GOODE, John Merton, 1936—
THE DEVELOPMENT OF AN INSTRUMENT TO
EVALUATE CERTAIN PRACTICES IN SCIENCE
SUPERVISION.

The Ohio State University, Ph.D., 1968
Education, general

University Microfilms, Inc., Ann Arbor, Michigan

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1968
THE DEVELOPMENT OF AN INSTRUMENT TO EVALUATE
CERTAIN PRACTICES IN SCIENCE SUPERVISION

DISSERTATION

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

By

John Merton Goode, A.B., M.A.

* * * * * * *

The Ohio State University
1968

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ACKNOWLEDGEMENTS

The author would like to express his appreciation and acknowledge his debt to three teachers: Dr. John S. Richardson for his advice and counsel through the author's graduate work, Dr. S. Winston Cram for his guidance and early inspiration to become a teacher and to Mrs. Elsie Waldron for awakening an interest in science.

Appreciation is expressed to those science supervisors and other science educators who assisted in the development of the instrument. Their cooperation and assistance made this study possible.

The cooperation and assistance of the North Carolina State Department of Public Instruction and Dr. Charles F. Carroll, State Superintendent, is sincerely appreciated.

Finally, the author would like to express his appreciation to his wife, Carolyn, and his children, Kent, Bradley, and Stacey, for their understanding and support during these past few years.
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CHAPTER I
INTRODUCTION TO THE STUDY AND PRESENTATION
OF THE PROBLEM

Supervision has been a part of the educational scene in the United States since the inception of public schools. The function of supervision has undergone change in much the same manner as the schools themselves have changed. The role of the supervisor was first filled by the Board of Education to insure that the directives prescribed by the Board of Education were being followed in the classroom.

As the education system evolved, the supervisory function became too complex for the typical Board of Education member. The function was assumed by the school administrator. As the school systems grew, the duties of the chief administrative officer became too involved to enable him to be the only person responsible for supervision. He delegated a portion of his responsibility for supervision to an assistant who assumed the role of supervisor.¹

The concept of supervision has undergone a gradual change in keeping with the change of responsibility for supervision from the school board to the supervisor. Supervision has moved from an exclusively inspectorial function to a very broad role in the education system. This change is emphasized by the Fifty-ninth Yearbook of the National Society

for the study of Education. "Just as 'teaching is not telling,' supervision is not inspecting, directing and rating, it is, rather, motivating, leading, and consulting, a process of co-operative analysis and synthesis involving teachers, administrators, students, and the public."\(^2\)

The change is described in more detail by Kulles.

...the old idea of supervision was centered on the improvement of the classroom situation by training and improving the teacher. Supervision was limited to such factors as the teaching plan, the teacher's application of the curriculum, the methods and techniques used, and the materials collected by the teacher. Modern supervision is directed toward planning a program for the improvement of learning. In a supervisory approach, learning has a much broader base than instruction. Since it centers its attention upon the child's development, it has to do with all major factors in the learning situation.\(^3\)

The interpretation of the role and function of the supervisor varies from position to position. Some of these differences will be described in the next chapter. Most tasks of the supervisor generally have components of the traditional inspectorial function as well as a less well defined leadership function. This latter function is sometimes thought of as being concerned with the improvement of the quality of education.\(^4\)


One of the results of the operational dichotomy of supervision is that there are no widely accepted standards for measuring the effectiveness of supervisors or supervisory techniques. Much attention has been given in the literature to his function and to his methods, but there have been few attempts to provide meaningful guidelines for making judgements concerning supervisory activities.

One of the two most frequently used techniques in assessing the effectiveness of supervisory programs involves requesting educators to evaluate the degree of effectiveness of the procedures being utilized by the supervisors being studied. The other technique uses some form of change in student behavior, such as scores on achievement tests, correlated with differences in the supervisory program. Although these techniques are effective for specific supervisory environments, they do not usually lead to broad generalizations that have wide application in many different school systems.

Science Supervision

The rapid expansion of the role of science in contemporary life has produced a similar expansion of the role of science in education. The public concern for the role of science in education that took focus in the latter half of the preceding decade has been documented by many writers. It will suffice to say that much of the concern took the form of interest in the quality and quantity of science being offered in the schools.

Because of the supervisors' responsibility in improving the quality of education, much of the public concern for the science program
was directly or indirectly diverted to the province of the supervisor. As a result of the specialized nature of the academic discipline, the general supervisor found himself without the necessary background, both in content and techniques, to effectively fulfill his obligations in either the quality or quantity of science being offered in the schools. Thus the need was established for a greater amount and more effective science supervision.

The Problem

The supervisor is confronted with an overwhelming array of problems. He is expected to efficiently handle problems ranging from curriculum development to public relations. Unfortunately, there are few resources available to guide the supervisor in his choice of solutions to these problems.

The literature provides little help for the science supervisor. Studies of effectiveness of science supervision have closely followed the pattern of those of general supervision. These studies, previously mentioned, have failed to yield results that will help the supervisor fulfill his functions. If the science supervisor is to efficiently discharge his obligations, the functions and techniques he uses must be subject to careful analysis and evaluation. It is the objective of this study to determine certain functions of the science supervisor and to develop an instrument to evaluate some practices that the science supervisor uses to fulfill these functions.
Definitions and Limitations

For the purposes of this study the term supervisor is being defined as a person who devotes full-time to the supervision of a science program. Although there are many elements of similarity in the supervision of programs of widely varying sizes, the study will be limited to supervisors having jurisdiction in only one local school system. A person who fills a supervisory role on a part-time basis would have other demands upon his time and would probably not have the breadth of experience of a full-time person. Since subject matter supervisors are more common in the secondary school than in the elementary school, the study is further limited to the secondary school.

The evaluation instrument was designed to meet several criteria. In so far as possible the validity of the instrument is independent of the background of the supervisor, the particular environment of the supervisor and the nature of the supervised.

Procedures

A careful survey of the literature yielded six areas of science supervision activities that are frequently performed by supervisors. Ten specific supervisory problems, at least one from each of the six areas, were developed to serve as the basis for the instrument. Five possible solutions were proposed for each of the ten supervision problems.

A jury of seventeen science educators and twenty-four science supervisors were asked to co-operate in the study by completing the instrument. The design of the instrument incorporated the forced-choice
and paired comparisons methods of rating. The instrument yielded five possible solutions, scaled in order of desirability, to each of the ten supervision problems posed.

**Plan for Following Chapters**

A review of selected, pertinent and related literature is presented in Chapter II. Methodology and procedures used in this study are described in Chapter III. The data and results are discussed in Chapter IV. Chapter V contains the conclusions and recommendations developed from the findings of the study relating to science supervisory practices and the use of the instrument.
CHAPTER II

REVIEW OF RELATED LITERATURE

The professional literature provides abundant resources for general supervision. The more specialized area of science supervision has been less favored by authors. Few references are available relating to the evaluation of supervision or supervisory practices.

The first section will discuss the history of supervision and the role of general supervision. The second section will deal with problems of evaluation of general supervision. The functions of supervision of science programs will be treated in the third section. The last part of the chapter will review the literature dealing with evaluating the effectiveness of science supervisory programs.

The Role of the General Supervisor

The instrument that was developed as a major part of the dissertation deals with specific functions of the supervisor. Before referring to the literature to find these specific functions, it is well to trace briefly the history of supervision in American education.

Supervision was first introduced into education from the authoritarian viewpoint of inspecting the quality and quantity of education that was being offered to the youth. This function was fulfilled by those who were charged with the responsibility of the
schools. This was usually a member of the board of education of the public schools or a member of the clergy or a special administrative committee in the parochial schools.

Gradually, the inspectorial function was found to be too demanding and complex for the usual person on the governing authority of the school. The function was transferred to the administrator of the school. As the school became more complex, the administrator assigned the tasks of quality and quantity control to other administrators.¹ ²

This evolutionary trend continues yet today. The supervisor, in many instances is detached from the administrative chain of command, but in other school systems, he still retains part or all of the authoritarian role of inspector.

The supervisor has become a major instrument of change in the public school system. He is the one, who by working with teachers in a more intimate fashion than any other administrator, has an opportunity to influence the direction of change within the classroom.

The supervisor usually finds his work involved both in the tractive and dynamic aspects of supervision. Harris has described tractive supervision as being geared to continuity and dynamic supervision as being directed to change in the program.³ It is difficult to imagine a situation where both influences are not present.

¹Ayer and Barr, loc. cit.
²Franseth, loc. cit.
Because of differences between the tractive and dynamic aspects of supervision, the manner in which a supervisor perceives his role as a supervisor greatly influences his actions. Hallberg, in a study at the University of Oregon, examined the expected roles of elementary supervisors as viewed by supervisors, superintendents, principals, and teachers. These roles were then compared with the actual roles perceived by the same groups of education workers.

Representatives from the four groups were asked to respond to statements of supervisory activities as to degree of desirability and to the degree of actual performance. The study resulted in seven conclusions:

1. Supervisors are expected to emphasize human relations and are perceived as fulfilling this expectation.

2. Some expected behaviors relating to the consultant concept are not usually met.

3. Administrative and clerical duties are not desirable expected behaviors nor are they usually perceived as being performed.

4. Oregon supervisors behave in a passive manner rather than showing forceful leadership, which agrees with their expected behavior.

5. There are contradictory expectations and confused thinking about the supervisory role.

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6. Some perceived and expected behavior have the potential of creating role conflict.

7. A lack of planning is evident in most supervisory programs.

The report of the study concluded by suggesting two courses of action to improve the situation. The first recommendation was for more planning of supervision by everyone directly or indirectly involved. The second recommendation concerned itself with better pre-service and in-service education for supervisors.

Writing some six years later, Allen still decries the lack of appreciable progress toward a clarification of the role of the supervisor.5 Although there has been much interest in the literature about supervision, little has been done to solve problems that were obvious in the previous decade. The need for additional trained personnel to attack the unanswered questions is the author's suggestion for helping improve supervision.

The Research Committee of the Indiana Association for Supervision and Curriculum Development undertook a three-year study of the perception of supervision.6 An opinionnaire was developed from a questionnaire sent to the organization's membership. The opinionnaire was submitted to groups of fifty administrators, principals, faculty members teaching elementary and secondary education courses, parents,

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supervisors, and teachers. The study was limited to Indiana. Only 139 of the 300 opinionnaires were completed.

The study showed that the respondents believed that the supervisor should develop curriculum, help teachers achieve effective learning environments, improve instruction, inspire teachers, render advice concerning methods and materials and serve as consultant or coordinator. The same respondents viewed the behavior of supervisors as being categorized by compiling library and audio-visual materials, giving professional advice to teachers, improving curriculum, taking care of clerical duties and testing and evaluating.

The results of this study, while being more specific than those found by Hallberg in Oregon, do not conflict, except the Indiana supervisors are perceived as having more clerical duties than those in Oregon. The Indiana study also concerned itself with recommendations for improvement of supervision and attempted to define supervision.

A slightly different approach to perceiving the role or function of the supervisor was taken by Payne. The supervisor was examined as to the qualities that he must possess to enable him to fulfill the role of the supervisor. These qualities have been categorized into four areas of competency needed to fill the role of general supervisor: good personal relationships; a knowledge of children and curriculum; the ability to serve as coordinator and consultant; and participation in professional activities.

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The functions of the supervisor have been outlined in more detail by Harris.\(^8\) He grouped the functions into ten categories:

1. Developing curriculum
2. Organizing for instruction
3. Staffing
4. Providing facilities
5. Providing materials
6. Arranging in-service education
7. Orienting new staff members
8. Relating special services
9. Developing public relations
10. Evaluating educational programs

The categories were grouped on the basis of functions, not on the basis of titles or objectives. This type of categorization is designed to help improve communication involving the role and function of supervision.

Evaluation of General Supervision

Some of the problems of evaluating general supervision are obvious. From previously cited references, it is apparent that authors do not agree on the role or function of supervision. To evaluate something as unstructured as supervision, it is the usual practice to operationally define supervision for the purposes of the particular study. Another approach is to have the respondent describe effective

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supervisory procedures according to his personal set of criteria. Several sources are cited in this section to show the types of techniques frequently used.

Wilcox has proposed two propositions to be used in the evaluation of supervision. "The effectiveness of supervision can be measured in terms of the goals established for the educational program." He offers suggestions as to types of empirical measurements such as various student records, tests, college success and other forms of student data that may be made in measuring such effectiveness.

His second proposition is not as amply supplied with empirical data. "The effectiveness of supervision can be measured by the growth in professional competency, professional responsibility, and professional autonomy achieved by the school staff." Suggestions as to types of available data to test effectiveness center around an increase in professional activity in individual teachers and groups of teachers. These vary from attending professional meetings to conducting educational research.

A similar type of evaluation of supervision is proposed by Saville. Comparisons of student achievement, attendance, holding power of classes, attitudinal changes of students and teachers and follow-up studies are suggested as sources of data for evaluation.


10 Ibid.

In a doctoral study at the Pennsylvania State University, Sandberg examined the effectiveness of supervisory techniques used by supervisors in working with beginning elementary teachers. Nine hundred forty-nine beginning teachers and sixty-four supervisors were asked to rate on a scale, the effectiveness of sixty-seven supervisory techniques. The teachers and supervisors agreed that all but seven of the techniques were effective. The teachers did not believe that inspectoral techniques were effective. The other types of supervision, previously mentioned in other resources in this chapter, were agreed upon as effective by both the teachers and supervisors.

Gwynn describes in detail how a program of supervision may be evaluated. He suggests that the objectives of the supervision program be the ultimate source of evaluative criteria and techniques. Teachers are asked to complete a questionnaire about the supervisory program. Questions concerning an increased awareness of professional literature and the sufficiency of supervisory time are asked. Administrators are asked to complete a similar questionnaire. They are requested to cite specific improvements in the school program that can be attributed to supervisors and to record any change in rapport among teachers.

The supervisor is asked to keep a complete log of his activity and to analyze his behavior. Each workshop participant is asked to complete a questionnaire concerning the effectiveness of the

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workshop. Follow-up questionnaires are given to workshop participants in an effort to determine long-range effects.

Netzer and Eye have developed two instruments for analyzing the role of supervision within a school system.\(^1\) The instruments were developed for the University of Wisconsin-Milwaukee and the Wisconsin Improvement Program. The first instrument is a checklist used in surveying the perceptions of the functions of supervision. It is given to all teachers in the school system.

The second instrument is a structured interview instrument. It is in two forms, one for teachers and the other for supervisors. The supervisor's form was phrased to find out what actual tasks performed by supervisors should or should not be performed. The teacher's form was designed to find the teacher's perception of the tasks the supervisor performs or should not perform.

Because of the nature of the instruments, they are of little value in large scale studies of supervision. They are designed to gain information and not to solve problems. They should, however, provide help in further understanding the role of supervision within a school system.

The five writers' suggestions for evaluation that have been discussed differ but yet have a common problem. The results of the studies of effectiveness are very difficult to translate into program changes on a large scale. A more exact procedure is needed to relate to specific duties of the supervisor so that alternative courses of action are

opened to the supervisor without merely finding that a particular response to a problem is not effective.

**Functions of Science Supervisors**

The professional literature is more precise about the role of the subject matter supervisor such as the science supervisor. To show how the functions of the science supervisor have evolved, several articles written about 1940 will be presented. Articles written within the past few years will serve to show the changes in the role of the science supervisor in the past quarter century.

One of the earlier discussions of the role of the science supervisor is provided by Wilt, writing in *Science Education* in 1940. Chicago had just initiated a program of science supervision and the article describes the duties of the supervisors.

The duties of the advisors were to help the teachers plan units of work, to develop individual lessons, to suggest and secure materials, to prepare reference lists, and to make frequent visits to note the progress of the work in the classroom. 15

Zechiel describes the work of the science supervisor in 1939, when dealing with experimental schools, primarily as coordinating the school experiences of students and not as coordinating science content. 16 He also points out that the supervisor must assist in curriculum development, serve as a constructive critic, be a clearing house for materials and keep up to date with the literature of his field.

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Also writing about the same time was Rawlins.\textsuperscript{17} He described the duties of the science supervisor in a large school district in more detail than the usual report in the literature, as shown by the following:

1. Contacts with teachers
2. Office work
3. Preparing and scoring examinations
4. Compilation of apparatus, equipment and supply lists
5. Attending meetings
6. Professional reading

A broadening of the concept of science supervision is evident by the writing of Lefler, seven years later.\textsuperscript{18} He describes the functions of the state science supervisor in Indiana which may be categorized into the following classifications.

1. Conferences with individual teachers, groups of teachers, supervisors and administrators
2. Preparation of curriculum materials
3. Development of resource materials
4. In-service education

A further broadening of supervision is apparent in an article in \textit{The Science Teacher} in 1957 by J. Myron Atkin.\textsuperscript{19} He describes the functions in only two categories, as a resource person and as a co-teacher.


Within this framework he describes procedures such as demonstration teaching, conducting workshops, curriculum development, planning conferences, learning materials evaluation and acquisition, and working with administrators.

Atkin also discusses the need for teacher education institutions to develop programs for the education of such specialists. He points out that specialists in art, music and physical education have such education programs available to them but there are few for science specialists.

In a doctoral study at the University of Mississippi Harwell studied the responsibilities of the science supervisor as indicated by science teachers.20 His experimental population was five hundred science teachers randomly selected from two thousand science teachers who taught in school systems that employed one or more science supervisors. Only 249 responses were received. The responsibilities that the respondents thought most important were:

1. Assumes the leadership role in preparation of courses of study
2. Serves as coordinator in developing an institutional philosophy of science
3. Attends institutes and workshops held at colleges and universities
4. Participates in policy making of science program of the local school system

5. Is available for personal counseling of science teachers
6. Publicizes events concerning the science program

In writing in *Science Education* about the need for science supervisors, Reinisch describes the duties of the supervisor. He groups these duties into four categories.21

1. Teach demonstration classes
2. Teach in-service courses
3. Advise schools on curriculum development
4. Resource person for new techniques

In his masters research project, Wrobleski surveyed the duties and functions of science coordinators in school districts having a population of over 30,000.22 For the purposes of the study he divided the duties of the science coordinator into the following general areas:

1. Curriculum development
2. Supervision of science instruction
3. In-service education
4. Personnel responsibilities
5. Guidance and counseling
6. Educational testing
7. Research
8. Radio and television


22 Bernard Edgar Wrobleski, "The Duties and Functions of a Science Coordinator in a 9-12 Science Program in Selected School Districts of the United States" (unpublished Masters research project, Indiana State College, August, 1965).
9. Audio-visual materials
10. Public relations

The study resulted in a survey of the frequency of performance of specific tasks that science coordinators might perform.

The Fifty-ninth Yearbook of the National Society for the Study of Education categorizes the role of the science supervisor into the following areas:

1. Developing in-service educational programs
2. Developing a science curriculum
3. Visiting classrooms
4. Establishing and implementing educational goals
5. Planning demonstration lessons
6. Co-ordinating services
7. Suggesting and supplying resource materials
8. Helping in the selection and purchase of textbooks and equipment

One of the more powerful means of communication that is at the disposal of the science supervisor is that of a newsletter or bulletin. Maddux has described techniques that can be adapted to various situations. She describes one function of the newsletter in terms of professional relations. "...to bring the headquarters office closer to the teacher and to help her feel that the department is interested in her personally..."

Another infrequently mentioned function of science supervisors is that of guidance. MacLean points out that trained guidance counselors are in short supply and usually are not well versed in vocational

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23Stotler et al. loc. cit., p. 226.

opportunities in science. The supervisor must assume the responsibility of encouraging science teachers to provide personal and vocational guidance to students. This would entail informing science teachers of basic guidance techniques, keeping the teachers up-to-date about vocational opportunities, and providing workshops for implementing guidance into the teacher's pattern of operation.

Several authors have directed their attention to problems of supervision in attacking specific problems in science education. Mandell describes a program of supervision to upgrade elementary science education in Virginia. The supervisors taught secondary science half days. The other half day was devoted to assuming the responsibilities of resource persons for elementary teachers. Their duties were to provide materials and equipment and demonstrate their uses to teachers; develop resource units; provide demonstrations for classes; and give the classroom teachers encouragement and technical assistance. More effort will be given to curriculum development in the future of the program.

Fowler offered a suggestion of how a University can cooperate with local school systems in providing up-to-date science supervision. The proposal included the use of a team of three science consultants, one trained in biological sciences, another in physical science and the third in mathematics. The major functions of these supervisors

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would be subject matter counseling, methods and materials counseling, curriculum development, career guidance, and encouraging teacher participation in professional societies.

In a study to determine the relative effectiveness of television and conventional methods of instruction, a study of the effectiveness of consultant services as supplements to these methods of instruction was made by DeVault, Houston, and Boyd.28 The supervisors were used chiefly in analyzing instructional problems, to develop activities or programs, and for clarification of new concepts presented in the in-service programs. Teacher reaction and pupil achievement was related positively to classroom observations, classroom demonstrations and to the amount of time the supervisor spent with each teacher.

A survey of the services performed by science supervisors in the public schools of Texas was reported on by Robert Cannon in School Science and Mathematics.29 Fifteen replies were returned from the sample of twenty-nine. A wide variety of jobs were reported by the supervisors. The jobs reported by the supervisors and the number of supervisors reporting this function are listed below:

1. Attendance at supervisors and administration meetings - Ten
2. Demonstration teaching - Four
3. Development of science curriculum - Four


4. In-service education - Five
5. Consultation with teachers about specific problems - Fifteen
6. Secure and distribute free materials - Ten
7. Looking up desired facts and materials - Twelve
8. Construction of devices or displays - Five
9. Collection of specimens for class use - Five
10. Setting up or operating science clubs - Eight
11. Working with science fairs - Fourteen
12. Publishing bulletins or courses of study - Nine
13. Working with audiovisual aids - Eleven

Paul F. Ploutz, in his doctoral study at Colorado State College, studied the conditions of employment, status, and professional responsibilities of science supervisors. He found that there were basic similarities of responsibility and function common to all supervisors of science as well as basic similarities of function at specific levels, elementary, K-12, secondary and state. The study was based on a sample of one hundred supervisors, twenty-five being selected from each of the four levels mentioned above. The one hundred supervisors represented thirty-two states with greater representation from regions of dense population. The following list of duties are in descending order of frequency mentioned:

1. Assisting teachers in the classroom
2. Providing materials, supplies, and information

3. Curriculum development
4. Organizational problems
5. In-service education
6. Demonstration classes
7. Administering National Defense Education Act

The professional stature of science supervision was enhanced by the appearance in early 1967 of two books exclusively devoted to science supervision. Both volumes explain science supervision and attempt to describe functions and procedures that would enable a supervisor to fulfill his responsibilities.

Stotler, Richardson and Williamson present a concept of supervision that is close to the dynamic end of the tractive-dynamic continuum of supervision that was developed by Harris and discussed earlier in this chapter. The three authors develop the concept that the major function of the science supervisor is to develop an atmosphere of creative instability. The majority of the book is devoted to explaining how the supervisor can utilize the education environment to create and maintain this creative instability.

The authors have developed an extensive checklist of jobs with which a supervisor should be concerned. These checklists are developed in such a way that some of them can be useful in almost every supervisory situation.

A considerable portion of the book is devoted to a description of a possible educational environment of the future. This environment can be described as unstructured and totally learning centered. In this environment the concept of the school has been broadened to include continual education throughout the lifetime of the citizen. The role of science in this environment is clearly explained and offers many imaginative ideas regarding the future of science education and more specifically, science supervision.

The second of the two books dealing with science supervision was prepared as a project of the National Science Supervisors Association and written in the format of a yearbook. The book offers short chapters on the specialized functions of science supervisors as well as chapters dealing with the interrelationship of science supervision with other institutions. Of specific interest are chapters dealing with the education of the supervisor and with resources that the supervisor can utilize in performing his duties. The book is written as a reference and not so much as a day-to-day job description of an idealized supervisory situation.

Attention has been given to both line and staff functions of science supervision. In comparing this book to the volume previously discussed, the source book is more descriptive of immediate supervisory practices and short-range possible improvement. Whereas the previous book was written for long-range stimulation.

Evaluation of Science Supervision

Attempts to evaluate science supervision have been few. Generally they follow the patterns of studies used in evaluation of general supervision. One technique is to request educators to judge the degree of effectiveness of specific duties of supervisors. Another technique is to measure certain outcomes of education, such as student performance on tests, and relate these results to variables within the supervision program.

In his doctoral study at Fordham University, Richard Turner appraised the effectiveness of twenty-five New York City science consultants. In September, 1958, twenty-one new science consultant positions were filled in New York City. This brought the total elementary science consultant staff to twenty-five members. Each science consultant was assigned to a particular district office and was responsible for elementary science in the associated schools. The study is concerned with the first year of operation of the consultants.

The practices employed by the elementary science consultants were determined by the use of a questionnaire that was completed by the consultants. The effectiveness of these practices was judged by the district assistant superintendents, the elementary school principals, a district science consultant, and the assistant director of science of the elementary school division.

The study resulted in a ranking of twenty-five specific duties performed by elementary science consultants in New York City.

An extremely low correlation between practices which were rated valuable and practices which were actually employed was found. Value ratings given to consultant practices by the assistant director of science and the other three categories of respondents had low agreement. Turner concluded that the consultants need greater direction in their activities and more efficient channels of communication.

In September, 1963, the *Journal of Educational Research* carried an article by John Ginther comparing the achievement of sixth grade science students under two instructional roles of science consultants. In one situation the consultants worked only with the teachers. In the second situation, the science consultant assumed responsibility for teaching one class each week. Variables such as text materials, guide books, laboratory materials, and amount of time given by each consultant to each teacher was carefully controlled.

Pre and post tests were developed to measure student achievement in the experiment. There was significant difference in the achievement of the students in favor of those who were taught by teachers in their conventional role. The conclusion of the study was that science consultants may have greater impact on achievement when they work with teachers than when they work with students.

Six months later, in March, 1964, Arlene Payne reported on a second study that was done following the previous one. The study

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again used two supervisory situations. The first situation used the consultant in giving assistance to teachers in planning activities. In the second situation, the consultant was used in planning and giving weekly demonstrations to both students and teachers. Variables such as time and materials were equated in both situations. Student achievement tests showed that there were no significant differences between the two supervisory techniques. Payne concluded that there were two factors not controlled that may have influenced the findings of the studies by Payne and by Ginther. The first factor was individual differences among the teachers and the second was the content of the unit studied. "In view of the conflicting findings of the 1960 study and the study presented in this report, no positive conclusions concerning the role of the science consultant are tenable at this time."36

One of the most complete evaluations of secondary science supervision was done by Lee in his doctoral dissertation at The Ohio State University.37 A list of a hundred and six activities that could be considered as possible supervisory activities in secondary school science education was obtained from the literature. These activities were divided into the areas of administration, methods, materials and equipment, curriculum study, public relations, in-service growth of teachers, self-growth and research.

A jury of thirty nationally known science educators were asked to evaluate the possible supervisory activities. Twenty-five jurors responded to the request.

36Ibid., p. 353.

State and local science supervisors were asked to cooperate in the study by indicating the frequency of performance of the listed activities. At the time of the study only six states had state science supervisors.

Comparisons of values established by the jury for the given activities with the extent of performance by state supervisors show an alarming difference of scores. In all but a few exceptions, the values by the jury are much higher than the extent of performance by the supervisors. Every indication is given that much is to be done in the field of science supervision before significant correlation between values and performance are realized.\(^{38}\)

Of the eighty-eight local science supervisors whose assistance was requested, eighty-four percent complied, resulting in the following conclusion.

Considerable differences are found between the values established for the activities by the jury of science educators in the extent of performance of the activities by the local supervisors of science. Disagreements are found in the ranking of activities within a category as well as in the ranking of major categories.\(^{39}\)

Lee was able to conclude that the supervision of secondary school science programs seldom meet the standards established by leaders in the field of science education. He found that the greatest needs lie in more consultive aid and a release from routine office procedures.

**Summary**

The literature dealing with the role of general supervision and the role of science supervision reveals a great deal of activity

\(^{38}\)Ibid., p. 248.

\(^{39}\)Ibid., p. 253.
during the past quarter century. Most of the authors have dealt with the duties of supervisors either from a detailed job description point of view or a general concept of supervision point of view. Little has been provided to give the supervisor guidance in carrying out his responsibilities. Most of the suggestions of duties and roles of science supervisors can be categorized into the following six areas.

1. Curriculum development
2. In-service education
3. Utilization of learning materials
4. Development of personnel
5. Professional growth
6. Promoting public relations

The literature concerned with evaluating supervision or supervisory practices has been less favored than that of the role of the supervisor. One of the two most frequent patterns of evaluation is based on judgements of the effectiveness of supervisors or supervisory practices by teachers, supervisors or administrators. The other frequently used technique involves the use of certain student outcomes, such as student achievement test scores, in relation to variables within the supervisory pattern.

It is difficult to apply the results of evaluations of these kinds to other situations because of the many uncontrolled variables. There was little evidence of innovative ideas in evaluating supervisory practices. Many authors cited the need for further studies in this area, but few writers have accepted the challenge.
CHAPTER III
THE RESEARCH STUDY DESIGN AND PROCEDURES

The procedures used to carry out this study can readily be divided into three phases.

1. Developing the instrument
2. Identifying a suitable jury of experts in science education
3. Validation of the instrument by the jurors

A description of the procedures used is presented in this chapter.

The Development of the Instrument

The professional literature dealing with general supervision and with science supervision was carefully analyzed. No reliable technique for measuring science supervision effectiveness was found. The report of the literature examined is presented in Chapter II.

The literature supports the belief that supervisory behavior takes place in a wide variety of specific environments. In order to control as much of the environmental variable as possible, it was decided to provide an artificial common environment by utilizing case studies as a basis for the instrument.

The analysis of the literature yielded many suggestions for functions of supervisors. They ranged from very detailed suggestions such as discussing the content of the monthly newsletter to that of
generally improving communication. These functions were summarized into the following six areas.

1. Curriculum development
2. In-service education
3. Utilization of learning materials
4. Development of personnel
5. Professional growth
6. Promoting public relations

Brief case studies were developed around problems suggested by the literature in each of the six areas. They were chosen because of the wide applicability to various supervisory situations. Environmental details were presented only when they contributed directly to the cause or possible solution of the problem. A total of fifteen problem areas were described in the case studies. A jury of experts in the field of science supervision was used to validate the instrument. The techniques used to select the jury are described later in this chapter.

Many possible solutions to each of the supervisory problems were listed. The five solutions to each of the supervisory problems that had widest applicability to different supervisory situations were chosen for inclusion in the instrument.

Format of the Instrument

Techniques borrowed from attitude scale construction were used for developing the format and for the analysis of the instrument. The

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psychological scale technique called "Paired Comparisons" was used to
analyze the data. In this technique each possible solution to the case
is paired with all other possibilities. The five solutions for each
problem yielded ten pairs. The respondent must choose the more
desirable of the two possibilities of each pair.

Statistical Treatment of Data

The method of Paired Comparisons is based upon the law of comp­
parative judgement as developed by Thurstone, and modified by Guilford.\(^2\),\(^3\)
This technique yields a physical continuum on which the possibilities
are ranged from more to less desirable. The scale of the continuum is
in psychological scale units.

According to Thurstone, when a large number of individuals make
judgements of some attribute of a stimulus, their responses will follow
the normal distribution curve. Any normal distribution curve can be
described in terms of two parameters, the arithmetic mean of the distri­
bution and the standard deviation of the distribution. We also know
for any normal distribution the mean, median and the mode all have the
same value. Therefore, the modal response to the stimulus can be
taken as the median of the normal distribution curve. The mean response
to the stimulus is taken as the scale value of the stimulus.

If a large number of persons were asked to make comparative
judgements about some characteristic of two stimuli and more people


\(^3\)Allen L. Edwards, *Techniques of Attitude Scale Construction*
choose one of the stimuli than the other, we can say that one has a higher modal response than the other. The difference in scale value of the two responses will be a function of the proportion of more favorable judgements. This function is the mathematical statement of Thurstone's law of comparative judgment.

\[ R_a - R_b = Z_{ab} \sqrt{d_a^2 + d_b^2 - 2r_{ab}d_ad_b} \]

Where:

- \( R_a \) = the response to stimulus a
- \( R_b \) = the response to stimulus b
- \( d_a \) = standard deviation of a
- \( d_b \) = standard deviation of b
- \( Z_{ab} \) = normal deviate or standard-measure distance
- \( r_{ab} \) = correlation between a and b

Standard tables are readily available to provide the Z value directly from the proportion of judgments. According to Thurstone we may assume that the standard deviations are equal and the intercorrelations are all equal to one another so the previous equation can be reduced to:

\[ Z_{ab} = R_a - R_b \]

This equation is known as Case V of the law of comparative judgment.

When more than two stimuli are used, a matrix is useful to clarify the presentation of the data.

**Pilot study**

In order to determine if the instrument and its interpretation was feasible, a pilot study was conducted. The study used data provided
by thirteen graduate students in science education. They completed an abbreviated version of the instrument, making use of four case studies, in an average of eighteen minutes with a range of thirteen to twenty-two minutes. The data provided by the graduate students were analyzed by the methods described in a previous section of this chapter.

The pilot study showed that the format of the instrument was workable with little evidence of misinterpretation by the graduate students. The techniques used in the interpretation of the data were shown to be practical. The statistical methods used were applicable to the type of data provided by the instrument. The pilot study and its analysis showed that the instrument met the major objective of the study in that supervisory techniques can be evaluated by using the instrument.

As an aid in securing a high return from the jury, the instrument was limited to ten case studies, which would enable most jury members to complete the instrument within an hour. The investigator and his advisor selected the ten case studies. Table 1 provides a brief description of the case studies and shows the distribution of them in the areas of supervision described on page 34.

Typical Analysis of Data

As an example of the statistical treatment of the data, the complete analysis of the second case study of the pilot study is presented below.

The five possible solutions were paired with each other in all possible combinations. For ease in computation, these are numbered.
<table>
<thead>
<tr>
<th>Curriculum Development</th>
<th>What is the best way to prepare the teachers for a major curriculum change?</th>
<th>How should the supervisor administer a course development project?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inservice Education</td>
<td>Problems in organizing a formal in-service course</td>
<td></td>
</tr>
<tr>
<td>Learning Materials</td>
<td>How can the science supervisor best spend an extra $150.?</td>
<td></td>
</tr>
<tr>
<td>Personnel Development</td>
<td>Which academic background having depth in various science areas would be best for a biology teacher?</td>
<td>The successful coach with a poor background is not interested in improving his teaching.</td>
</tr>
<tr>
<td>Professional Growth</td>
<td>Teacher has good science background but poor professional commitment. He does not fulfill any objectives except content.</td>
<td>Teacher is out of date in professional and academic areas. Teacher is well prepared but does not use the laboratory. Students only read about science.</td>
</tr>
<tr>
<td>Public Relations</td>
<td>How can the supervisor control a powerful science fair?</td>
<td></td>
</tr>
</tbody>
</table>
The responses to each of the pairs is given in Table 2 as a proportion of the total number of responses to the specific pair.

TABLE 2
FREQUENCY MATRIX FOR PILOT CASE STUDY 2

<table>
<thead>
<tr>
<th>Solution</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>16/30</td>
<td>18/29</td>
<td>17/30</td>
<td>23/30</td>
</tr>
<tr>
<td>2</td>
<td>14/30</td>
<td></td>
<td>11/28</td>
<td>16/30</td>
<td>16/29</td>
</tr>
<tr>
<td>3</td>
<td>11/29</td>
<td>17/28</td>
<td></td>
<td>17/31</td>
<td>14/30</td>
</tr>
<tr>
<td>4</td>
<td>13/30</td>
<td>14/30</td>
<td>14/31</td>
<td></td>
<td>13/29</td>
</tr>
<tr>
<td>5</td>
<td>7/30</td>
<td>13/29</td>
<td>16/30</td>
<td>16/29</td>
<td></td>
</tr>
</tbody>
</table>

Note: Column solution more favorable than row solution

The number of responses are converted into decimal proportions in Table 3. When each solution is compared with itself, the chances are even of one being selected over the other. Thus the proportion is .500.

A table of constants of the normal distribution curve is used to obtain the Z values from the proportions in Table 3. The Z value represents the scale distance between the scale values of the responses. When a proportion is less than .500 the Z value is negative. When the proportion is more than .500 the Z value is positive. The upper
right half of the matrix is a mirror image of the lower half except for the opposite sign.

**TABLE 3**

**PROPORTION MATRIX FOR PILOT CASE STUDY 2**

<table>
<thead>
<tr>
<th>Solution</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.500</td>
<td>.533</td>
<td>.621</td>
<td>.567</td>
<td>.767</td>
</tr>
<tr>
<td>2</td>
<td>.467</td>
<td>.500</td>
<td>.393</td>
<td>.533</td>
<td>.552</td>
</tr>
<tr>
<td>3</td>
<td>.379</td>
<td>.607</td>
<td>.500</td>
<td>.548</td>
<td>.467</td>
</tr>
<tr>
<td>4</td>
<td>.433</td>
<td>.467</td>
<td>.452</td>
<td>.500</td>
<td>.448</td>
</tr>
<tr>
<td>5</td>
<td>.233</td>
<td>.448</td>
<td>.533</td>
<td>.552</td>
<td>.500</td>
</tr>
</tbody>
</table>

Note: Column solution more favorable than row solution

The mean Z value for each of the five possibilities is computed. The sum of the sums should be equal to zero as an arithmetic check. The means should also sum to zero, within rounding error. To eliminate the negative numbers, for convenience, an arbitrary value of zero is given to the lowest of the five mean values. A positive number equal to the absolute value of the mean of the lowest value is then added to each mean. Table 4 shows the development of these psychological scale values. As such they are a measure of the differences and desirability of the five possible solutions.
### TABLE 4

**Z MATRIX FOR PILOT CASE STUDY 2**

<table>
<thead>
<tr>
<th>Solution</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.000</td>
<td>.083</td>
<td>.308</td>
<td>.169</td>
<td>.729</td>
</tr>
<tr>
<td>2</td>
<td>-.083</td>
<td>.000</td>
<td>-.272</td>
<td>.083</td>
<td>.131</td>
</tr>
<tr>
<td>3</td>
<td>-.308</td>
<td>.272</td>
<td>.000</td>
<td>.121</td>
<td>-.083</td>
</tr>
<tr>
<td>4</td>
<td>-.169</td>
<td>-.083</td>
<td>-.121</td>
<td>.000</td>
<td>-.131</td>
</tr>
<tr>
<td>5</td>
<td>-.729</td>
<td>-.131</td>
<td>.083</td>
<td>.131</td>
<td>.000</td>
</tr>
<tr>
<td>SUM</td>
<td>-1.289</td>
<td>.141</td>
<td>-.002</td>
<td>.504</td>
<td>.646</td>
</tr>
<tr>
<td>MEAN</td>
<td>-.258</td>
<td>.028</td>
<td>.000</td>
<td>.101</td>
<td>.129</td>
</tr>
<tr>
<td>MEAN + .258</td>
<td>.000</td>
<td>.286</td>
<td>.258</td>
<td>.359</td>
<td>.387</td>
</tr>
</tbody>
</table>

### Selection of Jury

To validate the instrument it was necessary to gain the benefit of the insights of the most knowledgable people in science supervision. Because of a lack of a clear definition of the function and description of science supervision, a random sample of science supervisors was not practical. A serious technical problem in doing research on science supervision is that no listing of science supervisors exists. Even if it would be possible to obtain names and addresses of all science supervisors, no criteria are available for deciding which of those supervisors listed would have the understanding necessary to judge effectiveness of supervisory practices.
To overcome these problems, the membership of the only national science supervisors professional organization, the National Science Supervisors Association, was asked to select supervisors that they judged competent to evaluate supervisory practices. Details of the procedures follow in subsequent sections.

Because of the role the college teacher of science education plays in supervision of student teachers, the training of science supervisors and in the supervision of on-going classroom programs, science educators were included in the jury. The procedures are explained below.

In choosing a jury by these techniques, the breadth of experience available in the National Science Supervisors Association has been used to select the jury without neglecting the contribution to science supervision of the science educator. These techniques have secured the highest probability of access to the most knowledgable people in science supervision that is available to a study of this scope.

Selection of Science Educators

Twenty-nine science educators who were not full-time science supervisors employed by a state, city or local educational agency were chosen by the investigator and his major advisor to assist in the selection of the jury. These science educators were asked to suggest up to ten science educators who would be competent to judge the effectiveness of science supervision procedures. A copy of the letter and the reply form is found in the appendix. These twenty-nine requests were mailed
in early November, 1966. Follow-up requests were made one month later. By February, 1967 twenty-six replies had been received for a return of 89 per cent.

With the assistance of the Statistical Division of the North Carolina State Department of Public Instruction, a compilation was made of the number of times each name was suggested. A total of 173 names was suggested by the science educators, 110 of them being different. The eighteen science educators who were most frequently mentioned were asked to participate in the study.

**Selection of Science Supervisors**

The members of the National Science Supervisors Association were asked to suggest up to ten science supervisors who would be competent to judge the effectiveness of science supervision procedures. A copy of the letter and the reply form are found in the appendix. A few members of the National Science Supervisors Association were not sent requests because they were included in the request of science educators previously described. In November, 1966, 440 requests were mailed. Follow-up requests were made one month later. By January, 1967, 304 replies or 69 per cent had been received. Ten requests were returned because of incorrect addresses. The return of usable replies was 67 per cent. Just over seventeen hundred names were suggested by the science supervisors. A compilation was made of the number of times each name was suggested. A total of 152 science supervisors were suggested three or more times. The twenty-three science supervisors who were mentioned most frequently were asked to participate in the study.
It is interesting to note that twenty-seven science supervisors who replied to the request reported that they could not suggest any names because they did not know any other science supervisors. An additional nine were able to suggest only themselves.

**Validation of the Instrument**

The instrument was mailed to the jury during the second week of February, 1967. A copy of the instrument and the letter of transmittal are included in the appendix. Of the forty-one instruments mailed out, thirty were returned by March 23, 1967. A follow-up letter was mailed with an additional copy of the instrument included. By April 11, 1967 a total of thirty-three replies had been received. Three replies were not included because they were not completely filled out. The jury provided a usable sample of 73 per cent.

The responses of the science supervisors and science educators were tabulated separately and then combined to yield three sets of data. Calculations of scale values were made for each of the three sets of data. The responses of the science educators and science supervisors were compared by use of rank correlation for each of the ten case studies. To find if the correlation was significant, a table listing the correlation values for different levels of significance was consulted. This table was developed by finding the standard error of correlations and converting this to t-values used in the t-test. This technique may be used when the number of cases is small, usually less than one hundred.\(^4\)

In a few cases there was complete agreement on a response. Thus the proportion matrix yielded a few cells with unity or zero present. When this occurred a special modification of the calculation techniques outlined earlier in this chapter was necessary. The technique developed by Edwards is based upon the solution of simultaneous equations for each row in the Z matrix. This technique yields scale separation values instead of scale values. Since the scale is arbitrarily anchored at zero, the results are comparable and are interchangeable.

**Summary**

The procedures used in this study have been presented in this chapter. The literature was analyzed to determine the types of common supervisory problems. From this information, case studies involving the supervisory problems were developed. Possible solutions to these supervisory problems were suggested for each of the case studies. A pilot study was used to determine if the techniques were practical and to determine a workable length for the instrument.

Selected science educators and members of the National Science Supervisors Association were requested to assist in selecting a jury to validate the instrument. Those persons most frequently suggested were requested to assist in the study. Of the forty-one jurors, 73 per cent provided data used in standardizing the instrument. The technique of Paired Comparisons was used for the analysis of the instrument. Statistical treatment of the data yielded scale scores for.

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each of the possible solutions to the case studies. In addition to obtaining the combined scale scores of the science educators and science supervisors, the significance of the correlations between these two groups was obtained for each of the ten case studies. The results of these analyses are given in chapter four of this report.
CHAPTER IV

ANALYSIS OF THE RESEARCH DATA

The analysis of the data is presented in ten sections, one for each case study. The analyzed data for each case study is presented in tabular form. The solutions are presented in order of desirability, the least desirable first and the most desirable last. A copy of the instrument may be found in the appendix.

Case Study One

One of the more controversial topics with which the supervisor must deal is that of the science fair. The problem is based on the publicity and public relations value of the science fair. Five possible suggestions were offered on how to control the science fair. Table 5 presents the scale values for the supervisors, educators and the supervisors and educators combined.

Data

The rank-order correlation between the supervisors and educators was .90. This is significant at the .001 level of confidence. The only difference in rank between supervisors and educators is that the supervisors prefer writing a guest editorial explaining the role of the science fair in preference to having the principals decrease the emphasis of the fair. The educators reversed the order of these two alternatives.
The situation

The local science fair has become an important public relations medium for the school system. Many teachers and administrators have expressed rather strong belief that the educational value of the fair has been seriously impaired because of the publicity. They feel that the fair has lost its usefulness because of an emphasis on the spectacular and not on the research and learning functions. Which one of the actions in each of the following pairs would be more effective?

<table>
<thead>
<tr>
<th>Solutions</th>
<th>Supervisors</th>
<th>Educators</th>
<th>Supervisors and Educators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take a firm stand and forcefully stop the undesirable practices of the teachers, administration and press.</td>
<td>.000</td>
<td>.526</td>
<td>.099</td>
</tr>
<tr>
<td>Work through the principals by having them to decrease the emphasis given the fair by the teachers.</td>
<td>.546</td>
<td>1.175</td>
<td>1.086</td>
</tr>
<tr>
<td>Write a guest editorial in the local newspaper explaining the role of the science fair in relation to the total science program of the school system.</td>
<td>1.317</td>
<td>1.115</td>
<td>1.364</td>
</tr>
<tr>
<td>Hold a meeting of the entire science faculty and administration and explain the role of the science fair.</td>
<td>1.867</td>
<td>1.827</td>
<td>1.884</td>
</tr>
<tr>
<td>Develop other extra-curricular science activities such as a Science Congress, a Junior Academy of Science or a Junior Science and Humanities Symposium and let these other activities share some of the publicity.</td>
<td>1.996</td>
<td>1.996</td>
<td>1.996</td>
</tr>
</tbody>
</table>
1. The jury strongly rejected the alternative of forcefully stopping the undesirable practices. The scale value distance between this alternative and the next least desirable alternative was more than the spread between the other four alternatives.

2. The alternative suggesting that indirect efforts through the principal might be effective in dealing with science fair problems received notably different responses from the supervisors and educators. The educators were much more favorably inclined toward the alternative than were the supervisors. This alternative received less favorable reaction than the alternative suggesting going to the public with a guest editorial to explain the role of the science fair.

3. The two solutions that received the most favorable responses differed very little in scale scores. The jury found that an explanation of the role of the science fair to the science faculty and administration would differ very little in effectiveness from the impact of the implementation of additional extra-curricular science activities.

Interpretation

The responses of the jury generally indicate the desirability of more indirect methods of solving public relations problems as opposed to more dogmatic, direct action. The responses also showed the tendency to keep the problem within the educational community and not expose the public through the guest editorial. The jury favored positive action rather than negative as demonstrated by their more favorable reaction to supplying an alternative to the problem
rather than stopping the action producing the problem. These results
are in agreement with modern trends in supervision as discussed in
Chapter II.

1. The data presented in number one of the preceding section
indicates a strong rejection of some of the methods used in the early
days of supervision and is more consistent with the modern concept of
supervision as creative leadership.

2. The reason for the lack of confidence in the principal's
ability to deal with the problem as indicated in number two of the
data section above, is not apparent in the study. This lack of confi-
dence is most evident with the supervisors who might be expected to be
more aware of the function of the principals than the educators. This
lack of confidence is even more unexpected when it is considered with
the rating of the guest editorial. The jury, primarily influenced by
the supervisors, felt that the public would be more effective in
stopping abuses of the science fair than would the principals working
through the teachers. This finding underscores the impact of science
fairs on the public relations of school systems.

3. The third item in the data section is interesting in that
the jury did not find the possible benefits of additional extra-
curricular science activities sufficiently attractive to give this
alternative a much greater scale score than other, more direct responses
to the problems of the science fair.
Case Study Two

The second case study is concerned with one of the most complex problems facing science supervisors. The problem of encouraging adequately prepared science teachers to generate science-like atmospheres in their classrooms is one that is widespread. Table 6 shows the analysis of the reaction of the jury to five possible solutions to this problem.

Data

The complexity of this problem is shown in the divergency of opinion found among the jurors. The correlation between the supervisors and the educators was -.30. This is the lowest correlation value found in the study for any of the case studies. The agreement between the supervisors and the educators is no greater than would be expected by chance. Another indication of the complexity of the problem is the low value of the scale scores indicating that the standard deviation of the responses was low.

1. The jury found relatively little difference among four of the solutions. The difference between the first and fourth ranked solution is about one-tenth scale unit.

2. The solution suggesting weekly meetings where discussions about science problems would be led by teachers was ranked considerably lower than the other possibilities by the supervisors and nearer the mean by the educators. When considered by the entire jury, the solution ranks much lower than the other four solutions.
The situation

Although secondary school science teachers have average academic and professional educations, most science instruction consists of reading about science. How can the supervisor encourage teachers to generate a science-like atmosphere by using the laboratory as the focal point in their teaching? Which one of the responses in each of the following pairs would be more effective?

<table>
<thead>
<tr>
<th>Solutions</th>
<th>Supervisors</th>
<th>Educators</th>
<th>Supervisors and Educators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hold a series of six weekly meetings where a different teacher at each meeting would serve as a reference person for a discussion of such topics as problemsolving and science projects.</td>
<td>.000</td>
<td>.387</td>
<td>.173</td>
</tr>
<tr>
<td>Have one science teacher from each building participate in a summer research participation program wherein the teacher would perform scientific research under the close supervision of an active researcher. Each teacher would be responsible for holding a seminar the following fall with the other teachers in the building concerning the experience.</td>
<td>.378</td>
<td>.517</td>
<td>.431</td>
</tr>
<tr>
<td>Lead the teachers and students in a large scale scientific research project such as a bird, insect or tree census. Make the teachers responsible for planning and administering the research project in much the same manner as a director of research.</td>
<td>.656</td>
<td>.341</td>
<td>.459</td>
</tr>
</tbody>
</table>
3. The educators ranked summer research participation second highest whereas the supervisors ranked this possibility second from the lowest.

4. The supervisors found the possibility of having the teachers and students participate in a large scale research project the most favorable possibility and the educators found it the least attractive. This difference is greater in magnitude and opposite in direction when compared with the summer research participation program.

5. The educators found the solution suggesting holding six weekly meetings about laboratory usage the most desirable of those presented for the case study. The supervisors found it the third most desirable.

6. The jury found the solution suggesting classroom visitation the most desirable solution suggested.
Interpretation

1. The small difference, described in number one of the previous section, indicates either an actual lack of discrimination among the solutions or the possibility of the supervisors who are ranking a solution high or low and the educators who are ranking it opposite in desirability. The data presented in items two, three and four of the data section, shows that the educators and supervisors have reacted oppositely as groups in their response to these items. The low scale score values indicates a low level of discrimination among the items.

2. The data presented in number three above indicates a difference in the value of summer research participation when perceived by educators and by supervisors. The possible reasons for this are many. The supervisors have had less opportunity to actively participate in scientific research than have most educators. This difference in rating suggests that science teacher education programs might well consider the inclusion of research participation into the curriculum for undergraduates and graduates.

3. The rankings, discussed in item four above, of the solution having the teachers and students participate in a large scale research project presents an interesting dichotomy with the rankings mentioned in the paragraph just above. It might be possible to rationalize the difference in rating in that the educators might favor the college environment of the summer research participation program and supervisors might favor the teacher and student involvement of the research project. This does not, however, explain the large difference in
scale scores or the degree of difference between the two responses. The findings of the study do not indicate a reason for this apparent conflict of logic in the data.

4. An indication of the desirability of active involvement of the teachers is found in the ranking given the solution suggesting holding six weekly meetings concerned with laboratory usage. The data is presented in item five of the data section. The solution is similar to the first solution which was given a very low ranking except that this solution includes demonstrating laboratory usage.

5. The responses discussed in item six above, show that classroom visitation was the most desirable solution suggested. This response represents the most active involvement and self-learning responsibility for the teacher of any of the solutions.

When the responses to the case study are considered as a whole, the trend toward more involvement and responsibility is evident. The findings of the case study have implications for the college supervisor of student teaching as well as the classroom supervisor. The student teacher supervisor should involve the student teacher as much as possible in his own improvement and should place much of the responsibility for improvement upon the student teacher.
Case Study Three

The problem of the teacher with a good science background and a poor professional commitment is the subject of case study three. The major teaching technique used by the teacher was lecture. Table 7 shows that the supervisors and the educators have a high degree of agreement that results in a correlation of .975. This correlation is significant at the .001 level of confidence.

Data

1. The jury and the educators found the suggestion of requiring the teacher to attend summer school the least desirable alternative. Although the supervisors gave this alternative a considerably higher scale score, it was tied for the least attractive alternative.

2. Assigning the major responsibility for the development of a course of study to the teacher fared better with the jury than the previous solution. The educators and the supervisors coincided in their judgement of the scale value of this solution.

3. The solution suggesting attendance at a regional NSTA meeting ranked third among the five possibilities.

4. The jury as a whole and the supervisors provided a large increase in scale values from the previous solution to the solution suggesting regular observation of a master teacher. The educators responded with a small increase compared to that of the supervisors and the jury.

5. The solution that received the highest scale values was that of appointing the teacher to a committee to evaluate curriculum
TABLE 7
SCALE VALUES FOR CASE STUDY 3

The situation

A science teacher with an above average science background and minimum professional certification requirements has voiced strong objections to the concepts of professional education. The courses that he teaches closely resemble some college courses, being mainly lecture. He does not attempt to fulfill any objective of science education except that of information. Which one of the responses in each of the following pairs should the supervisor take?

<table>
<thead>
<tr>
<th>Solutions</th>
<th>Supervisors</th>
<th>Educators</th>
<th>Supervisors and Educators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Require him to attend summer school at his expense to study the methods and philosophy of teaching science.</td>
<td>1.276</td>
<td>0.000</td>
<td>0.414</td>
</tr>
<tr>
<td>Give him the major responsibility for developing a course of study for science such as would be used for school accreditation by a regional accrediting agency.</td>
<td>1.267</td>
<td>1.267</td>
<td>0.801</td>
</tr>
<tr>
<td>Send him to a regional NSTA meeting at the expense of the school system.</td>
<td>1.680</td>
<td>1.455</td>
<td>1.166</td>
</tr>
<tr>
<td>Have him observe a master teacher on a regular basis.</td>
<td>2.445</td>
<td>1.503</td>
<td>1.678</td>
</tr>
<tr>
<td>Appoint him to a committee whose function is to evaluate curriculum innovations for possible inclusion into the curriculum.</td>
<td>2.578</td>
<td>2.654</td>
<td>2.277</td>
</tr>
</tbody>
</table>
innovations. The educators responded with a much greater increase in scale values from the previous solution than did the supervisors.

Interpretation

1. The data in number one above concerns a frequent method of forcing teachers to update their preparation as evidenced by the typical certification requirement of a certain number of credit hours every few years to maintain a valid teaching certificate. The low ranking given the alternative should cause consideration to be given the common practice of requiring additional course work to renew a teaching certificate. Other methods of insuring a cadre of up-to-date teachers should be investigated on a large scale.

2. Item three in the data section discusses the value of attendance at regional NSTA meetings. It is interesting to note that the supervisors assigned a slightly higher scale value than did the educators who have traditionally played a very strong role in the leadership of NSTA. Perhaps the educators were being modest in their estimate of the effectiveness of NSTA meetings.

3. The difference pointed out in number four above may be due to the supervisors close experience with this method of increasing teacher competency whereas the educators may not have as much practical experience with the technique. This result seems to point out the apparent value of observation in teacher education programs.

4. There are many hypotheses that might be suggested for the difference in reaction noted in number five above. One of the
hypotheses might be that the educator might not fully understand the large number of innovations that the classroom teacher has already evaluated and incorporated into the classroom activity. Another might be that the supervisor has observed that the teacher has already been forced to evaluate, perhaps by default, many innovations and noticed little change in behavior that can be traced to the evaluation of the innovations. Another hypothesis might be that the educators might feel the need for innovation more acutely than do the supervisors.
Case Study Four

The fourth case study deals indirectly with the problem of the shortage of qualified science teachers. The case study describes the plight of a semi-retired teacher who is drafted to teach science. The results are presented in Table 8. The supervisors and educators were in perfect agreement on the ranking of the five possible solutions, the correlation being 1.00.

Data

1. The analysis of all three groups of data revealed that the least attractive solution was the one suggesting that the head of the science department tutor the science teacher.

2. Demonstration teaching fared considerably better than tutoring, but not as well as viewing filmed science courses.

3. It is surprising that the filmed science courses received nearly the same rating as did university extension science courses.

4. By a considerable margin, team teaching received the most favorable report from the jury and the two subgroups.

Interpretation

1. On the first consideration, the data presented in paragraph one of the section above, it seems that a source of assistance with in-service education activities has been rejected. One can, however, imagine many professional complications that might develop from a tutoring arrangement. Another method of utilizing the experience of other teachers was given the most favorable score by the three groups. This solution is discussed next.
The situation

Because of an unexpected opening for a ninth grade physical science teacher, the superintendent, with approval of the board of education, hired, out of desperation, an older gentleman who has been in semi-retirement. His science background is adequate but thirty years out of date. He is in good health, realizes that education has changed since he left the classroom twenty years ago, but isn't willing to work hard enough to overcome his problems. Which one of the solutions in each of the following pairs would be more effective?

<table>
<thead>
<tr>
<th>Solutions</th>
<th>Supervisors</th>
<th>Educators</th>
<th>Supervisors and Educators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have the head of the science department tutor him in high school science courses.</td>
<td>.121</td>
<td>.765</td>
<td>.000</td>
</tr>
<tr>
<td>Teach his classes biweekly and have him critique the classes.</td>
<td>.496</td>
<td>1.355</td>
<td>.449</td>
</tr>
<tr>
<td>Have him view filmed science courses such as the Baxter Chemistry films produced for the Continental Classroom television series.</td>
<td>.770</td>
<td>1.711</td>
<td>.818</td>
</tr>
<tr>
<td>Require him to enroll in a university extension science course each semester to update his background.</td>
<td>.901</td>
<td>1.827</td>
<td>.923</td>
</tr>
<tr>
<td>Combine two classes and use the other teacher as the lead teacher for team teaching.</td>
<td>1.547</td>
<td>2.420</td>
<td>1.638</td>
</tr>
</tbody>
</table>
2. The result discussed in number two above, has considerable implication for practices commonly found in supervision. Filmed science courses have been more or less ignored since the demise of the Continental Classroom television series. Although many movie prints of these courses were purchased, there appears to be little widespread use of them, especially for in-service education. The professional literature has been practically mute on the use of these films in the past few years. This finding implies that we might profitably examine the use of these films for in-service education and not rely as extensively on demonstration teaching as has been done.

3. The lack of use of the filmed courses would imply that they were inferior to the typical university extension course. The data provided in item three above shows that because of the proximity of the rankings between the university extension courses and the filmed courses that this inferiority is not so extensive when compared to the lack of interest. Also indicated in this finding is the potential in the use of filmed science courses has not been realized. Perhaps a combination of the filmed courses with university extension courses might be a solution for the need for more in-service education programs.

4. The data presented in number four above is unclear as to whether the jury felt that the technique of team-teaching was the best way of improving the effectiveness of teaching methods or that the impact of poor methods would be less harmful to pupils if they were tempered by the presence of a good lead teacher in a team-teaching situation.
Case Study Five

The most desirable organization pattern for in-service education is the topic of the fifth case study. The agreement between the supervisors and the educators is not so great as in most of the case studies, the correlation being .40. This value is significant at the 0.5 level of confidence. The tabular results are presented in Table 9.

Data

1. The jury and the two groups within the jury, found the prospect of holding an hour meeting every day for eighteen school days considerably less attractive than the other four possible solutions.

2. The next most attractive alternative for the jury was that of all day Saturday sessions. The supervisors found this alternative the most attractive of the five possibilities, whereas the educators ranked it next to the least desirable.

3. The jury ranked the next three alternatives very close. The educators and the supervisors differed in their judgements when compared with the jury, on two of the alternatives. All three sets of data resulted in similar scale scores for the possibility of an hour meeting every two weeks for thirty-six weeks.

An hour meeting three times a week for six weeks was the choice of the educators and the supervisors, but when computed as a jury, the alternative was consigned to second choice. The choice of the jury was a three hour meeting twice a week for three weeks. The educators ranked it second and the supervisors ranked it third.
TABLE 9
SCALE VALUES FOR CASE STUDY 5

The situation

The board of education has authorized an in-service teacher education program for one class of twenty teachers for a total of eighteen hours. The main objective of this course is to increase the subject matter competency of the teachers. Lecture and laboratory techniques will be used. All meetings must be after school hours. Which one method of organization in each of the following pairs would be more effective?

<table>
<thead>
<tr>
<th>Solutions</th>
<th>Supervisors</th>
<th>Educators</th>
<th>Supervisors and Educators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hold an hour meeting every day for eighteen school days.</td>
<td>.000</td>
<td>.031</td>
<td>.016</td>
</tr>
<tr>
<td>Hold a meeting for six hours on each of three consecutive Saturdays.</td>
<td>.894</td>
<td>.310</td>
<td>.685</td>
</tr>
<tr>
<td>Hold an hour meeting every two weeks for thirty-six weeks.</td>
<td>.752</td>
<td>.792</td>
<td>.914</td>
</tr>
<tr>
<td>Hold an hour meeting three times a week for six weeks.</td>
<td>.858</td>
<td>1.469</td>
<td>.931</td>
</tr>
<tr>
<td>Hold a three hour meeting twice a week for three weeks.</td>
<td>.760</td>
<td>1.008</td>
<td>1.060</td>
</tr>
</tbody>
</table>
Interpretation

1. There are several plausible explanations for the data presented in item one above. The respondents might have been concerned that the frequent disruption of the normal school routine for the teachers, the lack of sufficient time in a one hour session, or the problem of obtaining an instructor for the course for such a short period of time on eighteen different days would severely decrease the possibility for success.

2. The possible reasons for the sharp disagreement between the supervisors and the educators in the data described in paragraph two of the previous section are many. The supervisor, feeling the press of regular teaching duties after school and the fatigue of a full day of teaching, might find the prospect of a full day being concentrated on the in-service education topic more appealing than the other alternatives. The educator, perhaps believing that more value might be realized in smaller doses, viewed this alternative near the other end of the scale from the supervisor.

3. The data discussed in item three of the previous section is interesting in that the jury and the educators found the alternative that most closely followed the typical schedule of college classes the most attractive of the possibilities. The supervisors were more receptive to the possibilities of other time schedules. The finding raises at least two questions. Is the traditional pattern of college scheduling the most efficient learning arrangement for in-service and/or, pre-service education? Does the convenience of the habit outweigh the inconvenience of other time schedules?
Case Study Six

The academic background of the teacher that must teach two areas of science is the subject of the sixth case study. The particular situation described is concerned with a half load of physical science and a half load of biology. The responses of the supervisors and educators had a degree of correlation of .90 which is significant at a .001 level of confidence. These data are shown in Table 10.

Data

1. The alternatives offered the jury forced them to compare the desirability of several factors: student teaching, a methods course, depth in physical science background and depth in biological science background. The least desirable of the alternatives were those offering strength in physical science at the expense of biological science. Although both these alternatives offered student teaching and a methods course, the scale scores were considerably below the other three alternatives.

2. The scale scores of the remaining three alternatives were similar. The supervisors and educators thought that five hours of chemistry, five hours of physics and five hours of biology were more valuable than a methods course. When the responses of the entire jury were considered, the methods course was more valuable.

3. The jury found the combination of twenty hours of physical science, twenty-five hours of biological science, a methods course and student teaching the most desirable of the alternatives. Although the educators and supervisors did not find this alternative the most desirable, the combined data resulted in the highest scale score.
The situation

An opening has occurred for a teacher whose teaching load will be two classes of ninth grade physical science and two classes of tenth grade biology. Assuming all variables equal except the academic preparation mentioned and all teachers properly certified, which one of the teachers in each of the following pairs of candidates should the supervisor select?

<table>
<thead>
<tr>
<th>Solutions</th>
<th>Supervisors</th>
<th>Educators</th>
<th>Supervisors and Educators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry, 25 hrs.; Physics, 10 hrs.; Biology, 10 hrs.; student teaching and a methods course</td>
<td>.009</td>
<td>.933</td>
<td>.000</td>
</tr>
<tr>
<td>Chemistry, 10 hrs.; Physics, 25 hrs.; Biology, 10 hrs.; student teaching and a methods course</td>
<td>.296</td>
<td>1.762</td>
<td>.184</td>
</tr>
<tr>
<td>Chemistry, 20 hrs.; Physics, 15 hrs.; Biology, 25 hrs.; student teaching</td>
<td>1.513</td>
<td>2.453</td>
<td>1.426</td>
</tr>
<tr>
<td>Chemistry, 15 hrs.; Physics, 10 hrs.; Biology, 20 hrs.; student teaching and a methods course</td>
<td>1.411</td>
<td>2.158</td>
<td>1.499</td>
</tr>
<tr>
<td>Chemistry, 10 hrs.; Physics, 10 hrs.; Biology, 25 hrs.; student teaching and a methods course</td>
<td>1.436</td>
<td>2.108</td>
<td>1.547</td>
</tr>
</tbody>
</table>
The only difference between the first and second place alternative was that the second place alternative had five hours credit transferred from biological to physical science.

**Interpretation**

It is interesting to note that the educators who would normally teach the methods courses, were not as strong in their support of a methods course as were the supervisors when both groups chose between additional course work or a methods course. Two possible reasons for this might be that the educators are providing a more valuable experience for their students than they are aware of, or the supervisors have unfounded faith in the methods course.
Case Study Seven

Case study seven deals with the problem of preparing teachers for a major curriculum change. The specific problem selected was that of implementing an earth science program in the ninth grade. The supervisor was notified nine months before the change was to be implemented. Only ten per cent of the teachers were qualified to teach earth science. The supervisors and educators were in general agreement on the ranking of the solutions which resulted in a correlation of .80 which is significant at the .001 level of confidence. Table 11 shows the results of the responses.

Data

In examining the scale scores of the five possible solutions, the desirability is obvious of a program aimed at developing indepth background understanding of the subject matter as well as specific content and methods as opposed to intensive workshops in methods and content. This is more apparent with the supervisors than with the educators. The supervisors found that participation of an outside subject matter expert much more desirable than the other alternatives when compared to the educators.

1. The lowest score was given to the preparation of a curriculum bulletin. The supervisors found this much less attractive than did the educators.

2. As in the other case studies dealing with in-service education, Saturday sessions did not appeal to the jury.

3. The supervisors scored weekly lectures on content considerably below the score given by the educators. The educators ranked the
The situation

It has been decided that earth science will be taught in the ninth grade next year. The supervisor of the one hundred affected teachers is notified of the decision nine months before the course is to begin. Only 10% of the teachers have any background in the earth sciences. Which of the programs in each of the following pairs would better prepare the teachers for this change?

<table>
<thead>
<tr>
<th>Solutions</th>
<th>Supervisors</th>
<th>Educators</th>
<th>Supervisors and Educators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepare a curriculum bulletin containing earth science teaching aids such as simple demonstrations, laboratory experiments and suggested resource units.</td>
<td>.000</td>
<td>.743</td>
<td>.287</td>
</tr>
<tr>
<td>Hold a series of all day sessions on the first three Saturdays of the new school year and discuss content and techniques.</td>
<td>.194</td>
<td>.436</td>
<td>.289</td>
</tr>
<tr>
<td>Arrange a year long weekly series of lectures on earth science content to be held the year before the introduction.</td>
<td>.296</td>
<td>1.128</td>
<td>.633</td>
</tr>
<tr>
<td>Arrange for an earth science consultant to conduct a two-week pre-school workshop in content and methods and pay the teachers extra for participating.</td>
<td>1.377</td>
<td>1.314</td>
<td>1.294</td>
</tr>
</tbody>
</table>
TABLE 11 - Continued

<table>
<thead>
<tr>
<th>Solutions</th>
<th>Supervisors</th>
<th>Educators</th>
<th>Supervisors and Educators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrange for a professor of geology from a nearby college to hold a monthly seminar in content and methods with the earth science teachers the year before and during the year of introduction.</td>
<td>1.344</td>
<td>1.344</td>
<td>1.344</td>
</tr>
</tbody>
</table>

lecture series close to the two alternatives involving programs by content experts. The jury, when considered as a whole, found the alternative considerably less attractive.

4. The jury and the two subgroups, found little difference in the desirability of the two alternatives involving content experts. The supervisors slightly favored the two week pre-school workshop over the monthly seminar for a school year. The educators reversed the order of preference.

Interpretation

1. The result presented in number one above, is interesting because it is given the lowest score by the same people that traditionally prepare and use the curriculum bulletins. The curriculum bulletin is looked upon with more favor by the educator who does not usually prepare or use them. This finding shows that the effort that goes into the preparation of a curriculum bulletin probably could better be expended in developing teachers. Another possibility
might be that since the educator is more likely accustomed to professional writing than the supervisor, the educator might have greater respect for the impact of written professional curriculum materials.

2. The data presented in two above reinforced other findings of the study that in-service education programs must be made an integral part of the teachers normal work load and not an appendage to it.

3. The scores discussed in section four argue for the conclusion that who leads the in-service education program is much more important than what format they use or when it is scheduled.
Case Study Eight

One of the classic problems of education is the subject of the eighth case study. The problem of the successful coach and unsuccessful teacher is one that has been the subject of much discussion and thought. The supervisors and educators responses had a correlation of .90 which was significant at the .001 level of confidence. The scale values are shown in Table 12.

Data

1. The jury and the supervisors found little difference in the scale scores of the three less desirable solutions. The educators, however, found these same three alternatives, considerably less desirable than did the supervisors or the total jury. The lowest scale score was given to the alternative suggesting giving the coach a teacher's aide to give him more time for preparation. Only faring slightly better was the suggestion to let the class utilize regional television each day. The prospect of attending summer school to strengthen his science background did little better.

2. The responses from the educators indicate that they do not find additional time for preparation, the substitution of educational television for a qualified teacher, or summer school adequate substitution for a good teacher. The supervisors were not quite so harsh on these alternatives.

3. One of the more exciting innovations in education that has been gaining popularity in the past few years is that of team teaching. The supervisors, in keeping with their responses discussed above,
TABLE 12
SCALE VALUES FOR CASE STUDY 8

The situation

A successful coach has the responsibility of teaching biology in addition to coaching. His science background consists of a year of general biology and a course in Human Anatomy and Physiology. The fact he feels that teaching is a necessary evil is well known. His teaching consists mainly of lectures about the small amount of conventional descriptive biology that he knows and salty tales of the gridiron. Which one of the actions in each of the following pairs would be more effective for the supervisor to take?

<table>
<thead>
<tr>
<th>Solutions</th>
<th>Supervisors</th>
<th>Educators</th>
<th>Supervisors and Educators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply him with a teacher’s aide to give him more time for preparation.</td>
<td>1.638</td>
<td>.000</td>
<td>1.281</td>
</tr>
<tr>
<td>Let the class utilize regional educational television for science class each day.</td>
<td>1.855</td>
<td>.534</td>
<td>1.500</td>
</tr>
<tr>
<td>Require that he attend summer school, at his own expense, to gain science background.</td>
<td>1.828</td>
<td>.932</td>
<td>1.740</td>
</tr>
<tr>
<td>Have him team teach with a master teacher.</td>
<td>3.013</td>
<td>1.932</td>
<td>2.836</td>
</tr>
<tr>
<td>Arrange his teaching load so that he is teaching only physical education.</td>
<td>3.283</td>
<td>3.283</td>
<td>3.283</td>
</tr>
</tbody>
</table>
were more enthusiastic in their response than were the educators although the difference between the two groups was less than for the other three alternatives.

4. The most attractive solution to the problem for all three groups completing the instrument was having the coach teach only physical education.

5. Several supervisors and educators wrote in comments that he should be fired or never originally employed.

Interpretation

1. It is interesting to consider the difference in the responses of the educators and supervisors noted in item two above. Perhaps the supervisors have been forced to modify their views in response to the necessities of staffing the classrooms. It is worthy to note that the educators did not feel that a modest increase in subject matter background would improve the coach's attitude toward teaching or his performance in the classroom. This has implications for those who feel that more academic content will solve any shortcomings in teachers.

2. Number four of the data section points to the desirability of having the coach teach physical education. It is interesting to note that no mention was made in the case study of his qualification or certification to teach physical education.

3. Several writers have suggested that supervision utilize the same techniques and methods as teaching. Since one of the basic concepts in good teaching is to take the students where they are and
proceed from there, the transferring of a teacher to another subject area, firing him or saying he should have not been employed in the first place, somehow begs the question. Because of the press of many duties and the need to protect the pupils, the supervisor might be justified in taking this alternative.
Case Study Nine

Case study nine describes a problem of fiscal values. The science supervisor has been given a sum of money to spend above and beyond his normal budget. Assuming that the usual needs of the school system have been met, what is the most effective use of the money? The agreement between the supervisors and educators is lower than has been usual for most of the case studies. The data are presented in Table 13. The rank correlation between the responses of the supervisors and educators is .50 which is significant at the .01 level of confidence.

Data

The case study yielded low scale values which indicates the responses were far from unanimous. The low scale values are an indication of a low standard deviation of the answers. This result is produced by an even distribution of the responses and no clear choices of the group of respondents. The low correlation value of the educators and supervisors reinforce this conclusion.

1. The jury and the educators found the least attractive way to spend the extra money was that of sponsoring lectures to the student body by a well known scientist. The supervisors ranked this alternative two places higher than did the other two groups.

2. Paying the tuition for a teacher to participate in scientific research at a local college received slightly more favorable reaction from the educators and the jury and less favorable reaction from the supervisors.
The situation

The science supervisor has been given $150 to be spent at his discretion. It is to be spent outside the usual budget. The typical basic needs of the program including laboratory equipment, library and audio-visual resources and teacher preparation, have been met. Which one of the expenditures in the following pairs would be more valuable for the science program?

<table>
<thead>
<tr>
<th></th>
<th>Solutions</th>
<th>Supervisors</th>
<th>Educators</th>
<th>Supervisors and Educators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sponsor a series of</td>
<td>.249</td>
<td>.000</td>
<td>.153</td>
<td></td>
</tr>
<tr>
<td>two lectures to all</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>the student body by</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a well-known scientist from a local college.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pay the tuition for a science teacher to participate in scientific research at a local college.</td>
<td>.187</td>
<td>.219</td>
<td>.203</td>
<td></td>
</tr>
<tr>
<td>Build a portable museum display of the type that might be used in a science and industry museum and display it in the lobbies of the schools.</td>
<td>.135</td>
<td>.349</td>
<td>.220</td>
<td></td>
</tr>
<tr>
<td>Take the science clubs on a field trip to a nearby area of scientific interest such as a nuclear reactor or a large telescope.</td>
<td>.301</td>
<td>.482</td>
<td>.370</td>
<td></td>
</tr>
<tr>
<td>Provide unusual materials that students need for science projects.</td>
<td>.653</td>
<td>.475</td>
<td>.579</td>
<td></td>
</tr>
</tbody>
</table>
3. The alternative that offered an opportunity for incidental education for scientific literacy received the lowest score from the supervisors and a ranking of third from the educators and the jury.

4. The sponsoring of a field trip received the second highest ranking by the supervisors and the jury, and the highest ranking by the educators.

5. Receiving the top ranking from the supervisors and the jury was the solution to provide unusual materials for science projects. The ranking of the educators did not differ appreciably from the previous solution. The supervisors scored the unusual materials considerably higher than the other four solutions.

Interpretation

1. The finding in item one of the data section questions the effectiveness of the practice of some institutions in providing guest lectures throughout the school year. Although it is probable that these lectures provide a valuable stimulus, would not other means to the same end be more efficient?

2. The difference in ranking between the supervisors and the educators presented in item two above, can be rationalized by the probability that the supervisors are not as well acquainted with the benefits that can be accrued from research participation as the educators. This finding reinforces earlier discussions about the need for better communication between educators and supervisors.
3. The difference in the responses of the educators and supervisors in item three above might be attributed to several factors. The first factor is that the supervisors may not have been acquainted with the need for increased scientific literacy. A second is that they may not have had experience with displays as a method of incidental education. Another possibility exists that the supervisors may not be willing to invest in a technique that deviates so far from the normal educational procedure.

4. Item four of the data section points out that there apparently is little difference of opinion in the desirability or effectiveness of field trips in science education.

5. The alternative discussed in item five above apparently meets a widely felt need for a source of unusual materials for science projects.

6. It is interesting to note the lack of a pattern of the responses regarding the expenditure of the funds to benefit a few persons as opposed to spending the money to directly affect large numbers of people. It is apparent that the jury was more concerned with the quality of involvement rather than the quantity of involvement.
Case Study Ten

The problem of assigning primary responsibility for curriculum development is considered in the final case study. The supervisors and educators were in agreement on their ranking of the possible solutions to the extent that the correlation is .875 which is significant at the .001 level of confidence. Table 14 presents the scale values.

Data

1. The least attractive proposed solution was to contract with a local college for the development. This judgement of the solution was agreed upon by the data from all three groups.

2. The educators and the jury found the possibility of turning the project over to a college teacher somewhat more attractive than turning it over to a college. The supervisors found this alternative no more promising than the first alternative. Although the scale score of the supervisors was the same for the first two alternatives, it was still greater than the scale score given the alternative by the educators.

3. The educators ranked the alternative of giving the major responsibility to the local high school physics teacher second, whereas the supervisors and jury ranked it third.

4. The jury ranked the suggestion of the supervisor heading the project as second most desirable. As might be expected, the supervisors gave this alternative considerably more favorable response than did the educators.
The situation

The board of education has authorized the science supervisor to develop a new approach to the teaching of physics. They have provided $10,000 per year for two years. Which one of the actions in the following pairs would be more appropriate?

<table>
<thead>
<tr>
<th>Solutions</th>
<th>Supervisors</th>
<th>Educators</th>
<th>Supervisors and Educators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter into a contract with a local college to develop the course.</td>
<td>.506</td>
<td>.000</td>
<td>.085</td>
</tr>
<tr>
<td>Hire a local college physics teacher for a year and give him the major responsibility with consultant help available.</td>
<td>.506</td>
<td>.462</td>
<td>.479</td>
</tr>
<tr>
<td>Hire the local high school physics teacher for a year and give him the major responsibility with consultant help available.</td>
<td>1.460</td>
<td>1.460</td>
<td>1.460</td>
</tr>
<tr>
<td>The supervisor would head the effort but farm out portions to the local high school physics teacher and the local college physics teacher.</td>
<td>2.262</td>
<td>1.005</td>
<td>1.570</td>
</tr>
<tr>
<td>Hire the local physics teacher, a local college physics teacher, a general secondary supervisor and the science supervisor for the summer to plan and write the course. The work would continue part-time during the school year.</td>
<td>3.316</td>
<td>1.847</td>
<td>2.231</td>
</tr>
</tbody>
</table>
5. By a considerable margin the most attractive solution proposed for the curriculum development problem was that of giving the supervisor, the high school physics teacher and the college physics teacher shared responsibility for the development of the physics curriculum.

Interpretation

1. The differences in scale scores, mentioned in item two in the data section, on both of the alternatives that proposed giving the major responsibility to the college or college teachers showed that the supervisors thought more highly of this prospect than did the college science educators. This finding might result from more faith in college professors by the supervisors than might be deserved or an undue sense of modesty on the part of the college science educators.

2. The difference in ranking in item three above between the educators and supervisors might be explained in a fashion similar, but reversed to than discussed about the previous alternative. The educators, not being as familiar with the secondary physics teacher as the supervisor, might have an undue high regard for his abilities where the supervisors might be overly modest about his abilities.

3. Item four describes the large difference in the scores of the supervisors and educators when they considered the supervisors' ability to handle such an assignment. The possible reasons for this difference in perception of ability are many. The most obvious finding from this data is that there exists a need for better communication between the supervisor and the educator to better discover the abilities available and define those needed for supervision.
4. The philosophy of using all available talent has been utilized in the major curriculum development projects sponsored by the National Science Foundation. It is interesting to ponder whether the high scale scores in item five above, result from a careful evaluation of the technique or from a feeling that this must be the most effective method of dealing with the problem simply because it has been used in a highly publicized manner with large sums of money to insure the success of the technique.
Summary

An instrument, based upon ten common science supervision problems, was developed to which a jury was asked to react to five possible solutions of the problems posed in the case studies. The jury was composed of science supervisors and science educators.

The instrument was designed for analysis by the use of the technique called Paired Comparisons. This technique yields scale scores for each of the five solutions to the case studies. The analysis of the data was made for supervisors, science educators and the complete jury.

The comparison of the results of the supervisors and science educators showed a high degree of correlation. Only three of the case studies had a correlation of less than .80. One of the three case studies had a negative correlation. Chapter V will present a brief summary of the study, findings, conclusions and recommendations.
CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Summary

Statement of the problem

Because of the potential influence of the science supervisor on the quality of education in the United States, it is necessary that careful analysis be made of the duties, functions and effectiveness of science supervisors. The investigation was designed to assist in the evaluation of some practices used in science supervision. The purposes of the study were two fold. The first was to determine certain functions of the science supervisor and to develop an instrument to evaluate practices that the science supervisor might use to fulfill these functions. The second was to determine the relative value of these practices as judges by science supervisors and by science educators.

Procedures

The professional literature dealing with supervision, and more specifically science supervision, was carefully examined to determine functions of the science supervisor. These functions were summarized in six areas. Case studies were written concerning problems in each of the functional areas of science supervisors. Five solutions to the problems posed in the case studies were developed. A pilot study was
conducted to determine an efficient length for the instrument and to determine if the procedures were effective.

Selected science educators were asked to suggest names for an appropriate jury of science educators to judge the effectiveness of supervisory practices. The membership of the National Science Supervisors Association was requested to suggest names of science supervisors who would be suitable for evaluating supervisory practices. The results of these requests were compiled and the jury, consisting of science educators and science supervisors was selected.

The data were analyzed by the technique called Paired Comparisons. This technique yielded scale scores for the five possible solutions to the problems posed in the case studies. A comparison was made between the responses of the science supervisors and the science educators. The significance of this comparison was tested for each of the case studies.

Findings

The functions of science supervisors were determined by analyzing the professional literature. These functions were summarized in the following six areas: curriculum development, in-service education, utilization of learning materials, development of personnel, professional growth and promoting public relations.

An instrument was developed utilizing case studies based on the functions of science supervisors. Science educators and science supervisors used the instrument to evaluate science supervisory practices.

The rank correlation of the responses of the supervisors and educators was .80 or above for seven of the ten case studies. This
correlation is significant at the .001 level of confidence. The three case studies having lower correlation values were concerned with in-service education, utilization of learning materials and professional growth. The findings from each of the six areas of supervision are presented below.

Curriculum development

Of the five possible solutions to the problem of how best to prepare ninth grade teachers to teach earth science, the jury chose the solution for a professor of geology to hold a monthly seminar in content and methods the year before and during the year of introduction.

Another case study dealt with the problem of who should have the responsibility for a curriculum revision of physics. The jury chose the solution that suggested a cooperative approach using a high school physics teacher, a college physics teacher, a general secondary supervisor and the science supervisor.

In-service education

The best arrangement of eighteen hours of in-service time for lecture and laboratory instruction was the quest of one case study. The jury selected a three hour meeting twice a week for three weeks as the best arrangement offered for consideration.

Utilization of learning materials

The wise expenditure of extra funds is the subject of the case study dealing with learning materials utilization. Of the five alternatives presented to the jury, the use of the funds for providing unusual materials for science projects was the most attractive.
Development of personnel

The problem of the successful coach but poorly motivated teacher received the attention of the jury. The possibility of arranging his teaching load so that he is teaching only physical education received the most favor from the jury.

The problem of choosing the best academic background for a combination physical science and biology teacher was the subject of a case study under the heading of personnel development. The jury chose from among the five solutions offered to them, ten hours of chemistry, ten hours of physics, twenty-five hours of biology, student teaching and a methods course.

Professional growth

The problem of encouraging a reasonably well prepared science teacher to generate a science-like atmosphere in her classroom received a mixed reaction from the jury. The rank correlation between the science supervisors and the science educators was -.30. This value is indicative of the result of having the educators, the supervisors, and the total jury, each find a different solution the most attractive of the possibilities offered. Because of this result, no definitive finding can be drawn from the data.

The teacher whose courses closely resemble some college courses, being mainly lecture, is the subject of one of the case studies dealing with professional growth. The jury selected the proposed solution of appointing the teacher to a committee to evaluate curriculum innovations as being the most promising solution to the problem.
The jury was requested to select a solution for the problem of updating an unprepared, out-of-date teacher who has been drafted into teaching physical science because of an unexpected opening. They chose the alternative of combining the classes with another teacher and making use of team teaching techniques.

Promoting public relations

The science fair that has lost some of its educational value but yet remains as an important public relations tool of the school was the subject of another case study. The jury chose the possibility of developing competing extra-curricular science activities to decrease the attention paid to the science fair as the most likely of the five proposed solutions.

Conclusions

The findings of the study indicate that it is possible to measure the effectiveness of science supervisory practices by the techniques used in the study. More specifically, the following features of the study proved to be successful.

1. The classification of supervisory practices into six areas provided an adequate categorization of the supervisory behavior discussed in the professional literature.

2. The utilization of short case studies as a basis for an instrument proved workable.

3. Techniques of jury selection involving the National Science Supervisors Association and selected science educators provided a jury of experts that judged supervisory practices.
4. The statistical analysis of the data provided by the instrument by the paired comparisons technique resulted in a ranking of possible solutions to science supervisory problems.

The instrument proved to be a usable tool in the evaluation of supervisory behavior. Of the ten case studies used in the instrument, seven provided data that had high statistical significance. The analysis of the other three case studies yielded correlation figures of -.30, .40 and .50. When compared to the correlation of .80 or higher for the other seven case studies, the results of the three case studies must be suspect.

Several hypotheses may be offered for the results of the three case studies.

1. The scores may result from an error of chance by the jury of experts in their selections of the more desirable solutions.

2. The five suggested solutions were not clearly stated and produced confusion among the jury.

3. The suggested solutions were not equally attractive to science educators and science supervisors.

It was beyond the scope of the study to investigate the validity of these hypotheses.

The conclusions regarding supervisory practices will be considered within the six classifications of supervisory behavior.

Curriculum development

The practice of writing curriculum bulletins as a method of curriculum development is seriously questioned by the results of the study. The study indicates that there are at least four other ways
that can better meet the needs the curriculum bulletin is designed to meet.

The four ways specifically described in the study involve the teachers in the educative process as a participant. They attempt to improve teaching performance by improving the teachers. It is an unusual curriculum bulletin that results in more than being a tool for the teacher. It can be concluded that effort invested in the teacher will pay bigger dividends than effort invested in curriculum bulletins.

We may also conclude that preparation for curriculum change can better be accomplished by the affected subject matter specialist rather than the generalist; that preparation sessions be held before and during the curriculum change rather than before or during; that preparation sessions be held infrequent enough to be assimilated but frequent enough to provide continuity; and the individual sessions should be long enough to be worthwhile but not too long to be excessively fatiguing.

Several conclusions present themselves when the data is examined from the case study dealing with who should assume the responsibility for development of a new course. The most readily visible conclusion is that the educators, supervisors and jury agree that the effort should be a cooperative endeavor. The assumption that different persons bringing different backgrounds, different responsibilities and different talents to curriculum development all have an important contribution to make seems to be valid.

If a choice must be made between utilizing a college academic teacher and a high school academic teacher, the choice should be given
to the high school teacher. This conclusion has implication for the many curriculum improvement projects as well as textbook writers who are considering sources of expert assistance.

Of the five possible solutions to the problem described in the case study, the solution that would probably result in the poorest product was that of contracting with a college to develop the course. One can only speculate on the many reasons for this. This finding is closely related to the one above concerning the desirability of including high school teachers compared to college teachers. This conclusion supports the contemporary concept of supervision as found in the analysis of the literature as explained in chapter two.

An interesting point to consider is how far this conclusion may be extrapolated. Does the same finding relate to the private foundation in its efforts in curriculum development or the publishing companies or the federal or state government? It is beyond the scope of this study to consider these questions but they could be examined with profit.

The conclusions concerned with curriculum development may be summarized by describing the role of the science supervisor in this area of activity. The supervisor is in a unique position to exert leadership both in the academic and education communities to coordinate the efforts of both groups in curriculum development. An inferior product will result if the leadership goes by default to either group.

Curriculum development does not cease with materials production. To be effective, revision must be a constant process. The functions of the supervisor include an important role in the dissemination of curriculum innovations. This process must be an integral part of the
on-going personnel development program. To be effective in changing teacher behavior, dissemination must include teacher participation in curriculum planning, curriculum decisions, materials acquisition and in-service education.

In-service education

Although the rank correlation between the responses of the supervisors and the educators was only .40 for the case study dealing with in-service education, several conclusions may be made. In-service sessions should be sufficiently frequent so that continuity is retained but yet not so long that the teacher becomes fatigued. More intensive experiences are more desirable than long extended sessions.

Because of the sharp difference in scale scores between the least attractive alternative and the other four, it may be concluded that an hour meeting every day is not the best schedule for in-service work. The other four alternatives received similar scale scores. It is apparent that what schedule is adhered to for in-service sessions is of minor importance when compared to who does the teaching and what is taught.

These conclusions reinforce and are reinforced by the conclusions of the previous section on curriculum development. The findings regarding the introduction of curriculum change are similar in nature.

The role of the supervisor in in-service education is one of active leadership. He must furnish initiative to evaluate the needs for professional growth. He must serve as a coordinator of the various agencies attempting to improve teacher competency. The supervisor
occupies the most logical position to lead in the evaluation of inservice activities.

An effective technique of in-service education is for the supervisor to always use the best teaching techniques in his normal working relationships. Depending on the scope of the supervisor's responsibility, he should be competent to play an active role in in-service instruction. To retain the needed competency, it is important that the supervisor not neglect his own in-service development.

Utilization of learning materials

The case study dealing with learning materials was another of the three cases studied that yielded low rank correlation values, however, it is possible to reach some conclusions. The most obvious conclusion is that the supervisors and educators are unsure as to the best expenditure of extra funds. This conclusion has interesting implications in light of the recent federal programs providing large sums of money for education. The low scale values are indicative of the lack of clear priorities among the respondents.

We may conclude, however, that extra funds should be expended on activities and materials to provide intensive experiences for students and not be diluted among many to the point of ineffectiveness.

The role of the supervisor in the broad area of utilization of learning materials is characterized by the concept of leadership. He must play a strong guiding role but the ultimate use or non use of materials resides in the teaching behaviors of the teacher.
He must lead the teachers into wise use of new or unfamiliar materials. This process should be an integral part of in-service education. The use of committees of teachers, learning material representatives and science educators can assist in meeting objectives in both areas.

Development of personnel

The question of the preferred academic background of a teacher for physical science and biology combination responsibility was the subject of a case study. It may be concluded that a broad background in physical science and biology is better than depth in chemistry, physics or biology. If a choice is necessary between physical science and biology, the latter would be preferred. The data also shows that additional work in physics is more valuable than additional work in chemistry.

The value of a methods course was clearly brought out in the data. The jury found that a methods course is more valuable than fifteen hours of science courses. We may therefore conclude that the methods course is an important part of teacher education curriculum and should not be replaced by additional depth in the subject matter area.

Another case study dealt with the problem of the successful coach but unsuccessful teacher. The jury clearly showed that the best solution to the problem was to remove him from the science classroom. It is worth repeating that the jury found the possibility of the coach teaching physical education the most attractive of the five alternatives
but that no mention was made of his certification, qualification, ability or interest in teaching physical education. We may safely conclude that the best solution would be to remove the ineffective teacher from the classes where he is ineffective and place him in an environment where he is more apt to find success.

If removal from the science classroom is not possible, the next best solution would be to decrease his role in the classroom as much as possible. Three possibilities in order of their desirability are team teaching, educational television or the use of a teachers aide. Attempting to transform him into an effective teacher by attendance at summer school is less desirable than removing him from the science classroom or decreasing his impact by using team teaching.

We may summarize the findings of this case study by concluding that the unsuccessful science teacher should be removed from the science classroom, if this is not possible decrease his impact on the students to a minimum.

The supervisor can best fulfill his role in the area of personnel development by remembering that it is his major concern to provide the best possible instruction for the school pupils. To do this he must have a thorough understanding of the learning process as well as teaching mechanics. He must be able to diagnose teaching problems and prescribe remedial procedures. In accomplishing this he must know the available resources such as scientists, science educators and institutions that may serve as consultants.
Professional growth

The third case study with low rank correlation values deals with the problem of encouraging science teachers to generate science-like atmospheres in their classrooms by using the laboratory as a focal point in their teaching. The rank correlation of -.30 shows a lack of concurrence in the responses of the educators and the supervisors. To the three hypotheses offered at the beginning of this section as possible causes for the low correlation values, the hypothesis that the educators and supervisors perhaps do not agree that a science-like atmosphere is desirable should be added. Although the objective of a science-like atmosphere in the laboratory is assumed as valid in most professional writing, the validity of this assumption has not been tested in this fashion before.

Because of the distribution of the scale scores, only one conclusion may be safely drawn from the case study. The technique that is occasionally used in faculty meetings of having a teacher lead a discussion on topics such as problem solving or science projects is one of the least effective methods of influencing classroom teacher behaviors such as making the classroom atmosphere more science-like.

In dealing with the teacher with adequate formal preparation but poor professional commitment an approach of intense professional involvement is more effective than a less direct approach. More specifically, the findings permit the conclusion that the teacher is more apt to experience professional growth and commitment by having responsibility for evaluating curriculum materials than by taking a passive role by attending summer school. It is possible that the teacher
may be involved in this type of activity in summer school but the findings did not reflect this.

We may also conclude that the development of a course of study such as would be used for school accreditation by a regional accrediting agency is not as effective for developing professional growth through professional commitment as other methods such as having the teacher attend a regional National Science Teachers Association meeting. This conclusion has special implication for teacher education programs as well as programs of supervision for beginning teachers. This period of the professional life of the teacher is where the professional commitment is usually made. The findings of the study indicate that attendance at professional meetings is more worthwhile than developing courses of study as is required in some teacher education programs. A change in emphasis of activity might result in more professional commitment and therefore a larger cadre of interested teachers.

Another effective method of meeting the needs of the teacher being questioned is that of having him observe a master teacher on a regular basis. This conclusion lends support to teacher education programs that utilize observation and bit teaching as a means of preparing the teacher to assume professional responsibility. Because of the difficulty in obtaining released time from the classroom, this practice meets with many practical problems in in-service situations.

A problem that is almost a mirror image of the one discussed above is that of the teacher who has good professional commitment and interest but realizes that his background is inadequate and out of date.
It is interesting to note that the findings indicate an almost inverse order in the desirability of the types of alternatives offered. The findings indicate that it may be concluded that the best solution to the problem is to decrease the influence of the teacher by utilizing him in a team teaching situation with the other teacher as the lead teacher.

Since the basic problem is fundamental background and not an attitudinal change, the solution is to gain background knowledge. The classical approach to the problem is to utilize college courses. If this is not possible a close substitute such as the Baxter Chemistry films developed for the Continental Classroom television series would be desirable. This conclusion has implications for colleges as well as certification departments of state departments of education. The colleges must offer courses that will encourage inadequately prepared and out of date teachers to enroll. The certification standards must be of such a nature to encourage such a teacher to enroll in courses of a comparatively elementary nature to gain the necessary background but yet not penalize the teacher's certification status.

The findings indicate that the least effective way to solve the problem is to have the teacher tutored by another teacher or for the supervisor to teach his classes and have the teacher observe. We may conclude that it is better to obtain background knowledge from authoritative sources rather than secondary sources.

The function of the supervisor in professional growth of teachers is not unlike that in the areas of in-service education and personnel development. He should have at his disposal a wide variety of techniques
to upgrade teachers. Although traditional college courses have an important part to play, other techniques should be utilized when appropriate.

The responsibilities of the supervisor imply competencies previously described as being able to diagnose teaching problems and prescribe treatment.

He should play an active part in professional organizations both for his own growth as well as providing growth for his teachers.

**Promoting public relations**

One of the most difficult problems in public relations is that of handling a science fair that has exceeded the limits of good education practice. From the findings of the study we may conclude that the best method to handle the problem is to develop other extracurricular science activities to compete with the science fair for the attention of the public as well as the energies of the students and faculties.

If this is not possible, the next best action would be to explain the role of the science fair to the faculty and administration, failing in this, then take the role of the science fair to the public through the medium of an editorial in the local newspaper.

If the more indirect methods of controlling the problem are not possible, more direct methods such as forcefully stopping the undesirable practices or working through the principals to stop the practices will be necessary.
The supervisor has an important role to play in public relations. He cannot let this role fall to others if the science program is to meet its function to improve scientific literacy as well as the more general aims of public relations. To accomplish these goals the supervisor should strive to have the science program presented to the public in the best possible manner.

This implies well run extra- and co-curricular science activities. It is important that these activities not achieve a dominant position in the educational program.

The supervisor should strive to involve the scientific and lay communities as much as possible directly in the educative process and not as bystanders.

Summary of conclusions

General conclusions regarding supervisory behavior can be summarized into a truism of education: we teach as we were taught. The jury consistently found the more dogmatic, dictatorial methods the least attractive of the alternatives. They found that supervisors best fulfill their functions when they use indirect methods. These conclusions are in agreement with the analysis of the professional literature discussed in Chapter II.
Recommendations

It is recommended that the instrument be used in the following ways:

1. Because of the lack of available data on effectiveness of science supervisory practices, the study can be used as resource information in courses in science supervision.

2. The results of the study can be used to evaluate supervisory services presently being offered by school systems.

3. The instrument may be used by school systems for evaluating applicants for science supervisory positions. The instrument would provide an index of the applicants agreement with techniques suggested by experts in science supervision.

4. The study can be used as a source of information in developing supervisory programs to assist with supervisory problems.

5. The instrument can be used as the basis of research in science supervision. Separate studies involving each of the problems described in the ten case studies could be made by developing additional solutions or by applying different statistical techniques so that more exact analysis can yield additional identifiable problems and subproblems. The relations of the various solutions to the case studies could be related to changes in teacher or student behaviors. The instrument could serve as the basis for longitudinal studies which would follow-up the recommendations in this study.
6. It is recommended that the conclusions regarding the six areas of supervisory behavior be carefully analyzed for possible adoption as practices for the solution of supervisory problems. They should provide a meaningful point of departure for innovation for the supervisor.

7. Because of the lack of quantitative and qualitative agreement between the responses of the science educators and the science supervisors, it is recommended that the dialogue between these two groups be increased. It is apparent that the science educator who is training the future science supervisor needs additional contact with the daily problems of the science supervisor. Conversely, the science supervisor needs the viewpoint of the science educator who is not as intimately involved in the day to day problems of supervision.
In the last decade the number of science supervisors has mushroomed. Very little help has been available to these supervisors in the form of written suggestions for the effective solution of various problems in supervision. Under the direction of Dr. John S. Richardson at The Ohio State University and with the encouragement of Dr. Charles F. Carroll, North Carolina Superintendent of Public Instruction, I am undertaking a study designed to delineate effective procedures for science supervisors.

The members of the National Science Supervisors Association are being requested to suggest names of science supervisors who are in a position to evaluate the effectiveness of science supervisory practices. Will you please indicate on the enclosed sheet the names and the areas of strength of as many as ten science supervisors who are providing leadership in science supervision? The list will be used to select a jury of science supervisors to evaluate selected supervisory practices.

A self-addressed, stamped envelope has been enclosed for your use. Thank you for your assistance.

Sincerely yours,

John M. Goode
Consultant in Science
Please write the names and check areas of strength of as many as ten science supervisors who are in a position to evaluate practices in six areas of science supervision. An example is given for your consideration. Please return this sheet in the enclosed stamped, self-addressed envelope.

<table>
<thead>
<tr>
<th>NAME</th>
<th>AREAS OF SCIENCE SUPERVISION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Curriculum Development</td>
</tr>
<tr>
<td>John Doe</td>
<td>X</td>
</tr>
</tbody>
</table>
In the last decade the number of science supervisors has mushroomed. Very little help has been available to them in the form of written suggestions for the effective solution of various problems in supervision. I am working on a research problem under the direction of Dr. John S. Richardson at The Ohio State University and with the encouragement of Dr. Charles F. Carroll, North Carolina Superintendent of Public Instruction, in an effort to delineate effective procedures for science supervisors.

Selected Science Educators are being requested to suggest names of science educators who are in a position to evaluate the effectiveness of science supervisory practices. Will you please indicate on the enclosed sheet the names and areas of strength of as many as ten science educators who are providing leadership in science supervision? The list will be used to select a jury of science educators to evaluate selected supervisory practices.

A self-addressed, stamped envelope has been enclosed for your use. Thank you for your assistance.

Yours truly,

John M. Goode
Science Consultant

JMG:mls.

Enclosure
Please write the names and check areas of strength of as many as ten science educators who are in a position to evaluate practices in six areas of science supervision. An example is given for your consideration. Please return this sheet in the enclosed stamped, self-addressed envelope.

<table>
<thead>
<tr>
<th>NAME</th>
<th>Curriculum Development</th>
<th>Inservice Education</th>
<th>Learning Materials</th>
<th>Personnel</th>
<th>Professional Growth</th>
<th>Public Relations</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Doe</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

107
It has been encouraging to have so many replies from my request for assistance in selecting a jury to evaluate science supervisory practices. The more responses I receive, the more assistance the study will provide for supervisors. Since some requests are yet unanswered, I am writing to ask if you have not yet returned the requested information, that you please do so in the near future. I realize that time is increasingly valuable, but I hope that you can find the few minutes necessary to return the reply.

I am enclosing a copy of the materials in case it has been mislaid. I appreciate your assistance in this study.

Sincerely,

John M. Goode
Science Consultant

Enclosure
Several weeks ago members of the National Science Supervisors Association and other science educators were asked to aid in the selection of a jury to evaluate science supervisory practices. The response was very encouraging with over 1800 names suggested. Your name was one of the most frequently suggested and therefore I would like to ask for your assistance in the second part of the study.

Will you assist me in the study by completing the enclosed instrument? With the exception of an appendix crediting the individuals participating in the study, the report of the research will not include references to individuals. An abstract of the research findings will be sent to those completing the instrument and indicating they desire this information. A self-addressed, stamped envelope has been enclosed for your use.

Both my adviser, Dr. John S. Richardson of The Ohio State University and I will appreciate your assistance in the completion of the study.

Very truly yours,

John M. Goode
Science Consultant

Enclosures
SUPERVISORY PRACTICES EVALUATION INSTRUMENT

DIRECTIONS

Ten situations involving supervisory problems are presented on the following pages. Following each problem situation are five possible solutions to the problem. Although there are many possible solutions to each of the problems, the five responses have been selected because they are applicable, with modification, in many different settings. There are many factors which would influence supervisory decisions in each of the situations. Please consider only the factors that have been presented in the descriptions and the possible solutions.

Each of the possible solutions has been paired with each of the other possible solutions. Please check what you judge to be the more desirable solution in each of the pairs.

On a pilot trial, the average time required for completion was one hour. Please place the instrument in the enclosed stamped, self-addressed envelope and return to John M. Goode, 604 Northbrook Drive, Raleigh, North Carolina 27609. If you would like an abstract of the completed study, please check. ( ) Thank you.
The local science fair has become an important public relations medium for the school system. Many teachers and administrators have expressed rather strong belief that the educational value of the fair has been seriously impaired because of the publicity. They feel that the fair has lost its usefulness because of an emphasis on the spectacular and not on the research and learning functions. Which one of the actions in each of the following pairs would be more effective?

- Develop other extra-curricular science activities such as a Science Congress, a Junior Academy of Science or a Junior Science and Humanities Symposium and let these other activities share some of the publicity.

- Take a firm stand and forcefully stop the undesirable practices of the teachers, administration and press.

- Write a guest editorial in the local newspaper explaining the role of the science fair in relation to the total science program of the school system.

- Work through the principals by having them to decrease the emphasis given the fair by the teachers.

- Hold a meeting of the entire science faculty and administration and explain the role of the science fair.

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Take a firm stand and forcefully stop the undesirable practices of the teachers, administration and press.
Although secondary school science teachers have average academic and professional educations, most science instruction consists of reading about science. How can the supervisor encourage teachers to generate a science-like atmosphere by using the laboratory as the focal point in their teaching? Which one of the responses in each of the following pairs would be more effective?

- Hold a series of six weekly meetings where a different teacher at each meeting would serve as a reference person for a discussion of such topics as problem-solving and science projects.

- Lead the teachers and students in a large scale scientific research project such as a bird, insect or tree census. Make the teachers responsible for planning and administering the research project in much the same manner as a director of research.

- Have one science teacher from each building participate in a summer research participation program wherein the teacher would perform scientific research under the close supervision of an active researcher. Each teacher would be responsible for holding a seminar the following fall with the other teachers in the building concerning the experiences.

- Conduct a series of six weekly meetings where laboratory usage and problem-solving techniques are discussed and demonstrated.

- Have one teacher from each building visit a teacher who uses the laboratory successfully in another school system and report to the teachers in his building the techniques that he observed. The expense of the program would be borne by the school system.

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Lead the teachers and students in a large scale scientific research project such as a bird, insect or tree census. Make the teachers responsible for planning and administering the research project in much the same manner as a director of research.
A science teacher with an above average science background and minimum professional certification requirements has voiced strong objections to the concepts of professional education. The courses that he teaches closely resemble some college courses, being mainly lecture. He does not attempt to fulfill any objective of science education except that of information. Which one of the responses in each of the following pairs should the supervisor take?

- Give him the major responsibility for developing a course of study for science such as would be used for school accreditation by a regional accrediting agency.
- Appoint him to a committee whose function is to evaluate curriculum innovations for possible inclusion into the curriculum.
- Have him observe a master teacher on a regular basis.
- Send him to a regional NSTA meeting at the expense of the school system.
- Require him to attend summer school at his expense to study the methods and philosophy of teaching science.
- Give him the major responsibility for developing a course of study for science such as would be used for school accreditation by a regional accrediting agency.
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Because of an unexpected opening for a ninth grade physical science teacher, the superintendent, with approval of the board of education, hired, out of desperation, an older gentleman who has been in semi-retirement. His science background is adequate but thirty years out of date. He is in good health, realizes that education has changed since he left the classroom twenty years ago, but isn't willing to work hard enough to overcome his problems.

Which one of the solutions in each of the following pairs would be more effective?

_____ Have the head of the science department tutor him in high school science courses.

_____ Have him view filmed science courses such as the Baxter Chemistry films produced for the Continental Classroom television series.

_____ Teach his classes biweekly and have him critique the classes.

_____ Require him to enroll in a university extension science course each semester to up-date his background.

_____ Combine two classes and use the other teacher as the lead teacher for team teaching.

_____ Have the head of the science department tutor him in high school science courses.

_____ Have him view filmed science courses such as the Baxter Chemistry films produced for the Continental Classroom television series.

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Combine two classes and use the other teacher as the lead teacher for team teaching.

Require him to enroll in a university extension science course each semester to update his background.

Have him view filmed science courses such as the Baxter Chemistry films produced for the Continental Classroom television series.
The board of education has authorized an inservice teacher education program for one class of twenty teachers for a total of eighteen hours. The main objective of this course is to increase the subject matter competency of the teachers. Lecture and laboratory techniques will be used. All meetings must be after school hours.

Which one method of organization in each of the following pairs would be more effective?

___ Hold an hour meeting every two weeks for thirty-six weeks.
___ Hold an hour meeting three times a week for six weeks.

___ Hold an hour meeting every day for eighteen school days.
___ Hold a three hour meeting twice a week for three weeks.

___ Hold a meeting for six hours on each of three consecutive Saturdays.
___ Hold an hour meeting every two weeks for thirty-six weeks.

___ Hold an hour meeting three times a week for six weeks.
___ Hold an hour meeting every day for eighteen school days.

___ Hold a three hour meeting twice a week for three weeks.
___ Hold a meeting for six hours on each of three consecutive Saturdays.
Hold an hour meeting every day for eighteen school days.

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Hold a meeting for six hours on each of three consecutive Saturdays.

Hold a three hour meeting twice a week for three weeks.

Hold an hour meeting three times a week for six weeks.
An opening has occurred for a teacher whose teaching load will be two classes of ninth grade physical science and two classes of tenth grade biology. Assuming all variables equal except the academic preparation mentioned and all teachers properly certified, which one of the teachers in each of the following pairs of candidates should the supervisor select?

- Chemistry, 25 hrs.; Physics, 10 hrs.; Biology, 10 hrs.; student teaching and a methods course
- Chemistry, 10 hrs.; Physics, 10 hrs.; Biology, 25 hrs.; student teaching and a methods course
- Chemistry, 10 hrs.; Physics, 25 hrs.; Biology, 10 hrs.; student teaching and a methods course
- Chemistry, 20 hrs.; Physics, 15 hrs.; Biology, 25 hrs.; student teaching
- Chemistry, 15 hrs.; Physics, 10 hrs.; Biology, 20 hrs.; student teaching and a methods course
- Chemistry, 25 hrs.; Physics, 10 hrs.; Biology, 10 hrs.; student teaching and a methods course
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| Chemistry, 20 hrs.; Physics, 15 hrs.; | Biology, 25 hrs.; |
| student teaching |
| Chemistry, 15 hrs.; Physics, 10 hrs.; | Biology, 20 hrs.; |
| student teaching and a methods course |
| Chemistry, 10 hrs.; Physics, 25 hrs.; | Biology, 10 hrs.; |
| student teaching and a methods course |
| Chemistry, 25 hrs.; Physics, 10 hrs.; | Biology, 25 hrs.; |
| student teaching and a methods course |
| Chemistry, 15 hrs.; Physics, 10 hrs.; | Biology, 20 hrs.; |
| student teaching and a methods course |
| Chemistry, 10 hrs.; Physics, 10 hrs.; | Biology, 25 hrs.; |
| student teaching |
| Chemistry, 20 hrs.; Physics, 15 hrs.; | Biology, 25 hrs.; |
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| Chemistry, 10 hrs.; Physics, 10 hrs.; | Biology, 25 hrs.; |
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It has been decided that earth science will be taught in the ninth grade next year. The supervisor of the one hundred affected teachers is notified of the decision nine months before the course is to begin. Only 10% of the teachers have any background in the earth sciences. Which of the programs in each of the following pairs would better prepare the teachers for this change?

- Arrange for a professor of geology from a nearby college to hold a monthly seminar in content and methods with the earth science teachers the year before and during the year of introduction.

- Prepare a curriculum bulletin containing earth science teaching aids such as simple demonstrations, laboratory experiments and suggested resource units.

- Arrange for an earth science consultant to conduct a two-week pre-school workshop in content and methods and pay the teachers extra for participating.

- Arrange a year long weekly series of lectures on earth science content to be held the year before the introduction.

- Hold a series of all day sessions on the first three Saturdays of the new school year and discuss content and techniques.

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__ Arrange a year long weekly series of lectures on earth science content to be held the year before the introduction.

__ Prepare a curriculum bulletin containing earth science teaching aids such as simple demonstrations, laboratory experiments and suggested resource units.
A successful coach has the responsibility of teaching biology in addition to coaching. His science background consists of a year of general biology and a course in Human Anatomy and Physiology. The fact he feels that teaching is a necessary evil is well known. His teaching consists mainly of lectures about the small amount of conventional descriptive biology that he knows and salty tales of the gridiron. Which one of the actions in each of the following pairs would be more effective for the supervisor to take?

____Arrange his teaching load so that he is teaching only physical education.
____Require that he attend summer school, at his own expense, to gain science background.
____Supply him with a teacher's aide to give him more time for preparation.
____Have him team teach with a master teacher.
____Let the class utilize regional educational television for science class each day.
____Arrange his teaching load so that he is teaching only physical education.
____Require that he attend summer school, at his own expense, to gain science background.
____Supply him with a teacher's aide to give him more time for preparation.
Have him team teach with a master teacher.

Let the class utilize regional educational television for science class each day.

Supply him with a teacher's aide to give him more time for preparation.

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Let the class utilize regional educational television for science class each day.

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Arrange his teaching load so that he is teaching only physical education.

Have him team teach with a master teacher.

Supply him with a teacher's aide to give him more time for preparation.

Let the class utilize regional educational television for science class each day.

Have him team teach with a master teacher.

Require that he attend summer school, at his own expense, to gain science background.
The science supervisor has been given $150 to be spent at his discretion. It is to be spent outside the usual budget. The typical basic needs of the program including laboratory equipment, library and audio-visual resources and teacher preparation, have been met. Which one of the expenditures in the following pairs would be more valuable for the science program?

___ Sponsor a series of two lectures to all the student body by a well-known scientist from a local college.

___ Pay the tuition for a science teacher to participate in scientific research at a local college.

___ Provide unusual materials that students need for science projects.

___ Take the science clubs on a field trip to a nearby area of scientific interest such as a nuclear reactor or a large telescope.

___ Build a portable museum display of the type that might be used in a science and industry museum and display it in the lobbies of the schools.

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Take the science clubs on a field trip to a nearby area of scientific interest such as a nuclear reactor or a large telescope.

Pay the tuition for a science teacher to participate in scientific research at a local college.
The board of education has authorized the science supervisor to develop a new approach to the teaching of physics. They have provided $10,000 per year for two years. Which one of the actions in the following pairs would be more appropriate?

___ Hire the local high school physics teacher for a year and give him the major responsibility with consultant help available.

___ Hire a local college physics teacher for a year and give him the major responsibility with consultant help available.

___ Hire the local physics teacher, a local college physics teacher, a general secondary supervisor and the science supervisor for the summer to plan and write the course. The work would continue part-time during the school year.

___ Enter into a contract with a local college to develop the course.

___ The supervisor would head the effort but farm out portions to the local high school physics teacher and the local college physics teacher.

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Hire a local college physics teacher for a year and give him the major responsibility with consultant help available.

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