil</td>
<td>.050</td>
</tr>
<tr>
<td>Enrollment</td>
<td>.436**</td>
</tr>
</tbody>
</table>

With 39 degrees of freedom (N - 2) correlation must be .321 to be significant at the .05 level or .413 to be significant at the .01 level.

*Significant at the .05 level.

**Significant at the .01 level.

experience, and be newer in their present position than superintendents of less adoptive districts. The correlations are small, however, and in view of the size of the sample may be due to chance.

The very small correlation of .05 between valuation per pupil and adoptiveness suggests that the availability of local tax resources is not an important variable in accounting for adoptiveness.

The final statistical testing of the data involved utilization of a computer program known as "Stepwise Regression." The objective in employing this program was to determine if any combination of variables
for which data from this study were available would be predictive of adoptiveness.

The "Stepwise Regression" program is designed to compute the partial correlations of a number of independent variables with a dependent variable. Having done this, it then selects the variable with the highest partial correlation and significance level and computes the correlation between it and the dependent variable. Partial correlations of the remaining variables with the dependent variable are then recomputed and again the variable with the highest partial correlation and significance level is removed. This variable is added to the previously selected variable or variables and a multiple correlation between these variables and the independent variable is determined. The process is repeated, each time selecting the variable with the highest partial correlation and significance level, adding it to previously selected variables, and computing a multiple correlation between the selected variables and the independent variable. The program not only provides the multiple correlation between the most predictive independent variables and the dependent variable, but it also obtains regression coefficients for each variable and a regression equation.

For this test all of the personality factor scores, both primary and second-order factors, the superintendent's age, teaching experience, administrative experience, years in present position, and year of
last graduate work; and school district enrollment and valuation per
pupil were taken as independent variables. Adoptiveness scores were
taken as the dependent variable.

In the first step, school district enrollment, of all the variables,
was found to have the highest partial correlation (0.436), as well as the
highest F ratio (9.198), which was significant beyond the .01 level.
With one and 38 degrees of freedom F must be 7.35 to be significant at
the .01 level. In the second step, Second-order Personality Factor IV,
with a partial correlation of -.317 and an F ratio of 4.258, significant
beyond the .05 level, was selected as the variable to be combined
with enrollment to make the best improvement in prediction of adopt-
iveness scores. A multiple correlation of .52 was obtained between
these two variables and adoptiveness scores. With two and 38 de-
grees of freedom the F ratio of 7.112 is significant beyond the .01 level.

In the third step, of variables not previously selected, the
superintendent's teaching experience became the variable with highest
partial correlation and F ratio. The partial correlation was -.39 with
an F ratio of 6.685 which was significant beyond the .05 level. The
negative correlation indicates an inverse relationship between teaching
experience and adoptiveness scores so that the less teaching experi-
ence a superintendent had the higher the adoptiveness score tended to
be.
When the superintendent's teaching experience was added to
the previously selected variables, a multiple correlation of .619 was
obtained between adoptiveness scores and the three independent
variables--enrollment, teaching experience, and Personality Factor IV.
The F ratio for the multiple correlation was 7.680, significant beyond
the .001 level. This highly significant multiple correlation indicates
a striking relationship between the three independent variables and
the dependent variable, adoptiveness.

The statistical significance of the multiple correlation between
adoptiveness and school district enrollment, superintendent's teaching
experience, and Personality Factor IV was examined. Statisticians
warn that multiple correlations computed from a sample tend to be
"inflated" with respect to the correlation in the population because of
the accumulation of chance errors.\(^{20}\) Garrett provides the following
formula to correct or "shrink" an obtained multiple correlation to give
a better measure of the correlation for the population.\(^{21}\)

\[^{20}\text{Henry E. Garrett, Statistics in Psychology and Education,}

\[^{21}\text{Ibid., p. 417.}\]
\[
\bar{R}_c^2 = 1 - k^2 \frac{(N - 1)}{(N - m)}
\]

where

- \(N\) = size of the sample
- \(m\) = number of variables in the problem
- \((N - m)\) = degrees of freedom
- \(k^2 = (1 - R^2)\)

Applying this formula to the multiple correlation of .619 for the sample a corrected correlation of .59 for the population is obtained. The difference between the sample and population correlations obviously is negligible.

Using the formula\textsuperscript{22}

\[
SE_R = \frac{1 - R^2}{\sqrt{N - m}}
\]

the standard error for the obtained multiple correlation of .619 is found to be .100 indicating that the chances are 95 in 100 that the correlation for the population is between .42 and .81 (.619 ± 1.96 \times .100).

The accuracy of prediction of adoptiveness scores from school district enrollment, teaching experience of the superintendent, and

\textsuperscript{22}ibid., p. 416.
Personality Factor IV scores is indicated by the standard error of estimate which is 3.2559. The chances are 2 in 3 that any predicted score will lie within ± 3.2559 points of the true score. Looking at the standard deviation of the adoptiveness scores in the sample it may be seen that a prediction that the mean adoptiveness score (the best "guess" which could be made) would be the actual score for any school in the population would not miss the actual score by more than ± 4 points in 2 out of 3 predictions. By comparison, it is apparent that prediction from the regression equation improves the forecast over chance but that the improvement is not great. The evidence is quite clear, however, that there is a significant though perhaps small, relationship between adoptiveness and school district enrollment, Personality Factor IV, and superintendent's teaching experience. Using the technique of squaring the coefficient of multiple correlation it appears that approximately one-third of the variability in adoptiveness is being accounted for by these three variables.

The Stepwise Regression program was continued through 31 steps, always adding to the regression equation in each step the next most significant variable or removing from the equation variables previously added which subsequently failed to enhance the equation. Table 10 summarizes the findings. For discussion in this analysis, however, further consideration was not given to variables other than
<table>
<thead>
<tr>
<th>Step Number</th>
<th>Variable Entered</th>
<th>Multiple R</th>
<th>Multiple $R^2$</th>
<th>Increase in $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Enrollment</td>
<td>.4368</td>
<td>.1908</td>
<td>.1908</td>
</tr>
<tr>
<td>2</td>
<td>P.F. IV</td>
<td>.5219</td>
<td>.2724</td>
<td>.0815</td>
</tr>
<tr>
<td>3</td>
<td>Teach. Exp.</td>
<td>.6195</td>
<td>.3837</td>
<td>.1114</td>
</tr>
<tr>
<td>4</td>
<td>P.F. I (i)</td>
<td>.6550</td>
<td>.4291</td>
<td>.0453</td>
</tr>
<tr>
<td>5</td>
<td>Age</td>
<td>.6979</td>
<td>.4870</td>
<td>.0580</td>
</tr>
<tr>
<td>6</td>
<td>P.F. Q3</td>
<td>.7333</td>
<td>.5377</td>
<td>.0507</td>
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<tr>
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enrollment, Personality Factor IV, and teaching experience since the partial correlations of the remaining factors failed to reach the .05 level of significance.

**Summary**

Two hypotheses were posed in this study to investigate possible relationships between the adoption of educational innovations and the personality of the superintendent of schools.

1. There are no differences in the personality factors of superintendents of highly adoptive school districts and the personality factors of superintendents of less adoptive school districts.

2. There is no relationship between personality factors of superintendents of schools and the adoptiveness of school districts.

Comparison of the differences in mean scores on each of 16 primary personality factors and four second-order personality factors revealed no statistically significant differences in these factors between the superintendents of the 20 most adoptive school districts in the study and the superintendents of the 21 least adoptive districts.

Calculation of coefficients of correlation revealed no statistically significant relationships between the 16 primary personality factors and four second-order factors and scores on the Adoptiveness Scale.
Significant correlations were found between adoptiveness scores and the superintendent's teaching experience and between adoptiveness scores and school district enrollment. In the case of teaching experience the correlation was \(-.358\) and significant beyond the .05 level, indicating that, in general, the superintendents of more adoptive school districts have had less teaching experience than those in less adoptive districts.

A positive correlation of \(.437\), significant beyond the .01 level, was found between adoptiveness scores and school district enrollment. It may be inferred from this finding that larger school districts tend to be more adoptive than smaller districts.

Multiple correlations of \(.54\) between adoptiveness scores and the 16 primary personality factors and \(.28\) between adoptiveness scores and the four second-order personality factors failed to reach significance at the .05 level, again upholding the null hypotheses.

By means of a stepwise regression procedure three variables—school district enrollment, Personality Factor IV, and superintendent's teaching experience—were isolated and found to have a multiple correlation of \(.619\), significant beyond the .001 level, with adoptiveness scores. This finding is quite significant to the focus of this study. While personality factors of the superintendent taken alone or even in combination with each other failed to appear significantly
related to adoptiveness, when taken in combination with two other variables—district enrollment and teaching experience—one of the personality factors considerably improved prediction of adoptiveness scores by means of a multiple regression procedure. Addition of Personality Factor IV to enrollment improved the multiple correlation from .437 to .521. While enrollment alone accounted for approximately 19 per cent of the variability in adoptiveness scores, the addition of Personality Factor IV increased the proportion of variance accounted for by eight per cent to 27 per cent of the variability in adoptiveness scores accounted for. Adding teaching experience to the regression equation raises the multiple correlation to .619 and the three variables together now account for 38 per cent of the variance in adoptiveness scores.
CHAPTER V

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

Summary

The importance of this study rests upon the assumption that in a dynamic society changes in that society's institutions, specifically its schools, are essential if those institutions are to achieve their purposes. The problems confronting a society change and if the institutions devised to cope with such problems do not change they cannot be effective. Specific, short-range objectives, if not long-range goals, of education must change as the problems of society change. Technical developments provide new tools for dealing with both the old and the new problems. Alterations in objectives, the new "hardware" to meet the objectives, new knowledge, and changing values all suggest different structures--different organizations--for attaining ends. In short, the world changes, so change in education is essential. Failure to change must result in failure to be effective.

Much of the change in the public schools of America results from the adoption of innovations that are developed outside of local
schools. Few school systems engage in the kind of research and development activity which produces major changes in education. That is not to say, of course, that there is no local innovative activity. But for most schools, innovations of the magnitude of the recent curriculum reforms in science and mathematics, so-called "teaching machines," and team teaching, to name some examples, are adopted after having been developed elsewhere. It is change in the form of adoption of innovations toward which this study was focused.

A current concern with respect to change in education is whether such change is to be planned or fortuitous. Consequently, considerable study has been made of the process of change. Some of the findings of such research were reported in Chapter II of this study. From this review it is apparent that much is known about change, how it occurs, and how it may be brought about. It is also apparent that there are gaps in the knowledge about change in education. Among these gaps is knowledge about the superintendent of schools and his relationship to change.

A number of authorities have supported the assumption that in the hierarchical organization of American schools, the superintendent of schools is a key figure in the adoption of innovations. Based upon this assumption, it has been asserted that the superintendent may be active or passive in the adoption of new ideas, but in either case,
given his position of potential authority, he is a crucial figure in the adoption process.

Raymond P. Cattell has advanced a theory of personality which states that individual behavior is the function of one's personality in a given situation. On the basis of this theory it was hypothesized that there would be a relationship between the personality factors of superintendents of schools and the adoption of innovations in the school district. Obviously, other factors would also affect the adoption of innovations. The personality of the superintendent would be but one of a number of variables. But it was one which had not been investigated previously and, in view of Cattell's theory, it offered some promise of fruitful inquiry.

Two hypotheses were proposed. For convenience in applying statistical tests they were stated in the null form as follows:

1. There are no differences in the personality factors of superintendents of highly adoptive school districts and the personality factors of superintendents of less adoptive school districts.

2. There is no relationship between the personality factors of superintendents of schools and the adoptiveness of school districts.

Adoptiveness was defined as a propensity for adoption as evidenced by the incorporation of new procedures or organizational patterns into some part of the operation or structure of the school
system. The Adoptiveness Scale consisting of 16 innovations in education was devised to evaluate adoptiveness in terms of number of adoptions and time of adoption. Personality was defined as "the dynamic organization within the individual of those need-dispositions and abilities that determine his unique interaction with the environment." Personality was measured by means of the Sixteen Personality Factor Questionnaire in terms of 16 primary and four second-order personality factors.

Data consisting of the scores on the Sixteen Personality Factor Questionnaire, the age, teaching experience, administrative experience, recency of graduate study, and years in present position of the superintendent of schools, and the enrollment, valuation per pupil, and adoptiveness scores of the school district were obtained from State Department of Education records and from questionnaires completed by the superintendents of 41 school districts in Ohio. These schools constituted a random sample of 227 school districts in Ohio stratified according to valuation per pupil, meeting criteria of enrollment, organization, and tenure of the superintendent. Data obtained from these instruments are reported in detail in Chapter IV of this study.
**Major Findings**

Statistical tests of the differences between the mean scores on the Sixteen Personality Factor Questionnaire of the superintendents of the 20 school districts with the highest adoptiveness scores and those of the 21 districts with the lowest adoptiveness scores revealed that these differences were not significant beyond chance at the .05 level. This finding would not support rejection of the first null hypothesis.

A second statistical test of the data involved computation of coefficients of correlation between the scores on each of the factors in the Sixteen Personality Factor Questionnaire and adoptiveness. None of the correlations reached significance at the .05 level.

Multiple correlation between the 16 primary personality factors in combination and adoptiveness and between the four second-order personality factors and adoptiveness also failed to reach the .05 level of significance.

These statistical tests, therefore, provided no support for rejecting the second hypothesis which stated that there is no relationship between personality factors of superintendents of schools and adoptiveness of school districts.

While analysis of the data at this point appeared to vitiate the proposition that school district adoptiveness and the superintendent's
personality were related, some significant relationships did appear between adoptiveness and two other variables for which data were obtained. A notable correlation of .436, significant beyond the .01 level, was found between adoptiveness and school district enrollment. Furthermore, the years of teaching experience superintendents had appeared to be inversely related to adoptiveness so that the superintendents of more adoptive school districts tended to have had fewer years of teaching experience than superintendents of less adoptive school districts. The correlation between these variables was -.357, attaining a level of significance beyond .05.

Correlations between adoptiveness scores and the superintendent's age, total administrative experience, years in his present position and recency of graduate work were not statistically significant. Small correlations found between age, administrative experience, and years in present position were all negative, suggesting the possibility that superintendents in more adoptive districts may tend to be somewhat younger, have less administrative experience, and be newer in their present jobs. These correlations, however, are small and in view of the sample size may be due to chance.

The very small correlation of .05 between valuation per pupil and adoptiveness suggests that availability of local tax resources is
not an important variable in accounting for adoptiveness. A similar finding has been reported by Hughes.¹

The finding that adoptiveness was significantly correlated with enrollment and the superintendent's teaching experience led to additional analysis of the data. It had been recognized from the outset of the investigation that the adoption of innovations in a school district was due to a variety of factors; no single variable alone—the superintendent's personality nor any other—was thought to account for adoptiveness. The difficulty of identifying all of these variables, to say nothing of controlling them, was thought to be beyond the limits within which this study had to be conducted. Some opportunity for control was provided, however, by collecting data on such factors as the superintendent's age, teaching experience, administrative experience, tenure in present position, and recency of graduate work, as well as the enrollment and per pupil valuation of the school district. Finding that two of these variables had significant correlations with adoptiveness, a question was raised as to whether or not significant relationships between some personality factors and adoptiveness might appear if the effect of some of the other variables could be controlled.

¹Hughes, op. cit.
To test for this possibility a computer program known as "Stepwise Regression" was employed. A more detailed description of the program is given in Chapter III but briefly it may be described as one which systematically selects from a number of independent variables those variables which may be combined in a multiple regression equation to produce the best prediction of a dependent, or criterion, variable. In the present case, 27 independent variables for which data had been obtained were submitted for analysis.

In the first step of the "Stepwise Regression" program, school district enrollment was selected from the 27 variables as the single variable which was most predictive of adoptiveness. The correlation with adoptiveness scores was .432 and significant beyond the .01 level. In the second step, Second-order Personality Factor IV, Subduedness versus Independence, was selected as the variable which would best improve the prediction of adoptiveness scores. Combining Factor IV and enrollment produced a multiple correlation of .52 which was significant beyond the .01 level.

In the third step of the stepwise regression program, the superintendent's teaching experience was selected as the variable which could be combined with the previously selected variables to improve prediction of adoptiveness. A multiple correlation of .619 was obtained which was significant beyond the .001 level. The "Stepwise
Regression program was continued through 28 more steps but the partial correlations of other variables failed to reach the .05 level of significance and their addition to the multiple regression equation, while increasing the multiple correlation coefficient, did not improve its significance.

As far as personality is concerned, the significance of this finding is that, when the effect of two other variables—enrollment and the superintendent's teaching experiences—are taken into account, Personality Factor IV in the superintendent contributes significantly to the prediction of adoptiveness in the school district. Although the magnitude of this variable's contribution is not large, accounting for only about eight per cent of the variability in adoptiveness scores, statistically it is quite significant.

Conclusions

Enrollment

The finding that enrollment is significantly related to adoptiveness is consistent with findings by Carlson in Pennsylvania and West Virginia. In his Pennsylvania sample Carlson found a correlation of .32, significant at the .05 level, between enrollment and adoptiveness. In West Virginia the correlation was .50, also significant at the

2Carlson, op. cit.
.05 level. The correlation of .43 between enrollment and adoptiveness found in the present study tends to corroborate Carlson's findings. The magnitude of these correlations suggests that from 10 to 25 per cent of the variability in adoptiveness can be accounted for in the relationship it bears to enrollment. In the present study some control was exercised over this variable by restricting the population studied to districts in the 1,000 to 10,000 pupil range. Even within this restricted range adoptiveness varies considerably with enrollment. In restricting the sample for this study on the enrollment criterion it was reasoned that greater opportunity for adoption, or trial, exists in larger districts. A district with several elementary schools, for example, might be more willing to risk trial of an innovation in a single school than a district which had only one elementary school. The evidence from this investigation, of course, does not directly support this reasoning. The evidence that enrollment and adoptiveness are related, however, is compelling.

**Teaching experience**

The inverse relationship between adoptiveness and the superintendent's years of teaching experience may support the thinking of some contemporary writers who question teaching experience as the most appropriate preparation for administrators. Roald Campbell has
suggested that insistence that superintendents have prior experience as teachers and principals "makes almost certain that prospective superintendents are socialized in the roles of teacher and of principal." 3

He continues:

   In a stable society and a stable school this type of induction may be very effective but when new conditions create new demands upon the school, socialization of the inexperienced by the experienced may be a stultifying approach. 4

The evidence from this study seems to support the contention that innovations are less likely to be adopted in districts with superintendents who have had longer periods of "socialization" as teachers.

Personality

   Approximately 20 per cent of the variability in adoptiveness scores is accounted for by the correlation of .436 with enrollment. An additional seven per cent of the variability may be accounted for when the scores on Personality Factor IV are added to enrollment producing a multiple correlation of .522 with adoptiveness. The increase is small but its presence suggests that with the variability in enrollment held constant at least one factor of the superintendent's personality is significantly related to the adoptiveness of school districts.

3Roald F. Campbell, "Is the School Superintendent Obsolete?" Phi Delta Kappan, 48 (October, 1966), pp. 50-58.

4Ibid.
Factor IV is a second-order personality factor derived from scores on primary personality factors E (Dominance or Ascendence versus Submission), M (Autia versus Praxernia), Q1 (Radicalism versus Conservatism), and Q2 (Self-sufficiency versus Group dependency) as positive factors and Factors A (Cyclothymia versus Schizothymia) and G (Character or Superego Strength versus Lack of rigid internal standards) as negative factors. In general, high scores on Factor IV are associated with persons who are independent, aggressive, daring, and incisive. Low scores are related to characteristics of subduedness, group dependency, and passiveness. Since the regression coefficient in the regression equation and the correlation coefficient between Factor IV and adoptiveness are negative, it is the low scorer, the more subdued individual, who appears to be most often found as the superintendent of the more adoptive school district.

From examination of the primary personality factors which comprise Factor IV it appears that the superintendent of the more adoptive district tends to be more submissive, dependent, kindly, soft-hearted, expressive, conventional, easily upset, and self-sufficient. He is likely to be more alert to practical needs and his interests may be

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5Descriptive phrases are taken from Raymond B. Cattell, and Herbert W. Eber, Handbook for the Sixteen Personality Factor Questionnaire, and Cattell and Eber, Manual for Forms A and B, Sixteen Personality Factor Questionnaire.
narrowed to immediate issues. He may lack spontaneous creativity but he has sound, realistic, dependable, practical judgment. He may be earnest, concerned, and even worried, but very steady. He tends toward conservatism as opposed to radicalism and is group dependent rather than self-sufficient and resourceful. He may be characterized as warm, sociable, good natured, and easy going. He is cooperative, attentive to people, soft-hearted, kindly, trustful, adaptable, and warm-hearted. He is perservering, determined, and responsible. He is emotionally mature, consistently ordered, conscientious, and attentive to people.

One's first impression in looking at these descriptions of the source traits associated with superintendents of adoptive school districts may be that they are almost the opposite of what is expected. "Submissive," "dependent," "conventional," "conservative," are terms one would not usually associate with innovativeness. It should be remembered, however, that it is the adoption of innovations, not their creation, which was the object of inquiry. The criterion measure was adoptiveness--the incorporation into the school system of practices and procedures already developed elsewhere. None of the innovations included in the adoptiveness scale was invented or created within a district in the sample. Wherever it appeared, it had been adopted from outside the district. Adoption is not a creative act and, in fact,
in terms of group dynamics may be quite the opposite. It may be that it is in part the need to conform which leads to adoption. The personality characteristics of superintendents in the most adoptive school districts reveal them to be "group dependent," "sociable," "cooperative," "attentive to people," and "adaptable." They tend to be group oriented rather than independent. While it is reasonable to associate creativity with aggressiveness, daring, and independence--characteristics associated with high Factor IV scores--it may be reasonable to expect adoption of ready-made ideas to be associated with leaders who are more group-conscious.

Some of the research on diffusion and adoption of innovations reported by Rogers and Lionberger found the early adopter, or innovator, to be something of a deviate. He seemed not to be concerned with group norms as might one who scores high on Factor IV. This research, however, usually dealt with individual farmers rather than organizations, such as schools, as adopters. It may be that organizations need leadership which is more attentive to group desires in order to adopt new ideas, while the individual adopter must be willing to ignore group norms.

It must be emphasized that even though the role of the superintendent may be crucial in the adoption of innovations in schools, there is no doubt that variables other than the superintendent of schools
are operating to account for this phenomenon. From this study and others it is clear that enrollment is one of these variables and that it is an important one. The strongest and most significant conclusion to be drawn from this study is that adoption of educational innovations of the type included in the Adoptiveness Scale employed in this study is most likely to occur in larger school districts whose superintendents score low on Personality Factor IV, Subduedness versus Independence, and who have had relatively less classroom teaching experience.

Implications

Implications for practice

Perhaps the most impressive implication for educational practice to come from this study derives not from the findings relative to personality but from the findings relative to school district enrollment. The evidence from this study indicates a positive relationship between enrollment and adoptiveness. From this investigation it appears that almost 20 per cent of the variability in adoptiveness is accounted for by enrollment. The implication seems very clear that adoption of innovations of the type represented by the Adoptiveness Scale is more likely to occur in districts above 2,000 enrollment. Sixty-five per cent of the districts scoring above the mean on the Adoptiveness Scale had enrollments of 2,000 or above while only 19 per cent of
those below the mean had enrollments that high. Eighty-one per cent of the less adoptive districts were below 2,000 in enrollment. See Table 11.

Table 11

<table>
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<th>Years of Teaching Experience</th>
<th>Number of Superintendents At or Above Mean</th>
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<td>7</td>
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</tr>
<tr>
<td>11 - 15</td>
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<td>8</td>
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<td>Totals</td>
<td>20</td>
<td>21</td>
</tr>
</tbody>
</table>

A second implication for educational practice to be derived from this study also is related to an incidental finding rather than to personality, which was the primary focus of the investigation. The evidence from this inquiry suggests that adoption of innovations of the type included in the Adoptiveness Scale is more likely to occur in districts where the superintendent has had ten or fewer years of teaching experience before becoming an administrator. In this study 80 per cent of the superintendents in the most adoptive districts had 10 or fewer years of teaching experience while in the least adoptive districts
52 per cent had more than 10 years teaching experience. See Table 12. Multiple regression analysis indicated that the superintendent's teaching experience accounted for 11 per cent of the variability in adoptiveness scores in this study. The implication is rather strong that if adoption of innovations of the type included on the Adoptiveness Scale is desired superintendents should be employed who have not had extensive classroom teaching experience before becoming administrators.

### TABLE 12

**NUMBER OF SCHOOL DISTRICTS ABOVE AND BELOW MEAN ADOPTIVENESS SCORE BY ENROLLMENT**

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<th>Enrollment</th>
<th>Number of Districts At or Above Mean</th>
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</tr>
<tr>
<td>2000-2999</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>3000-3999</td>
<td>5</td>
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<td>1</td>
<td>0</td>
</tr>
<tr>
<td>5000 and above</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>21</td>
</tr>
</tbody>
</table>

The findings relative to the superintendent's personality must be interpreted with caution in drawing implications for practice. While the relationship of Personality Factor IV to adoptiveness in the multiple regression equation is highly significant, its contribution to the
prediction of adoptiveness is relatively small. Only about eight per cent of the variability in adoptiveness scores is accounted for by scores on Factor IV. To be sure, this is a significant finding. There is little question that when other variables such as enrollment and teaching experience are controlled this second-order personality factor bears significantly upon adoptiveness. It does not, however, appear to be of sufficient magnitude to suggest usefulness in the selection of educational administrators.

Implications for research

The findings of this study suggest very strongly that when other variables are controlled some aspects of personality relate significantly to adoptiveness. Even though this relationship is not of sufficient magnitude to suggest utility in selection of administrators it does support the thesis that personality is sufficiently related to adoptiveness to warrant further inquiry. There can be no doubt that the adoption of innovations in education is a complex phenomenon and that a great many variables must be identified to account for it. A limitation of this study was the inability to control the many variables other than personality which affect adoptiveness. Other investigators with greater resources may be able to provide those controls. Results of this study have provided a revealing glimpse of personality as a
variable in adoptiveness. While it is seen but fleetingly through a number of other variables, its existence has been established. It remains for others to grasp this bit of evidence and finally to establish its unquestioned existence.
APPENDIX A

LETTER TO SUPERINTENDENTS
It seems to us that there are some important questions that need to be answered about change in education - the process by which it occurs, the setting in which it takes place, and its quality. We believe that data relative to these questions would be pertinent to our broad concern for school district organization in Ohio.

An inquiry into this area is being conducted by John Allen as a doctoral dissertation at The Ohio State University. Your help is needed to complete the study. A sample of Ohio school districts has been carefully selected to represent school districts of various size, financial resources, and organization. Your district is a part of that selected sample.

We would appreciate it very much if you would take a few minutes to complete the enclosed survey questionnaire. Because of the sampling technique employed, the success of the study and its potential contribution to improvement in education are dependent upon your participation. A stamped, self-addressed envelope is enclosed for your convenience in returning the completed questionnaire.

You may be assured that all information will be confidential and that no identification of the data with individual schools will be made in the report.

Sincerely yours,

Ralph D. Purdy
Project Director

John E. Allen
Research Assistant
APPENDIX B

SECOND LETTER TO SUPERINTENDENTS
Thank you for taking part in the initial phase of the study of the adoption of selected educational practices by schools in Ohio. A summary of some of the preliminary findings is enclosed. More detailed analysis of the data will be made to be incorporated into the overall study of school district organization.

I would now like to ask you to take part in the final phase of the study which, while not a part of the school district organization study, will be an important aspect of the total research I am undertaking. It is specifically concerned with the relationship between the interests and attitudes of superintendents of schools and the kinds of practices that are adopted in schools.

Two questionnaires are enclosed which, if you will complete them, will provide the information needed to conclude the study. One questionnaire asks for some basic personal data about yourself; the other is about some of your interests and attitudes. The latter is a standardized instrument designed for this purpose in order that comparable data may be obtained. It will take 30-45 minutes of your time to complete.

Again, I need to stress that the selection of school districts to be included in the study followed a rigid sampling procedure. The success of the study, therefore, depends upon obtaining information from every school in the sample. You may be assured that all data will be treated confidentially and that no identification of individual school districts or superintendents with the data will be used in any report. Please return the 16 PF Questionnaire, the 16 PF Answer Sheet, and the Personal Data Questionnaire in the enclosed stamped, self-addressed envelope.

I will be most grateful for your help.

Sincerely yours,

John E. Allen, Research Assistant
School District Organization Project
APPENDIX C

ADOPTIVENESS SCALE
Please indicate in the space provided the school year in which your school district first tried any of the following practices. Year of first trial would be the school year in which the practice was introduced on a trial, experimental, or permanent basis.

Please draw a line through any of the practices which were tried but subsequently discontinued.

<table>
<thead>
<tr>
<th>School Year</th>
<th>Practice</th>
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</thead>
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<td>___________</td>
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</tr>
<tr>
<td>___________</td>
<td>Nongraded or ungraded organization</td>
</tr>
<tr>
<td>___________</td>
<td>Modern mathematics (SMSG, Greater Cleveland, etc.)</td>
</tr>
<tr>
<td>___________</td>
<td>Team teaching</td>
</tr>
<tr>
<td>___________</td>
<td>Programmed instruction or teaching machines</td>
</tr>
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<td>___________</td>
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APPENDIX D

SIXTEEN PERSONALITY FACTOR QUESTIONNAIRE
WHAT TO DO: Inside this booklet are some questions to see what attitudes and interests you have. There are no "right" and "wrong" answers because everyone has the right to his own views. To be able to get the best advice from your results, you will want to answer them exactly and truly.

If a separate "Answer Sheet" has not been given to you, turn this booklet over and tear off the Answer Sheet on the back page.

Write your name and other particulars at the top of the Answer Sheet.

First, you should answer the four sample questions below so that you can see whether you need to ask anything before starting. Although you are to read the questions in this booklet, you must record your answers on the answer sheet (alongside the same number as in the booklet).

There are three possible answers to each question. Read the following examples and mark your answers at the top of your answer sheet where it says "Examples." Put a mark, x, in the left-hand box if your answer choice is the "a" answer, in the middle box if your answer choice is the "b" answer, and in the right-hand box if you choose the "c" answer.

EXAMPLES:

1. I like to watch team games. (a) yes, (b) occasionally, (c) no.

2. I prefer people who:
   (a) are reserved, (b) (are) in between, (c) make friends quickly.

3. Money cannot bring happiness, (a) yes (true), (b) in between, (c) no (false).

4. Woman is to child as cat is to: (a) kitten, (b) dog, (c) boy.

   In the last example there is a right answer--kitten. But there are very few such reasoning items among the questions.

Ask now if anything is not clear. The examiner will tell you in a moment to turn the page and start.
When you answer, keep these four points in mind:

1. You are asked not to spend time pondering. Give the first, natural answer as it comes to you. Of course, the questions are too short to give you all the particulars you would sometimes like to have. For instance, the above question asks you about "team games" and you might be fonder of football than basketball. But you are to reply "for the average game," or to strike an average in situations of the kind stated. Give the best answer you can at a rate not slower than five or six a minute. You should finish in a little more than half an hour.

2. Try not to fall back on the middle, "uncertain" answers except when the answer at either end is really impossible for you—perhaps once every two or three questions.

3. Be sure not to skip anything, but answer every question, somehow. Some may not apply to you very well, but give your best guess. Some may seem personal; but remember that the answer sheets are kept confidential and cannot be scored without a special stencil key. Answers to particular questions are not inspected.

4. Answer as honestly as possible what is true of you. Do not merely mark what seems "the right thing to say" to impress the examiner.

DO NOT TURN PAGE UNTIL TOLD TO DO SO
1. I have the instructions for this test clearly in mind. (a) yes, (b) uncertain, (c) no.

2. I am ready to answer each question as truthfully as possible. (a) yes, (b) uncertain, (c) no.

3. It would be good for everyone if vacations (holidays) were longer and everyone had to take them. (a) agree, (b) uncertain, (c) disagree.

4. I can find enough energy to face my difficulties. (a) always (b) generally, (c) seldom.

5. I feel a bit nervous of wild animals even when they are in strong cages. (a) yes (true), (b) uncertain, (c) no (false).

6. I hold back from criticizing people and their ideas. (a) yes, (b) sometimes, (c) no.

7. I make smart, sarcastic remarks to people if I think they deserve it. (a) generally, (b) sometimes, (c) never.

8. I prefer semiclassical music to popular tunes. (a) true, (b) uncertain, (c) false.

9. If I saw two neighbors' children fighting, I would: (a) leave them to settle it, (b) uncertain, (c) reason with them.

10. On social occasions I: (a) readily come forward, (b) respond in between, (c) prefer to stay quietly in the background.

11. I would rather be: (a) a construction engineer, (b) uncertain, (c) a teacher of social studies.

12. I would rather spend a free evening: (a) with a good book, (b) uncertain, (c) working on a hobby with friends.

13. I can generally put up with conceited people, even though they brag or show they think too well of themselves. (a) yes, (b) in between, (c) no.

14. I'd rather that the person I marry be socially admired than gifted in art or literature. (a) true, (b) uncertain, (c) false.
15. I sometimes get an unreasonable dislike for a person: (a) but it is so slight I can hide it easily, (b) in between, (c) which is so definite that I tend to express it.

16. In a situation which may become dangerous I believe in making a fuss and speaking up even if calmness and politeness are lost. (a) yes, (b) in between, (c) no.

17. I am always keenly aware of attempts at propaganda in things I read. (a) yes, (b) uncertain, (c) no.

18. I wake up in the night and, through worry, have difficulty in sleeping again. (a) often, (b) sometimes, (c) never.

19. I don't feel guilty if scolded for something I did not do. (a) true, (b) uncertain, (c) false.

20. I am considered a liberal "dreamer" of new ways rather than a practical follower of well-tried ways. (a) true, (b) uncertain, (c) false.

21. I find that my interests in people and amusement tend to change fairly rapidly. (a) yes, (b) in between, (c) no.

22. In constructing something I would rather work: (a) with a committee, (b) uncertain, (c) on my own.

23. I find myself counting things, for no particular purpose. (a) often, (b) occasionally, (c) never.

24. When talking I like: (a) to say things, just as they occur to me, (b) in between, (c) to get my thoughts well organized first.

25. I never feel the urge to doodle and fidget when kept sitting still at a meeting. (a) true, (b) uncertain, (c) false.

26. With the same hours and pay, I would prefer the life of: (a) a carpenter or cook, (b) uncertain, (c) a waiter in a good restaurant.

27. With acquaintances I prefer: (a) to keep to matter-of-fact impersonal things, (b) in between, (c) to chat about people and their feelings.

28. "Spade" is to "dig" as "knife" is to: (a) sharp, (b) cut, (c) shovel.
29. I sometimes can't get to sleep because an idea keeps running through my mind. (a) true, (b) uncertain, (c) false.

30. In my personal life I reach the goals I set, almost all the time. (a) true, (b) uncertain, (c) false.

31. When telling a person a deliberate lie I have to look away, being ashamed to look him in the eye. (a) true, (b) uncertain, (c) false.

32. I am uncomfortable when I work on a project requiring quick action affecting others. (a) true, (b) in between, (c) false.

33. Most of the people I know would rate me as an amusing talker. (a) yes, (b) uncertain, (c) no.

34. Many ordinary people would be shocked if they knew my inner personal opinions. (a) yes, (b) uncertain, (c) no.

35. I get slightly embarrassed if I suddenly become the focus of attention in a social group. (a) yes, (b) in between, (c) no.

36. I am always glad to join a large gathering, for example, a party, dance, or public meeting. (a) yes, (b) in between, (c) no.

37. In school I preferred (or prefer): (a) music, (b) uncertain, (c) handwork and crafts.

38. I believe most people are a little "queer" mentally though they do not like to admit it. (a) yes, (b) in between, (c) no.

39. I like a friend (of my sex) who: (a) seriously thinks out his attitudes to life, (b) in between, (c) is efficient and practical in his interests.

40. "If at first you don't succeed, try, try, again," is a motto completely forgotten in the modern world. (a) yes, (b) uncertain, (c) no.

41. I feel a need every now and then to engage in a tough physical activity. (a) yes, (b) in between, (c) no.

42. I would rather mix with polite people than rough, rebellious individuals. (a) yes, (b) in between, (c) no.
43. In intellectual interests, my parents are (were): (a) a bit below average, (b) average, (c) above average.

44. When I am called in by my boss (or teacher), I: (a) see a chance to put in a good word for things I am concerned about, (b) in between, (c) fear something has gone wrong.

45. I feel a strong need for someone to lean on in times of sadness. (a) yes, (b) in between, (c) no.

46. I occasionally get puzzled when looking in a mirror, as to the meaning of right and left. (a) true, (b) uncertain, (c) false.

47. As a teenager, I joined in school sports: (a) occasionally, (b) fairly often, (c) a great deal.

48. I would rather stop in the street to watch an artist painting than listen to some people having a quarrel. (a) true, (b) uncertain, (c) false.

49. I sometimes get in a state of tension and turmoil as I think of the day's happenings. (a) yes, (b) in between, (c) no.

50. I sometimes doubt whether people I am talking to are really interested in what I am saying. (a) yes, (b) in between, (c) no.

51. I would like to be: (a) a forester, (b) uncertain, (c) a grammar or high school teacher.

52. For special holidays and birthdays, I: (a) like to give personal presents, (b) uncertain, (c) feel that buying presents is a bit of a nuisance.

53. "Tired" is to "work" as "proud" is to: (a) rest, (b) success, (c) exercise.

54. Which of the following items is different in kind from the others? (a) candle, (b) moon, (c) electric light.

55. I admire my parents in all important matters. (a) yes, (b) uncertain, (c) no.

56. I have some characteristics in which I feel definitely superior to most people. (a) yes, (b) uncertain, (c) no.
57. If it is useful to others, I don't mind taking a dirty job that others look down on. (a) true, (b) uncertain, (c) false.

58. I like to go out to a show or entertainment; (a) more than once a week (more than average), (b) about once a week (average), (c) less than once a week (less than average).

59. I think that plenty of freedom is more important than good manners and respect for the law. (a) true, (b) uncertain, (c) false.

60. I tend to keep quiet in the presence of senior persons (people of greater experience, age, or rank). (a) yes, (b) in between, (c) no.

61. I find it hard to address or recite to a large group. (a) yes, (b) in between, (c) no.

62. I would rather live in a town: (a) which is rough, prosperous, and booming, (b) uncertain, (c) artistically laid out, but relatively poor.

63. If I make an awkward social mistake, I can soon forget it. (a) yes, (b) in between, (c) no.

64. When I read an unfair magazine article, I am more inclined to forget it than to feel like "hitting back." (a) true, (b) uncertain, (c) false.

65. My memory tends to drop a lot of unimportant trivial things, for example, names of streets or stores in town. (a) yes, (b) in between, (c) no.

66. I am considered a person easily swayed by appeals to my feelings. (a) yes, (b) in between, (c) no.

67. I eat my food with gusto, not always so carefully and properly as some people. (a) true, (b) uncertain, (c) false.

68. I generally keep up hope in ordinary difficulties. (a) yes, (b) uncertain, (c) no.

69. People sometimes warn me that I show my excitement in voice and manner too obviously. (a) yes, (b) in between, (c) no.

70. As a teenager, if I differed in opinion from my parents, I usually: (a) kept my own opinion, (b) in between, (c) accepted their authority.
71. I prefer to marry someone who can: (a) keep the family interested in its own activities, (b) in between, (c) make the family a part of the social life of the neighborhood.

72. I would rather enjoy life quietly in my own way than be admired for my achievements. (a) true, (b) uncertain, (c) false.

73. I can work carefully on most things without being bothered by people making a lot of noise around me. (a) yes, (b) in between, (c) no.

74. I feel that on one or two occasions recently I have been blamed more than I really deserve. (a) yes, (b) in between, (c) no.

75. I am always able to keep the expressions of my feelings under exact control. (a) yes, (b) in between, (c) no.

76. In starting a useful invention, I would prefer: (a) working on it in the laboratory, (b) uncertain, (c) selling it to people.

77. "Surprise" is to "strange" as "fear" is to: (a) brave, (b) anxious, (c) terrible.

78. Which of the following fractions is not in the same class as the others? (a) 3/7, (b) 3/9, (c) 3/11.

79. Some people seem to ignore or avoid me, although I don't know why. (a) true, (b) uncertain, (c) false.

80. People treat me less reasonably than my good intentions deserve. (a) often, (b) occasionally, (c) never.

81. The use of foul language, even when it is not in a mixed group of men and women, still disgusts me. (a) yes, (b) in between, (c) no.

82. I have decidedly fewer friends than most people. (a) yes, (b) in between, (c) no.

83. I would hate to be where there wouldn't be a lot of people to talk to. (a) true, (b) uncertain, (c) false.

84. People sometimes call me careless, even though they think me an attractive person. (a) yes, (b) in between, (c) no.
85. My reserve always stands in the way when I want to speak to an attractive stranger of the opposite sex. (a) yes, (b) in between, (c) no.

86. I would rather have a job with: (a) a fixed, certain salary, (b) in between, (c) a larger salary, but depending on my constantly persuading people I am worth it.

87. I prefer reading: (a) a realistic account of military or political battles, (b) uncertain, (c) a sensitive, imaginative novel.

88. When bossy people try to "push me around," I do just the opposite of what they wish. (a) yes, (b) in between, (c) no.

89. Most people would be "better off" if given more praise instead of more criticism. (a) true, (b) uncertain, (c) false.

90. In discussing art, religion, or politics, I seldom get so involved or excited I forget politeness and human relations. (a) true, (b) uncertain, (c) false.

91. If someone got mad at me, I would: (a) try to calm him down, (b) uncertain, (c) get irritated.

92. I would like to see a move toward: (a) eating more vegetable foods, to avoid killing so many animals, (b) uncertain, (c) getting better poisons to kill the animals which ruin farmers' crops (such as squirrels, rabbits, and some kinds of birds).

93. If acquaintances treat me badly and show they dislike me: (a) it does not upset me a bit, (b) in between, (c) I tend to get downhearted.

94. Careless folks who say "the best things in life are free" usually haven't worked to get much. (a) true, (b) in between, (c) false.

95. Because it is not always possible to get things done by gradual, reasonable methods, it is sometimes necessary to use force. (a) true, (b) in between, (c) false.

96. At fifteen or sixteen I went about with the opposite sex: (a) a lot, (b) as much as most people, (c) less than most people.

97. I like to take an active part in social affairs, committee work, etc. (a) yes, (b) in between, (c) no.
98. The idea that sickness comes as much from mental as physical causes is much exaggerated. (a) yes, (b) in between, (c) no.

99. Quite small setbacks occasionally irritate me too much. (a) yes, (b) in between, (c) no.

100. I very rarely blurt out annoying remarks that hurt people's feelings. (a) true, (b) uncertain, (c) false.

101. I would prefer to work in a business: (a) talking to customers, (b) in between, (c) keeping office accounts and records.

102. "Size" is to "length" as "dishonest" is to: (a) prison, (b) sin, (c) stealing.

103. AB is to dc as SR is to: (a) qp, (b) pq, (c) tu.

104. When people are unreasonable, I just: (a) keep quiet, (b) in between, (c) despise them.

105. If people talk loudly while I am listening to music, I: (a) can keep my mind on the music and not be bothered, (b) in between, (c) find it spoils my enjoyment and annoys me.

106. I think I am better described as: (a) polite and quiet, (b) in between, (c) forceful.

107. I attend social functions only when I have to, and stay away any other time. (a) yes, (b) uncertain, (c) no.

108. To be cautious and expect little is better than to be happy at heart, always expecting success. (a) true, (b) uncertain, (c) false.

109. In thinking of difficulties in my work, I: (a) try to plan ahead, before I meet them, (b) in between, (c) assume I can handle them when they come.

110. I have at least as many friends of the opposite sex as of my own. (a) yes, (b) in between, (c) no.

111. Even in an important game I am more concerned to enjoy it than to win. (a) always, (b) generally, (c) occasionally.
112. I would rather be: (a) a guidance worker with young people seeking careers, (b) uncertain, (c) a manager in a technical manufacturing concern.

113. If I am quite sure that a person is unjust or behaving selfishly, I show him up, even if it takes some trouble. (a) yes, (b) in between, (c) no.

114. Some people criticize my sense of responsibility. (a) yes, (b) uncertain, (c) no.

115. I would enjoy being a newspaper writer on drama, concerts, opera, etc. (a) yes, (b) uncertain, (c) no.

116. I find it embarrassing to have praise or compliments bestowed on me. (a) yes, (b) in between, (c) no.

117. I think it is more important in the modern world to solve: (a) the political difficulties, (b) uncertain, (c) the question of moral purpose.

118. I occasionally have a sense of vague danger or sudden dread for no sufficient reason. (a) yes, (b) in between, (c) no.

119. As a child I feared the dark. (a) often, (b) sometimes, (c) never.

120. On a free evening I like to: (a) see an historical film about past adventures, (b) uncertain, (c) read science fiction or an essay on "The Future of Science."

121. It bothers me if people think I am being too unconventional or odd. (a) a lot, (b) somewhat, (c) not at all.

122. Most people would be happier if they lived more with their fellows and did the same things as others. (a) yes, (b) in between, (c) no.

123. I like to go my own way instead of acting on approved rules. (a) true, (b) uncertain, (c) false.

124. Often I get angry with people too quickly. (a) yes, (b) in between, (c) no.
125. When something really upsets me, I generally calm down again quite quickly. (a) yes, (b) in between, (c) no.

126. If the earnings were the same, I would rather be: (a) a lawyer, (b) uncertain, (c) a navigator or pilot.

127. "Better" is to "worst" as "slower" is to: (a) fast, (b) best, (c) quickest.

128. Which of the following should come next at the end of this row of letters: xoooooxoooox? (a) xox, (b) oox, (c) oxx.

129. When the time comes for something I have planned and looked forward to, I occasionally do not feel up to going. (a) true, (b) in between, (c) false.

130. I could enjoy the life of an animal doctor, handling disease and surgery of animals. (a) yes, (b) in between, (c) no.

131. I occasionally tell strangers things that seem to me important, regardless of whether they ask about them. (a) yes, (b) in between, (c) no.

132. I spend much of my spare time talking with friends over social events enjoyed in the past. (a) yes, (b) in between, (c) no.

133. I enjoy doing "daring," foolhardy things "just for fun." (a) yes, (b) in between, (c) no.

134. I think the police can be trusted not to ill-treat innocent people. (a) yes, (b) in between, (c) no.

135. I consider myself a very sociable, outgoing person. (a) yes, (b) in between, (c) no.

136. In social contacts I: (a) show my emotions as I wish, (b) in between, (c) keep my emotions to myself.

137. I enjoy music that is: (a) light, dry, and brisk, (b) in between, (c) emotional and sentimental.

138. I try to make my laughter at jokes quieter than most people's. (a) yes, (b) in between, (c) no.
139. I admire the beauty of a fairy tale more than that of a well-made gun. (a) yes, (b) uncertain, (c) no.

140. Hearing different beliefs about right and wrong is: (a) always interesting, (b) something we cannot avoid, (c) bad for most people.

141. I am always interested in mechanical matters, for example, in cars and airplanes. (a) yes, (b) in between, (c) no.

142. I like to tackle problems that other people have made a mess of. (a) yes, (b) in between, (c) no.

143. I am properly regarded as only a plodding, half-successful person. (a) yes, (b) uncertain, (c) no.

144. If people take advantage of my friendliness, I do not resent it and I soon forget. (a) true, (b) uncertain, (c) false.

145. I think the spread of birth control is essential to solving the world's economic and peace problems. (a) yes, (b) uncertain, (c) no.

146. I like to do my planning alone, without interruptions and suggestions from others. (a) yes, (b) in between, (c) no.

147. I sometimes let my actions get swayed by feelings of jealousy. (a) yes, (b) in between, (c) no.

148. I believe firmly "the boss may not always be right, but he always has the right to be boss." (a) yes, (b) uncertain, (c) no.

149. I tend to tremble or perspire when I think of a difficult task ahead. (a) generally, (b) occasionally, (c) never.

150. If people shout suggestions when I'm playing a game, it does not upset me. (a) true, (b) uncertain, (c) false.

151. I would prefer the life of: (a) an artist, (b) uncertain, (c) a secretary running a social club.

152. Which of the following words does not properly belong with the others? (a) any, (b) some, (c) most.
153. "Flame" is to "heat" as "rose" is to: (a) thorn, (b) red petals, (c) scent.

154. I have vivid dreams, disturbing my sleep. (a) often, (b) occasionally, (c) practically never.

155. If the odds are really against something's being a success, I still believe in taking the risk. (a) yes, (b) in between, (c) no.

156. I like it when I know so well what the group has to do that I naturally become the one in command. (a) yes, (b) in between, (c) no.

157. I would rather dress with quiet correctness than with eye-catching personal style. (a) true, (b) uncertain, (c) false.

158. An evening with a quiet hobby appeals to me more than a lively party. (a) true, (b) uncertain, (c) false.

159. I close my mind to well-meant suggestions of others, even though I know I shouldn't. (a) occasionally, (b) hardly ever, (c) never.

160. I always make a point, in deciding anything, to refer to basic rules of right and wrong. (a) yes, (b) in between, (c) no.

161. I somewhat dislike having a group watch me at work. (a) yes, (b) in between, (c) no.

162. I keep my room smartly organized, with things in known places almost all the time. (a) yes, (b) in between, (c) no.

163. In school I preferred: (a) English, (b) uncertain, (c) mathematics or arithmetic.

164. I have sometimes been troubled by people's saying bad things about me behind my back, with no grounds at all. (a) yes, (b) uncertain, (c) no.

165. Talk with ordinary, habit-bound, conventional people: (a) is often quite interesting and has a lot to it, (b) in between, (c) annoys me because it deals with trifles and lacks depth.

166. I like to: (a) have a circle of warm friendships, even if they are demanding, (b) in between, (c) be free of personal entanglements.
167. I think it is wiser to keep the nation's military forces strong than just to depend on international goodwill. (a) yes, (b) in between, (c) no.

168. People regard me as a solid, undisturbed person, unmoved by ups and downs in circumstances. (a) yes, (b) in between, (c) no.

169. I think society should let reason lead it to new customs and throw aside old habits or mere traditions. (a) yes, (b) in between, (c) no.

170. My viewpoints change in an uncertain way because I trust my feelings more than logical reasoning. (a) true, (b) to some extent, (c) false.

171. I learn better by: (a) reading a well-written book, (b) in between, (c) joining a group discussion.

172. I have periods when it's hard to stop a mood of self-pity. (a) often, (b) occasionally, (c) never.

173. I like to wait till I am sure that what I am saying is correct, before I put forth an argument. (a) always, (b) generally, (c) only if it's practicable.

174. Small things sometimes "get on my nerves" unbearably though I realize them to be trivial. (a) yes, (b) in between, (c) no.

175. I don't often say things on the spur of the moment that I greatly regret. (a) true, (b) uncertain, (c) false.

176. If asked to work with a charity drive, I would: (a) accept, (b) uncertain, (c) politely say I'm too busy.

177. Which of the following words does not belong with the others? (a) wide, (b) zigzag, (c) regular.

178. "Soon" is to "never" as "near" is to: (a) nowhere, (b) far, (c) next.

179. I have a good sense of direction (find it easy to tell which is North, South, East, or West) when in a strange place. (a) yes, (b) in between, (c) no.

180. I am known as an "idea man" who almost always puts forward some ideas on a problem. (a) yes, (b) in between, (c) no.
181. I think I am better at showing: (a) nerve in meeting challenges, (b) uncertain, (c) tolerance of other people's wishes.

182. I am considered a very enthusiastic person. (a) yes, (b) in between, (c) no.

183. I like a job that offers change, variety, and travel, even if it involves some danger. (a) yes, (b) in between, (c) no.

184. I am a fairly strict person, insisting on always doing things as correctly as possible. (a) true, (b) in between, (c) false.

185. I enjoy work that requires conscientious, exacting skills. (a) yes, (b) in between, (c) no.

186. I'm the energetic type who keeps busy. (a) yes, (b) uncertain, (c) no.

187. I am sure there are no questions that I have skipped or failed to answer properly. (a) yes, (b) uncertain, (c) no.
APPENDIX E

PERSONAL DATA QUESTIONNAIRE
PERSONAL DATA QUESTIONNAIRE

NAME___________________________________________________________________

SCHOOL DISTRICT______________________________________________

AGE________

EXPERIENCE:

Total teaching________

Total administration____

In present position_____

PROFESSIONAL PREPARATION:

Please indicate year of each degree or certificate.

Bachelor's Degree________

Master's Degree__________

Specialist's Certificate____

Doctor's Degree___________

Year of last graduate work_____
APPENDIX F

WEIGHTS TO GET SECOND-ORDER STEN SCORES

FROM 16 PF PRIMARY STENS
WEIGHTS TO GET SECOND-ORDER STEN SCORES FROM 16 PF PRIMARY STENS*

Factor I: Low versus High Anxiety

Start out with constant 38
Add 2 times sten on Factor L +
Add 3 times sten on Factor O +
Add 4 times sten on Factor Q4 +
Subtotal
Subtract 2 times sten on Factor C -
Subtract 2 times sten on Factor H -
Subtract 2 times sten on Factor Q3 -
Total

Factor II: Introversion versus Extraversion

Take 2 times sten on Factor A
Add 3 times sten on Factor E +
Add 4 times sten on Factor F +
Add 5 times sten on Factor H +
Subtotal
Subtract 2 times sten on Factor Q2 -
Subtract constant, always 11 -11
Total

Factor III: Tenderminded Emotionality versus Alert Poise

Start out with constant 77
Add 2 times sten on Factor C +__
Add 2 times sten on Factor E +__
Add 2 times sten on Factor F +__
Add 2 times sten on Factor N +__

Subtotal

Subtract 4 times sten on Factor A __
Subtract 6 times sten on Factor I __
Subtract 2 times sten on Factor M __

Total

Factor IV: Subduedness versus Independence

Take 4 times sten on Factor E __
Add 3 times sten on Factor M +__
Add 4 times sten on Factor Q₁ +__
Add 4 times sten on Factor Q₂ +__

Subtotal

Subtract 3 times sten on Factor A __
Subtract 2 times sten on Factor G __

Total
APPENDIX G

SUPERINTENDENTS' PERSONALITY FACTOR SCORES
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|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 34    | 12 | 9  | 15 | 13 | 9  | 17 | 15 | 8  | 10 | 16 | 12 | 9  | 10 | 15 | 13 | 11 | 53 | 48 | 43  | 61 |
| 35    | 11 | 12 | 20 | 13 | 11 | 16 | 18 | 11 | 9  | 12 | 12 | 8  | 13 | 14 | 16 | 7  | 33 | 55 | 47  | 66 |
| 36    | 13 | 7  | 21 | 22 | 11 | 12 | 19 | 4  | 6  | 11 | 10 | 9  | 8  | 8  | 16 | 6  | 29 | 80 | 75  | 58 |
| 37    | 17 | 11 | 15 | 11 | 14 | 17 | 11 | 13 | 12 | 9  | 14 | 4  | 15 | 6  | 14 | 7  | 45 | 59 | 25  | 32 |
| 38    | 2  | 9  | 13 | 12 | 9  | 13 | 3  | 9  | 11 | 12 | 13 | 9  | 8  | 12 | 15 | 22 | 81 | 13 | 63  | 69 |
| 39    | 17 | 8  | 17 | 17 | 16 | 16 | 23 | 6  | 12 | 12 | 10 | 7  | 10 | 10 | 13 | 17 | 52 | 93 | 49  | 42 |
| 40    | 17 | 11 | 20 | 15 | 16 | 18 | 23 | 12 | 11 | 13 | 14 | 9  | 6  | 5  | 13 | 15 | 47 | 94 | 39  | 16 |
| 41    | 9  | 6  | 14 | 15 | 11 | 16 | 18 | 7  | 10 | 16 | 13 | 11 | 8  | 10 | 6  | 9  | 17 | 70 | 62  | 53 | 55 |
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| 48    | 10 | 7  | 15 | 5  | 10 | 20 | 11 | 9  | 7  | 11 | 12 | 8  | 11 | 9  | 11 | 10 | 53 | 30 | 39  | 25 |
APPENDIX H

SUPERINTENDENTS' AGE, TEACHING EXPERIENCE, ADMINISTRATIVE EXPERIENCE, YEARS IN PRESENT POSITION, AND YEAR OF LAST GRADUATE STUDY
### SUPERINTENDENTS' AGE, TEACHING EXPERIENCE, ADMINISTRATIVE EXPERIENCE, YEARS IN PRESENT POSITION, AND YEAR OF LAST GRADUATE STUDY

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APPENDIX I

SCHOOL DISTRICT ENROLLMENT AND PER PUPIL VALUATION
### SCHOOL DISTRICT ENROLLMENT AND PER PUPIL VALUATION

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FORMULÆ USED IN REGRESSION ANALYSIS

NOTATION

\(x_1, x_2, \ldots\) observable independent variables.

\(y_1, y_2, \ldots\) observable dependent variables.

\(y_{ja}, x_{ia}\) \(\text{a}^{th}\) observation of the \(j^{th}\) dependent and \(i^{th}\) independent variables.

\(I = \text{number of independent variables.}\)

\(J = \text{number of dependent variables.}\)

\(N = I + J\)

\(M = \text{number of sets of observations.}\)

SAMPLE MEANS:

\[
\bar{x}_i = \frac{1}{M} \sum_{a=1}^{M} x_{ia}
\]

\[
\bar{y}_j = \frac{1}{M} \sum_{a=1}^{M} y_{ja}
\]

SAMPLE SUMS OF SQUARES:

\[
SS_i = \sum_{a=1}^{M} x_{ia}^2
\]

SAMPLE SUMS OF SQUARED DEVIATIONS:

\[
s^2_i = \sum_{a=1}^{M} (x_{ia} - \bar{x}_i)^2
\]

\[
s^2_y = \sum_{a=1}^{M} (y_{ja} - \bar{y}_j)^2
\]
SAMPLE SUMS OF CROSS DEVIATIONS:

\[ S_{ij} = \sum_{a=1}^{M} (x_{ia} - \overline{x}_i)(x_{ja} - \overline{x}_j) = \sum_{a=1}^{M} x_{ia}x_{ja} - \frac{1}{M} \left( \sum_{a=1}^{M} x_{ia} \right) \left( \sum_{a=1}^{M} x_{ja} \right) \]

UNBIASED STANDARD DEVIATIONS:

\[ \sigma_i = \sqrt{\frac{1}{M-1} \sum_{a=1}^{M} (x_{ia} - \overline{x}_i)^2} = \sqrt{\frac{s_i^2}{M-1}} \]

UNBIASED COVARIANCES:

\[ \sigma_{ij} = \frac{1}{M-1} \sum_{a=1}^{M} (x_{ia} - \overline{x}_i)(x_{ja} - \overline{x}_j) = \frac{s_{ij}}{M-1} \]

CORRELATION COEFFICIENT:

\[ r_{ij} = \frac{s_{ij}}{\sigma_i \sigma_j} \]

(The output of \( r_{ij} \) includes \( i = 1, 2, \ldots, N \) and \( j = i, i+1, \ldots, N \))

Elements of inverse correlation matrix are denoted by \( r_{ij}^{-1} \).

\[ \beta_i = \sum_{j=1}^{1} r_{ij}^{-1} r_{ij}, \quad i \neq 0. \]

\[ \beta_0 = \frac{\sum_{a=1}^{M} y_a}{S_y} \]
REGRESSION COEFFICIENTS:

\[ b_1 = \frac{S_y}{S_x} \beta_1, \quad i \neq 0 \]

\[ b_0 = \bar{y} - \sum_{i=1}^{1} b_i \bar{x}_i \]

SQUARE OF MULTIPLE CORRELATION:

\[ R^2 = \sum_{i=1}^{1} \beta_i x_{iy} \]

SUM OF SQUARES OF RESIDUALS:

\[ Q_A = \sum_{a=1}^{M} (y_a - \hat{b}_0 - b_1 x_{1a} - \cdots - x_{la})^2 \]

\[ = \left( \sum_{a=1}^{M} y_a^2 - \beta_0 S_y \right) - \sum_{i=1}^{I} \beta_i r_{iy} \]

\[ = S_y^2 - S^2 R^2 = S_y (1 - R^2) \]

MULTIPLE HYPOTHESIS:

\[ Q = \sum_{a=1}^{M} (y_a - \hat{b}_0 - b_1 x_{1a} - \cdots - b_{k_{1-s}} x_{k_{1-s}})^2 \]

where the problem is reduced to

\[ y = \hat{b}_0 + b_1 x_{1} + \cdots + b_{k_{1-s}} x_{k_{1-s}} \]

under the hypothesis that \[ b_{i_1} = b_{i_2} = \cdots = b_{i_s} = 0 \]
F-TEST OF THE MULTIPLE HYPOTHESIS:

\[ F = \frac{(Q_r - Q_a)/S}{Q_a/(M-1)} \]  
with \((S, M-1-1)\) degrees of freedom.

SUM OF SQUARES OF FACTORS = \(Q_r - Q_a\)

F-TEST for \(R_i\):

\[ F = \frac{R^2}{1-R^2} \cdot \frac{M-1-1}{I} \]  
with \((I, M-1-1)\) degrees of freedom.

STANDARD DEVIATION OF REGRESSION COEFFICIENTS:

\[ \sigma_{b_i} = \sqrt{\frac{1}{S_i^2} \cdot \frac{S_y^2(1-R^2)}{M-1-1}} \quad i = 1, 2, \ldots, I \]

\[ \sigma_{b_0} = \sqrt{\left(\frac{1}{M} + \sum_{i=1}^{I} \sum_{j=1}^{I} \frac{x_i x_j}{S_i S_j}\right) \frac{S_y^2(1-R^2)}{M-1-1}} \]

T-TEST OF REGRESSION COEFFICIENTS:

\[ t_{b_i} = \frac{b_i}{\sigma_{b_i}} \]  
with \(M-1\) degrees of freedom \((i = 0, 1, \ldots, I)\)

\(y_a\) = actual observed values of the dependent variable  
\((a = 1, 2, \ldots, M)\)

\(y_a^* = b_0 + b_1 x_1a + \cdots + b_I x_Ia\) - predicted values of dependent variable \((a = 1, 2, \ldots, M)\)

\(y_a - y_a^*\) = Residuals or deviations \((a = 1, 2, \ldots, M)\)

UNBIASED STANDARD DEVIATION OF RESIDUALS:

\[ \sigma_{y-y^*} = \sqrt{\frac{Q_A}{M-1-1}} \]
APPENDIX K

STEPWISE REGRESSION
COMPUTATIONAL PROCEDURE

Step 1. The data are read and transgenerated (see Introduction, Section III-B). Let \( p \) denote the number of variables after transgeneration, \( n \) the number of cases and \( x_{ij} \) the value of the \( j \)th variable, after transgeneration, for the \( i \)th case. The means

\[
x_i = \frac{1}{n} \sum_{k=1}^{n} x_{ki}
\]

are computed and, if called for, printed. If a zero regression intercept is not requested on the Problem Card, the matrix \( A \)

\[
a_{ij} = \sum_{k=1}^{n} (x_{ki} - \bar{x}_i)(x_{kj} - \bar{x}_j) \quad i, j = 1, \ldots, p
\]

is computed. If a zero regression intercept is requested, the matrix \( A \)

\[
a_{ij} = \sum_{k=1}^{n} x_{ki} x_{kj} \quad i, j = 1, \ldots, p
\]

is computed instead.

Step 2. The covariances, standard deviations, and correlations

\[
s_{ij} = \frac{1}{m} a_{ij} \quad i, j = 1, \ldots, p
\]

\[
m = \begin{cases} n, & \text{if zero regression intercept is requested} \\ n-1, & \text{otherwise} \end{cases}
\]

\[
s_i = \sqrt{s_{ii}} \quad i = 1, \ldots, p
\]

\[
x_{ij} = s_{ij}/s_i s_j \quad i, j = 1, \ldots, p
\]

are computed and, if called for, printed. It should be noted that if the zero regression intercept option is chosen, these statistics will not be centered about the mean. A similar statement applies to all the computations which follow.
At each step in the stepwise regression procedure the variables \( x_1, \ldots, x_p \) are divided into two disjoint sets:

\[ x_1, \ldots, x_i \] : The independent variables in the regression equation.

\[ x_j, \ldots, x_r \] : The remaining variables including the dependent variable \( y = x_d \).

For purposes of exposition, assume that \( x_1, \ldots, x_q \) are the first \( q \) variables \( x^\prime, \ldots, x^{\prime q} \). The regression equation at a typical step then has the form

\[ y = \alpha + \beta_1 x_1^1 + \cdots + \beta_p x_p^p + \varepsilon \]

Let

\[ A = \begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix} \]

be a partition of the matrix \( A \) from Step 1; let

\[ B = \begin{bmatrix} A_{11}^{-1} & A_{11}^{-1} A_{12} \\ A_{21} A_{11}^{-1} & A_{22} - A_{21} A_{11}^{-1} A_{12} \end{bmatrix} \]

let \( m = n-1 \) if a zero regression intercept is not requested; and let \( m = n \) if it is requested. For each step in the stepwise procedure the following are computed and printed:

The residual degrees of freedom, sum of squares, and mean square.

\[ df = m-q, \quad SS = b_{dd}, \quad MS = SS/df \]

The regression degrees of freedom, sum of squares, mean square, and \( F \) value.

\[ rdf = q, \quad RSS = a_{dd} - b_{dd} \]

\[ RMS = RSS/rdf, \quad F = RMS/MS \]
The standard error of estimate and multiple correlation coefficient.

\[ S = \sqrt{MS}, \quad R = \sqrt{RSS/a_{dd}} \]

For each independent variable \( x_i \) in the regression equation, the following are computed and printed:

The regression coefficient, its standard error, and \( F \) value.

\[ \beta_i = b_{id}, \quad S_i = b_{ii}^{1/2}, \quad F_i = (\beta_i/S_i)^2 \]

If a zero regression intercept is not requested, the intercept \( \alpha \) is computed.

\[ \alpha = \sum_{i=1}^{q} \beta_i x_i \]

For each independent variable \( x_i \) not in the regression equation, the following are computed and printed:

The tolerance level, partial correlation coefficient, and \( F \) value.

\[ T_i = b_{id}/a_{ii}, \quad R_i = \frac{b_{id}}{\sqrt{b_{ii}b_{dd}}}, \quad F_i = \frac{b_{id}^2 (m-q-1)}{b_{ii} b_{dd} - b_{id}^2} \]

**Step 4.** To move from one step to the next, an independent variable is added to or removed from the regression equation according to the following three rules:

(1) If there are one or more independent variables in the regression equation whose control value, as specified by the Control-Delete Card, is 2 (i.e., a free variable) and whose \( F \) value is less than the "F-to-remove" value specified on the Subproblem Card, the one with the smallest \( F \) value will be removed.
(2) If no variable is removed by (1) and there are one or more independent variables not in the regression equation which pass the tolerance test and have control values of 3 or more (i.e., forced variables), the one which has the highest control value and the highest F value among all with the same control value will be added.

An independent variable $x_i$ not in the regression equation is said to pass the tolerance test if its tolerance value $T_i$ is greater than or equal to the "minimum tolerance value" specified on the Sub-problem Card.

(3) If no variable is removed by (1) or added by (2) and there are one or more independent variables not in the regression equation which pass the tolerance test, have a control value of 2 (i.e., a free variable), and an F value greater than or equal to the "F-to-enter" value specified on the Sub-problem Card, the one with the highest F value will be added.

If no variable is added or removed by (1), (2), or (3), the stepwise procedure is terminated.

**Step 5.** If a list of residuals is called for on the Sub-problem Card, the residuals

$$r_i = y_i - \alpha - \sum_j \beta_j x_{ij}$$

$i = 1, \ldots, n$

are computed and printed. The summation is over all indices $j$ of independent variables $x_j$ in the regression equation at the last step.

For each variable $x_j$ specified on the Index-Plot Card, the points

$$(r_i, x_{ij})$$

$i = 1, \ldots, n$

are computed and plotted.
BIBLIOGRAPHY
BIBLIOGRAPHY

Books


**Articles and Periodicals**


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