Order Number 8719223

A profile analysis and study of the perceptions North Carolina elementary public school principals have of the elementary school science program in grades K–6

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The University of North Carolina at Greensboro, 1986

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A PROFILE ANALYSIS AND STUDY OF THE PERCEPTIONS NORTH CAROLINA ELEMENTARY PUBLIC SCHOOL PRINCIPALS HAVE OF THE ELEMENTARY SCHOOL SCIENCE PROGRAM IN GRADES K-6.

by

Barbara Ann Bennett Leonard

A Dissertation Submitted to
the Faculty of the Graduate School at
The University of North Carolina - Greensboro
in Partial Fulfillment
of the Requirements for the Degree
Doctor of Education

Greensboro
1986

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APPROVAL PAGE

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November 10, 1986
Date of Acceptance by Committee

November 3, 1986
Date of Final Oral Examination

LEONARD, BARBARA ANN BENNETT, Ed.D. A Profile Analysis and Study of the Perceptions North Carolina Elementary Public School Principals have of the Elementary School Science Program in Grades K-6. (1986)
Directed by Dr. Ernest W. Lee. 202 pp.

The purpose of this study was to examine and describe the perceptions North Carolina elementary (K-6) public school principals have of their role and participation in the science program of their schools.

Questionnaires were mailed to a random sample of 455 elementary school principals whose schools housed any of the grades from kindergarten through sixth. Of the returned instruments, 374 were used for a total response rate of 82%.

Major findings and conclusions are as follows:

(1) Twenty five percent of the sample population of elementary school principals have had teaching experience in science while 12.6% held undergraduate degrees in science. The majority of those sampled were comfortable to highly satisfied with their handling of the science curriculum.

(2) Elementary school principals revealed, through their perceptions of their administrative role in the supervision of the science program, a wide and variable range of participation. Less than half (40%) of the principals provided science inservice during the past year while slightly over 50% of the sampled principals indicated the availability of local school funds for science.

(3) Science fairs had been held in over 60% of the schools but less than 35% of the sampled principals reported

use of NSF-developed curricula. Less than 50% indicated the presence of a special facility for science teaching.

(4) Principals perceived their teaching staff as: comfortable with science material, primarily using the lecture/discussion method of teaching science, and teaching science for more than 30 minutes every day.

(5) The science experiences of principals did not appear to make a significant difference in the direction or involvement of the principal in the science program.

Data from this study suggests that a study by an independent observer is necessary to obtain additional evaluation of what principals have perceived as their role in the science program.

ACKNOWLEDGMENTS

Throughout my doctoral studies I have been especially grateful to Dr. Ernest Lee, my advisor, for his support, guidance, and patience during the coursework and this study. I also extend appreciation to Dr. Shirley Haworth, Dr. Richard Weller, and Dr. Frank McCormack for their advice, friendship, and constructive criticism as committee members.

To my family I owe special thanks: my parents who instilled in me the importance of all educational endeavors; my husband, C.H.B., for his support; my two children, Leslie and Phillip, for being proud; and my brother for all the long distance advice and encouragement.

Appreciation is also extended to the K-5 principals in the Lexington City Schools and their chief administrators who gave me the opportunity to explore the world of elementary school science and thereby igniting the spark of an idea which lead to this study.

This study is dedicated to Glenn Bemisderfer, who was my mentor as a beginning science teacher. Mr. B, as he was known by faculty and students alike, opened the door to the world in which a teacher may bring the best to her students through science.

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CHAPTER I

INTRODUCTION

Science is natural for children (Trojcak, 1979). They are "natural born" investigators (Blough & Schwartz, 1984) as well as curious, active and filled with a "sense of wonder" (Carson, 1965). Students in the elementary school have a "seemingly innate and unending interest in things called 'science'" (Hounshell & Coble, 1979, p. 17). Yet words such as "floundering" (Mechling, 1983b), "a vanishing species!" (Rowe, 1980), "amorphous and repetitive" (Goodlad, 1984) and "not basic" (Simpson, 1983) describe what many people, including science educators, consider the condition of elementary school science today.

The Russian launching of the satellite "Sputnik" almost thirty years ago ignited an explosion of funds into a massive effort of curriculum reform and development of the new "hands-on" elementary school science (Bratt, 1983; Naiman, 1983). The Golden Age of Science Education (Kyle, 1984a), the period from 1955 to 1974, was considered "unparalleled in the degree of activity in science education" (Helgeson, Blosser, & Howe, 1978, p. 13). So, what has hindered progress in elementary school science?

The economic crunch of the early seventies began an era of disillusionment for science education (Kyle, 1984a;

Naiman, 1983). School science had to struggle with a teacher shortage, the termination of funding, and the social backlash response of the public to the role technology played in Vietnam (Naiman,1983; Yager, Aldridge, & Penick, 1983).

In 1978 three major studies conducted on the status of science education in the United States reported that despite the development of the "hands on" curricula, government funding, and the few NSF institutes for elementary teachers, only 30% of the nation's schools were using the curricula. Students were falling behind in science (Helgeson, Blosser, & Howe, 1977; Stake & Easley, 1978; Weiss, 1978). "...To suggest that even half of the nation's youngsters would have a single elementary school year in which their teacher would give science a substantial share of the curriculum..." (p. 19:3) was the finding of Stake and Easley (1978) in the Case Studies in Science Education. The third Science Assessment made by the National Assessment of Educational Progress [NAEP] in 1978 further confirmed the overwhelming need to review science education (Kyle, 1984a; Yager & Penick, 1983).

Immediately following these studies were the highly publicized nationwide reports, such as A Nation at Risk, Goodlad's A Place Called School, and Educating Americans for the 21st Century which called for school reform (Day & France, 1985). It was like a replay of the post-Sputnik period (Greenleaf, 1982). In the eighties science education including elementary school science, has again become "fashionable" (Shamos, 1984). The results of the national science education studies were synthesized and interpreted in the "Project Synthesis" report (Yager, Aldridge, & Penick, 1983). Project Synthesis has now provided the criteria for setting standards in science K-12 (Teacher Handbook, 1986; Yager, Aldridge, & Penick, 1983).

One major cause of the de-emphasis of elementary science teaching has been the "Back to Basics" movement (Coble & Rice, 1982; Franz & Enochs, 1982; Orlich, 1980; Simpson, 1983). Stake and Easley (1978) found that this movement was the most important issue of concern throughout the case studies. Also revealed was the finding that what "science education will be for any one child...is most dependent on what that child's teacher, believes, knows, and does..." (p. 19:1).

The problems of teaching elementary school science have changed little from the 1950's (Coble & Rice, 1982). Several studies indicated that the dearth of science teaching in the elementary school was created by the teacher's inadequate science background. These studies (Bethel, 1982; Coble & Rice, 1982; Horn & James, 1981; Sanders & Sanders, 1982; and Weiss, 1978) revealed that the teachers perceived their own feeling of inadequacy as a major reason. Failure of preservice teacher education programs

(Bethel, 1984; Twiest, 1983), lack of inservice training (Coble & Rice, 1982; Mechling, Stedman, & Donnella, 1982; Piel, 1980), poor attitude toward science (Enochs & Phares, 1982), teacher anxiety (Brockley, 1982), lack of materials (Stake & Easley, 1978), and lack of time (Goodlad, 1984) have been reported as obstacles to the teaching of science in the elementary classroom.

Although the studies of the barriers to good elementary school science have apparently been focused on the role of the teacher, the explanation for the lack of nation-wide implementation of the "hands on" science curricula is still being investigated. With the recent attention on accountability and excellence in education, the effective schools research and the National Science Teachers Association [NSTA] program, The Search for Excellence in Science Education [SESE], have identified that the principal is the "key educator" in the school (Day & France, 1985; Mechling, 1983b; Yager, Aldridge, & Penick, 1983).

What was the role of the elementary school principal during The Golden Age of Science Education (Kyle, 1984a) and the implementation of the new science curricula? Mechling (1983b) reported that only a few principals participated in the National Science Foundation institutes. Weiss (1978) found that one out of four principals did not feel at all comfortable in supervising science.

> Nobody seems to be blaming the elementary principal for the sorry state of elementary school science --rightly so, for the surge of support for science education in the sixties and seventies virtually ignored the principal (Mechling, 1983b, p. 72).

Teachers in the exemplary science programs regarded the administrators and principals as "allies", supporters as well as initiators in some cases (Penick & Johnson, 1983).

If the principal is the key to the success of a school and its program, then how does the principal today perceive the role as instructional leader in making positive decisions for elementary school science? Is a science background necessary for a principal to function as a leader in the local school science program? What can science educators do to assist principals in bringing activity oriented science back into the elementary school classroom as a basic subject?

Statement of the Problem

The purpose of this study was to examine and describe the perceptions North Carolina public elementary school principals have of their role and participation in the science program in their schools. Aspects of the principal's role which were explored included the qualifications in science, management of the physical plant, and leadership in the school science program. Participation in this study was by elementary school principals in North Carolina public schools having grades kindergarten through sixth.

Assumptions and Limitations

The basic assumptions of this study were as follows:

- The elementary school principal is the instructional leader in the local school setting and can effect positive changes in the science curriculum.
- The elementary school principal has the positional authority to affect positive support for the science program in the local school.
- Teachers can provide better science teaching for students when the principal is aware of the needs and is supportive of the teacher.

The following limitations were made in this study:

- This study was limited to a random sample of the population known as North Carolina elementary public school principals employed during the 1985-1986 school year.
- The principals had to be administrators of schools that contained any grades from kindergarten through sixth.
- The study did not include any ungraded elementary schools or special elementary level schools such as the North Carolina School for the Deaf.

Definition of Terms Used

Administrator: Also referred to as a principal in an elementary school.

Elementary Public School: a public grade school operated free for all young children including one or more grades between kindergarten and sixth.

Elementary School Principal: a "professional administrator responsible for the management of an elementary school" (Dejnozka & Kapel, 1982, p. 187).

Elementary School Science: " an integral part of the elementary school... curriculum (which) provides for the daily opportunities for the sequential development of basic physical and life science concepts, along with the development of science process and inquiry skills... fostering in children an understanding of, an interest in, and an appreciation of the world in which they live" (Brown & Butts, 1983, p. 110).

Inservice Education: "denotes programs that are based on identified needs, planned and designed for a specific group of individuals in the school district, have specific set of learning objectives or activities, and are designed to extend, add, or improve the job-oriented skills or knowledge."(Orlich, 1984, p. 34) and may be referred to as staff development.

Staff Development: "a program of activities that, in education, is most commonly designed to promote the professional growth of teachers" (Dejnozka & Kapel, 1982, p. 492) and which might be referred to as inservice education.

Questions to be Answered

1. What qualifications, experiences, and attitudes do the elementary school principals have in the area of science?

2. How do elementary school principals in North Carolina perceive their administrative roles in areas of

local school finance, inservice education, instruction, and teacher evaluation in relationship to their science program?

3. What characteristics does the local school have for the science program? facilities? science fair?

4. How do principals perceive their staff as teachers of science?

5. Do the principals with science experiences in their background perceive the science program any differently from those without a science background?

6. What are the demographics of the elementary school principal population in this study?

Significance of the Study

The state of North Carolina has taken the initiative in providing for improvements in the science and math education of its students in the last five years (Coble, 1985). The Elementary and Secondary School Act of 1983 (Session Laws, 1984) provided funding of two dollars per child in grades K-6 to be spent on math and science equipment and supplies. In the summer of 1986, the Competencies for Science K-12, as part of the Basic Education Plan, were placed in the hands of principals and teachers in the local education units. Students are now tested, and have been for two years, in science at grade levels 3, 6, 8, and 9. Principals are heavily involved in evaluation of teachers through the Teacher Performance Indicators instrument and the Quality Assurance Plan. Principals have been indirectly involved in a number of studies for science including the Coble and Rice study (1980, 1982) of elementary school science in North Carolina. At present there are no published studies reported in the literature of how principals in North Carolina perceive the elementary school science program.

As a result of this study, a baseline of information collected from the principals will furnish a point of comparison for more complete analysis in the future of North Carolina's elementary school science program as well as that of the role of the principal in school science. The study will provide some direction as to how science educators could facilitate the growth of science in the elementary school curriculum through the support of the principal.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

> A place to excite students' curiosity, build their interest in the world and themselves, and provide them the opportunities to "practice" the methods of science. . . (Cited in King, 1985, p. 5),

decribes what the ideal elementary school would be for science. Yet almost thirty years after Sputnik, elementary school science remains much the same. There has been little change in the mode of instruction, stated objectives, and even less time spent teaching science (Coble & Rice, 1982; Hegleson, Stake, Weiss, et al., 1978; Fulton, Krockover, & Gates, 1980; King, 1985; Audeh, 1982).

The three major National Science Foundation [NSF] studies of the 70's revealed that the problems in school science were more pronounced than ever (Helgeson, Blosser, & Howe, 1978; Stake & Easley, 1978; Weiss, 1978), even with expenditures of over two billion dollars to improve science since 1957 (Yager & Penick, 1983). As government support decreased during the 1970's so did the teaching of science (Lapp, 1980). The hue and cry was "back to the basics" and the teaching of the 3 R's - reading, 'riting' and 'rithmetic! Science became lost in the "stampede" for elementary schools to teach these "basics" (Mechling, 1983b).

> The subject matter in science is the natural world but yet in the elementary school, drawing on the natural curiosity of the child is not basic (Mechling & Oliver, 1982, p. 31).

Gone was the paramount need to produce future scientists and engineers as a means for maintaining national security (Audeh, 1982; Hill, 1979; Kyle, 1984a; Wirszup, 1983/84). Science was in danger of becoming nonexistent at the elementary school level (Yager, Aldridge, & Penick, 1983).

As science education has entered the 1980's, cultural pressures have made it essential for steps to be taken to change direction. The goal for science education has now become the need to help all children, not just the able, cope with the role science and technology plays in their lives (Harms & Yager, 1981; Maben, 1980). When the results of the NSF studies were analyzed, new goals for science were established and published in the report "Project Synthesis" (Harms & Yager, 1981). The curriculum efforts that produced the "alphabet soup" programs (Kyle, 1984a) for elementary school science in the 60's, have now become only the first stage of science reform (Brandt, 1983/84).

Although it was recognized that the direction for science in the schools and society has changed, there still exists

> In many of the 16,000 school districts in the U.S., elementary science programs [that] lie mortally wounded or dead... (Mechling & Oliver, 1983b, p. 15).

It has been acknowledged that science education of the 60's and 70's failed to involve the "key" educator in the school, the principal, in the implementation process (Day & France, 1985; Kyle, 1984b; Mechling, 1983b). The elementary school principal could make the difference in this second stage of science reform. How? By being the "catalyst" and forming an alliance with science educators, the principal is in the position to facilitate actions to make science a valued part of the elementary curriculum (Koballa, 1984; Kyle, 1984a; Maben, 1980; Mechling, 1983a, 1983b; Mechling & Oliver, 1983a; Stanbury, 1981).

The Role of the Elementary School Principal

The elementary school principal is the "professional administrator responsible for the management of an elementary school" (Dejnozka and Kapel, 1982, p. 187). The General Statutes of North Carolina stated the powers and duties of principal as

> (a) To Grade and Classify Pupils.
> (b) To Make Accurate Reports to the Superintendent and to the Local Board.
> (c) To Improve Instruction and Community Spirit.
> (d) To Conduct Fire Drills and Inspect for Fire Hazards.
> (e) To Discipline Students and to Assign Duties to Teachers with Regard to the Discipline, General Well-being, and Medical Care of Student.
> (f) To Protect School Property. ($ 115C-288, pp.147-148)

Under subsection (c) the statute reads "The principal shall give suggestions to teachers for the improvement of instruction" (p. 148). The policies of the local school board, however, do control the extent to which the principal exercises those powers and duties ($ 115C-286, 1984).

The primary responsibility of the elementary school principal is seen as providing leadership to the school (Sigman, 1985). Welch described the principal as serving "a unique role of boss, shepherd, counselor, and manager all rolled into one. He or she is ...the major factor in the school's operation..." (Stake & Easley, 1978, p. 5).

The early elementary school principal was first a record keeper then an inspector (Jacobson, Logsdon, & Wiegman, 1973). After 1900, business management (or business administration) practices provided the direction for the operation of the elementary school (Blumberg & Greenfield, 1980; Jacobson, et al., 1973). By 1945, principals were the "students of instructional problems" (National Education Association, 1945). The responsibility of the principal by then had become one of gathering together all usable resources to improve the quality of the school's instructional program (Tanner & Tanner, 1975).

As the function of the elementary school principal changed, the ambiguity of that role became a critical issue facing these administrators (Jacobson, et al. 1973). The study, "Issues and Problems in Elementary School Administration" under Keith Goldhammer's direction, (cited in Jacobson, et al., 1973) reported that principals perceived supervising and assisting teachers as a major role responsibility. Within this domain, however, principals identified planning and implementation of innovations as a problem area. Goldhammer's study also disclosed that a principal's lack of understanding and preparation in the areas of innovation contributed to the lack of leadership in the school.

A more recent dilemma posed for principals has been the choice of being either a strong instructional leader or an effective school manager (Blumberg & Greenfield, 1980). For a better understanding of the complexity of the principal's role in the school, Knezevich offered this description:

> ...counselor of students, school disciplinarian, the organizer of the schedule, the supervisor of instructional program, the pupil-relations representative for the attendence area, the director and evaluator of teaching efforts, the manager of the school facilities, the supervisor of custodial and food service employees with the building, and professional leader (p.17).

Nevertheless, elementary school principals surveyed in 1978 saw their primary responsibility to be supervision and instructional improvement (Pharis, 1979; Pharis & Zakariya, 1979).

What are the characteristics of successful elementary school principals? Effective schools research has found that good principals provided strong instructional leadership. Principals were the major factor in school operation (Mechling, 1983a; O'Toole, 1974; Ritz, 1983), and therefore they were identified as the key to the success or failure of the public school (Sigman, 1985). Principals were the "authority who make the budgetary, personnel, and administrative decisions" in the school (Day & France, 1985, p. 5). The National Science Board (1983) found that most successful schools "boast a principal who is highly accessible to teachers, who involves them in the planning and decision making process and who is a knowledgeable educator" (p. 36). Schools with effective leadership emphasized achievement with all areas of learning stressed, not just reading and math. Instructional programs were well coordinated and teachers had received the necessary support from the principal. The principal in turn monitored the classrooms, supervised the instruction and provided teachers time to plan together (Kyle, 1984b; Koballa & Bethel, 1984).

The National Congress of Parents and Teachers and the National Academy of Science, two diverse groups, concurred that the school principal was a key agent for educational change (Mechling, 1983b). For a real change to occur in science education, there must be substantial involvement of all educators at the school-building level (Exxon, 1984). "Trust" also must exist between the principal and teachers for change and innovation to occur (Goodlad, 1984).

Research reports indicated that the administrators who were shown the value of a new program would be supportive

(Orlich, Ruff, & Hansen, 1976; O'Toole, 1974; Ritz, 1983), as illustrated in Loucks and Hall's (1979) study of the implementation of a new science curriculum. This study reported that actions taken by the building principal, to support or inhibit a change effort, had a direct effect on how teachers viewed and ultimately used a new program.

Immediate job pressures, however, could interfere with the principal's desire to make changes. Consequently, the principal may have had to depend upon innovative ideas coming from other sources such as supervisors and teachers (Mechling & Oliver, 1983a; Tanner & Tanner, 1975). Boroughs (1976) found that teachers, convinced of a need for a program, were able to influence the principal to implement the program.

Although the role as the "manager of change -- promoter of innovation" was inherent to the job (Orlich, 1976, p. 5), there has been a tendency to underestimate the power of the principal (Lipham, 1981). The principal has had the potential capability to make things happen in a school (Mechling & Oliver, 1983c). Bricknell (1964) described this power very consummately,

> The administrator [principal] may promote--or prevent--innovation. He cannot stand aside, or be ignored. He is powerful not because he has a monopoly on imagination, creativity, or interest in change--the opposite is common--but simply because he has the authority to precipitate a decision (p. 503).

Illustrations of this power or image of the principal can be found in the Case Studies in Science Education (Stake & Easley, 1978). Smith found that the elementary schools in her case study were very independent units and that "the image of the principal as Lord in His Domain remains strong" (p. 2:3). Terry Denny shares one principal's perception of his role, giving his "prescription for change"

> You want to know why I'm boss here? I'll tell you why I'm boss here. Because I have authority. You need coordinators (at the district level) with real clout if you want an integrated, funnelling program. You need people with "authority", not with "supervisory" capacity. That's the way things get done in T_____. Until that happens each principal will run their [sic] own school the way he wants to. When the Associate Superintendent speaks, we do it. The others muddy the waters (Stake & Easley, 1978 p. 1:9).

In summary, the elementary school principal has had the responsibility of providing guidance for the instructional program of the school. One result of a principal's strong leadership role in utilizing the positional authority to the benefit and development of the elementary school's curriculum does appear to be an effective instructional program.

The Elementary School Principal and Science

> Administrators worth their NaCl should recognize where we have been, where we are, and where we are going if they seek to assume the leadership necessary to offer science education appropriate to the 1980's (Maben, 1980, p. 39).

"Who's Responsible?", queried Trojcak (1972), for the improvement of childrens' experiences in science? Along with teachers, supervisors, and teachers of prospective teachers, principals have had the responsibility to provide a first class science program (Maben, 1980; Mechling & Oliver, 1982; Trojcak, 1972). Whitla and Pinck (1973a), in a statewide study of Massachusetts schools, identified the principal as the person most commonly responsible for the science program. Serrano (Stake & Easley, 1978) discovered in his case study, that "The inclusion of a science program...is left in the hands of the building principal" (p. 7:5). Kyle (1984b) credited the effective schools research in alerting science educators to the knowledge that although the 60's science curricula were successful in improving students' performances (Shymansky, Kyle, & Alport, 1982), the principal's influence was overlooked. Principals had little opportunity to examine the new curricula, therefore a need had not been established for the use of the programs (O'Toole, 1974). The principal who did not understand the significance of the new programs, abandoned these programs easily when the drive to teach the basics developed (Kyle, 1984b).

Inadequate participation by the principal contributed in a large part to the lack of success in establishing a viable "hands on" science program in the schools during the 60's and 70's (Kyle, 1984b; Mechling, 1983b). Although teachers from a school were selected to attend the NSF institutes, the principal from that school was seldom involved (O'Toole, 1974). Unfortunately only a few principals have ever attended these implementation programs (Mechling, 1983a). It was apparent that the program dissemination of the NSF curricula did not reach the appropriate decision makers (Mechling, 1983b; Pratt, 1981).

Administrators, however, have suffered from "benign neglect" (Mechling, 1983a, p. 20) in the implementation of science programs. It has been reported that when involved, principals have played a key role in implementing science programs, especially the NSF developed programs (Boroughs, 1976; Orlich, 1976). Principals and superintendents have now acknowledged the need for help in the implementation of new science programs (Lapp, 1980; Weiss, 1978).

Conversely, a number of studies (Koballa, 1984; Loucks & Melle, 1982; Loucks & Hall, 1982; Boroughs, 1976) identified the lack of support from the school principal as one of the many barriers to a successful science program. An example of this nonsupport was illustrated in Loucks and Melle's report (1982) of the implementation of a science program for upper elementary students in 80 Colorado schools. The formative evaluation of the project in each school produced a profile, in some cases, of unsuccessful implementation. The teacher problems were most often due to lack of commitment by the principal to the program,

> which resulted in consumable supplies not being reordered, facilities and classes scheduled in such a way that science instruction was difficult and supply closets that were always in disarray (p. 106).

Responsible principals should have been actively involved in the science program (Beisenherz, 1972; Trocjak, 1972). Regrettably, it has only been the recent issues of excellence (Coble & Rice, 1982) and accountability for the decline in student achievement (Hegelson, Blosser, & Howe, 1977; Kyle, 1984b; Mechling & Oliver, 1982; Shamos, 1983/84; Yager, 1983/84) that has had local administrators reviewing their role in science education.

The literature revealed very little information about the relationship between the principal and professional experiences with science. Weiss (1978) reported that 11% of the principals had majored in science. Pratt (1981) noted 9% of the principals felt they had an inadequate background in science. While 90% of the principals felt very well or adequately qualified to supervise the reading, math, and social studies curricula, only 75% of the principals felt adequately prepared to supervise the science curriculum (Helgeson, Stake, Weiss, et al., 1978). Whitla and Pinck (1973a) found only one out of seven principals had taught science full time. Two studies (Audeh, 1982; Whitla & Pinck, 1973a) reported that 13% and 10% of the elementary school principals respectively, had attended NSF institutes. Selser and Milliken (1973) did report findings of 48% of the principals (elementary and secondary) who had not experienced labs in undergraduate method courses. The 52%

who stated yes had some science academic experience, although most of it was of the "cookbook" science variety.

Principals and the Barriers to a Good Science Program

A number of barriers have been identified which elementary school principals as well as teachers have faced in efforts to improve the science curriculum. The most obvious hinderance has been the rush to join the "Back to Basics" movement (Coble & Rice, 1982; Franz & Enochs, 1982; Orlich, 1980; Simpson, 1983). There was "the perception that school science has never been favored with full acceptance as a vital part of the elementary ... curriculum" (Stedman & Stivers, 1983, p. 23).

Elementary school science has not been considered "basic" therefore priority for science has been low (Burke, 1980; Franz & Enochs, 1982; Koballa, 1984; Stake & Easley, 1978). Welch reported that principals observed in his case study ranked science and health together as fifth after reading, math, social studies, and physical education (Stake & Easley, 1978). In the Case Studies in Science Education, Stake & Easley (1978) found that teaching the "basics" was the issue that most occupied the attention of the principals. Principals were ambivalent about their feelings for science. A number of principals did agree science was important but the three R's should be taught first (Audeh, 1982; Stake & Easley, 1978). Others saw science as simply increased reading skills (Stake & Easley, 1978).

The principals' attitude towards science could act as a barrier. Selser and Milliken (1973) found that a positive attitude, which included financial support and encouragement given by the principal, directly affected the increased usage of the NSF science programs. Boroughs (1976) found this was also evident with South Carolina elementary school principals. In the Massachusetts study, Whitla and Pinck (1973a) reported that principals did not believe a science program could be sold to teachers just because of the personal interest of the principal. The same study also provided information about satisfaction with the science curriculum. The principals were more dissatisfied with the social studies and math areas than that of science. Whitla and Pinck (1973a) also reported that while two out of three principals were content with the science teaching, only 16% spent extra time talking with teachers about science.
This comment from a Vortex principal best illustrated the attitude of some of the principals in the Case Studies,

> But if you have a person teaching science who really loves it, those kids really have a good science program. On the other hand, I've had to almost force someone to put the science kit in their classes. No one wanted to have anything to do with it. You know how science was treated? They got their minimum time allotments in (Stake & Easley, 1978, p. 19:2).

The superintendent's philosophy for the school system was another obstacle. This type of influence could prevent the initiation of a new program by the principal (Selser & Milliken, 1973; Stake & Easley, 1978). Many principals as a result did not require the use of the "hands on" approach in their schools and saw no need for the programs (O'Toole, 1974).

Even when interest was high for the new "hands on" curricula (Franz & Enochs, 1982), the cost of these programs created another barrier. School administrators and school board members were usually anxious about the cost and did not often provide monetary support for implementation (Gega, 1980; Selser & Milliken, 1973). Insufficient funds was often documented as a reason for a poor science program (Coble & Rice, 1982; Gega, 1980; Selser & Milliken, 1973; Stake & Easley, 1978). Even the federal government's financial support was not the long term commitment needed to have allowed completion of the large scale implementation of science programs (Lapp, 1980). For example, in 1959, 45% of the National Science Foundations' $134 million budget went to science education. In 1982, science education was allocated only 2% or $21 million of the $994 million dollar budget (Greenleaf, 1982).

Differences in the perceptions that principals and teachers have of a program have also proven to be an obstacle to improving science programs. Rowe and Hurd (1966) reported that teachers and principals perceived a difference in opinion about the "hands on" curricula.

This generated a resistance to the change in the curriculum. While teachers found management and discipline a barrier, the principals saw the problem as a lack of teacher "know how" in science. On the other hand teachers viewed the principals as being concerned with quiet and orderly classrooms (Hegelson, Stake, Weiss, et al., 1978; Mechling, 1983a; Mechling & Oliver, 1983a). Teachers' inadequate background and lack of teacher preparation for science instruction were also perceived by principals as reasons for failure of science programs. Teachers seldom gave the same reasons as principals did for not teaching science (Bethel, 1982; Green, 1981; Weiss, 1978).

Diminished time was another factor affecting science in the elementary school (Goodlad, 1984; Hegelson, Stake, Weiss, et al., 1978; Maben, 1980; Merseth, 1983/84). Smith recorded her impressions of the typical schedule found for science in the elementary school.

> "We do science and social studies, in the afternoon, if there's a chance", one teacher said. Although there is a schedule of both subjects, actually finding instruction taking place was sometime like tracking the Sasquatch (Stake & Easley, 1978, p. 2:20).

Science has been consistently receiving the least amount of teaching time in the classroom (Coble & Rice, 1982; Koballa & Bethel, 1984; Maben, 1973; Stake & Easley,1978; Weiss, 1978). One recent national survey reported that science received the least amount of time in the fourth grade when compared to reading/language arts, math, and social studies (Cawelti & Adkisson, 1985). Bethel and Hord (1982) found 60% of the inservice teachers in their study did not teach science at all, while Goodlad (1984) reported that the least amount of time was spent in science at the lowest grade levels.

The principal does need to be aware of the time allocation for science (Kyle, 1984b). A lack of teachers' planning time scheduled for science appeared to have resulted from the belief science was less important, therefore inadequate time has been given to teaching it (Hegleson, Stake, Weiss, et al., 1978). In a ten state study, Audeh (1982) found that principals were perceived as having had more influence in deciding the time alloted for science for grades 4-6 than in K-3. Cawelti and Adkisson (1985) reported that the "knottiest" problem for principals was the need to cover all the basics while providing a broad base of experiences for children. Time was a very serious constraint to accomplishing this goal.

Other recognized obstacles for the principal included unfamiliarity with science education methods (Maben, 1980), inadequate consultant or supervisory services (Audeh, 1982; Hegelson, Stake; Weiss, et al., 1978; Pratt, 1981; Sanders & Sanders, 1982), lack of inservice support (Audeh, 1982; Maben, 1980) and lack of state support for curriculum development (Audeh, 1982).

Despite these difficulties, there were schools that did successfully use the NSF curricula. The most likely places that researchers found the new programs established were schools where a principal or teachers had participated in an NSF institute (Boroughs, 1976; Pratt, 1981).

Therefore, in summary, elementary school principals have been recognized as a critical factor for improving the science program. The support and involvement of principals could have been influenced by a number of conditions that prevented positive developments to occur. Some of the conditions such as lack of supervisory help and the superintendent's policy are beyond the principal's control. Other factors such as personal involvement were not. Degrees and/or experiences in science were not predominating characteristics of the elementary school principals included in the studies cited.

Principals and Science Programs of Excellence

In 1982, The National Science Teachers Association [NSTA} initiated a program called The Search For Excellence In Science Education [SESE] to identify and describe "real world models of excellence in science education" (Bonnstetter, Penick, & Yager, 1983, p. 1). The NSTA, which Yager (1983/84) described as the largest society in the world dedicated to science education (40,000 members), utilized the results of Project Synthesis as criteria for the search (Yager, Aldridge, & Penick, 1983). Those criteria as R. T. Johnson (1983) listed them -- Personal Needs, Societal Issues, Academic Preparation, and Career Education/Awareness were employed as described in the elementary school section of the Project Synthesis findings in What Research Says To The Science Teacher, Vol. 3 (Pratt in Harms & Yager, 1981).

In the elementary science issue of the Focus On Excellence series, Penick (1983) described some of the characteristics of administrators of those exemplary elementary science programs:

> *Support good science programs.
> *Become involved in elementary science.
> *Provide systematically for availability of science materials and inservice related to science teaching.
> *Identify key science teachers as leaders in the Search for Excellence in elementary science (p. 156).

Kyle (1984b) also reported that the conditions for effective school leadership were also found in schools with exemplary science programs.

> Principals support good science programs. Principals are actively involved with the program, they demonstrate positive attitudes toward the program, they communicate their interest in science to teachers and members of the community, and they observe classes when science lessons are being taught. Principals also provide the necessary materials and provide inservice opportunities in science that address the needs of individual teachers. Finally, principals recognize that science is a basic part of their curriculum (p. 127).

In addition, The NSTA sponsored action in another direction with a project called "Promoting Science Among Elementary School Principals" (Mechling, 1983a). This was a move away from the exclusive focus on the teaching and a means to enlist the help of principals to improve science programs (Greenleaf, 1982). The project produced four handbooks in the series: Science Teaches Basic Skills (I), The Principal's Role in Elementary School Science (II), Characteristics of a Good Elementary Science Program (III), and What Research Says About Elementary School Science (IV).

In the NSTA series, Mechling and Oliver (1982II) described seven roles principals assumed in establishing a good science program.

A. The Principal as a Science Leader.

B. The Principal as a Curriculum Analyst.

C. The Principal as a Force in the Selection or Development of a New Science Curriculum.

D. The Principal as a Provider of the Wherewithal.

E. The Principal as a Provider of Inservice Instruction.

F. The Principal as a Monitor of Progress in Science Programs.

G. The Principal as a Troubleshooter (p. xi - xiv).

Attention has been given to the administration of the elementary science program by the National Association of Elementary School Principals with two series of articles in the organization's journal, Principal (formerly The National Elementary Principal). The first series was an issue devoted to science education published in January, 1980. The second was a series of articles which disseminated information about the NSTA program for principals.

The "Project Promoting Science Among Elementary School Principals" has provided principals with a tool with which to guide their elementary school programs toward excellence. Mechling and Oliver have not been the only members of the educational community giving attention to how elementary school principals could assist the development of their science curriculum. Stanbury (1981), a principal herself, suggested the following: establish a school philosophy for science with guidelines and plans to maintain it, "create maximum professsional autonomy for each teacher" (p. 15), provide the needed resources, be knowledgeable in the science area if possible, and encourage and provide teachers with opportunities to particpate in inservice education. Orlich (1984) has instructed principals to provide curriculum support by acting as an advocate for innovative science programs.

Maben (1980) outlined a number of steps the principal could utilize in the effort to improve the elementary school's science curriculum.

1. Examine existing science teaching.
2. Assess unrecognized science teaching.
3. Determine available community resources that are most likely to be used in present programs.
4. Look for ways to implement a K-8 science curriculum.
5. Recognize that good teachers are constantly searching for better materials and programs to use in their classroooms.
6. Provide support services to teachers.
7. Keep your currriculum future oriented (p. 43).

Purkerson and Whitfield (1977) told principals to become involved and promote interest in the science program. They continued by listing a number of school wide projects that might motivate science in the classroom. Some of the suggestions included an outdoor learning center, school weather station, science fairs, science museum, ecology club, and school planetarium. Gega (1980) provided some recommendations for ways the principal could effectively support a program that has been selected for use in the school. The principal must first insure success by providing the teachers with inservice instruction and encouraging better scheduling of science into 45 to 60 minute time slots per day. The principal also should have supplied the leadership in the initial program selection and subsequent adaption of the program to fit the local school needs.

There were several commonalities in the various recommendations for the principals' actions. First was the very strong emphasis on administrative support for every aspect of an elementary school science program. Secondly, two major areas were addressed throughout all articles. These two areas included budget support for the instructional program in science and greater emphasis on science inservice progams for teachers.

Mechling and Oliver (1982II) described one role of the principal as the "provider of the wherewithal" (p. xiii) with the responsibility to see that science gets its share of the money (Mechling, 1983a). "Bankruptcy" (or no money) is the term Mechling and Oliver (1983b) used in describing one of the "killers" of an elementary school science program. In a Massachusettes study, Whitla and Pinck (1973) reported that 90% of the principals did make a budget request yearly for science. However, Mechling and Oliver (1982) noted the more frequent observation was that few schools have had a separate budget for science. Financial support by the principal did appear to have a positive correlation towards implementation of innovative programs (Burroughs, 1976; Selser & Milliken, 1973). In a slightly different tact, Horn and Marsh (1976) have recommended that administrators and finance officers should receive training or orientation to the needs in science in order to facilitate the improvement of the science program.

Mechling and Oliver (1983II) listed ways the principal can ensure the monies being available.

1. Budgeting for new and replacement science materials.
2. Providing a petty-cash fund for the purchase of inexpensive, local supplies (p. xiii).

Budgeting for science supplies was critical as it has already been noted in the Loucks and Melle (1982) and Coble and Rice (1980, 1982) studies. Showalter (1984) listed among the conditions for good science

> An adequate supply of modern science supplies and equipment should be available for individual and small

> group activities and experiments...elementary classrooms should be well supplied with appropriate, inexpensive, and easily obtained materials (p. 10).

Also recommended for elementary school science was a separate account for science within the local school budget and petty cash for supplies and consumables needed throughout the year (Showalter, 1984). Gega (1980) suggested that at the elementary level, parents and the local PTA/PTO's could be a source of funds especially since the large federal monies were no longer available (Piltz & Sund,1974).

Mechling and Oliver (1982II) listed two additional descripters for funding the science program. They are

> 3. Anticipating costs related to program selection and teacher attendance at conventions.
>
> 4. Making allowances for costs related to science inservice programs (p. xiii).

Funding has been a major issue for inservice education. Lack of funds has been a barrier and a weakness for inservice education (Hite & Howey, 1977; Orlich, 1984) especially in the area for the locally funded release time for teachers (Showalter, 1984). The local education agencies have provided limited funds at best (Hite & Howey, 1977).

The history of funding for elementary science inservice programs began in the 60's and 70's with the monies made available by the NSF for inservice institutes. These institutes were designed for implementation of the then new "hands on" science curricula (Piltz and Sund, 1974). These funds are no longer available. The disappearance of the NSF institutes, in Piel's view (1980), has depreciated the teachers' own training and qualifications.

In 1975 there was federal funding of the Teacher Corp which led to the establishment of teacher centers (Hite & Howey, 1977). This money is also no longer available. The last year of funding through the NSF via the Department of Education for elementary science inservice programs was 1981. After 1982, block grants by the states became the funding sources (Office of Educational Research and Improvement, 1982). Showalter (1984) suggested that the cost of released time should be part of the school system's regular operating budget. At the local school level, the principal has been the main provider of inservice training and has had the responsibility to provide financial support (Selser & Milliken, 1973).

Relationship of Principals and Teachers

Prevading all aspects of the principal's role in the science program of the school was the relationship of the administrator with the teacher. For each of the seven roles identified by Mechling and Oliver, (1982II) the teacher is one of the focal points. For example,

A. The principal as science leader.
   - Discussing science with their teachers (p. xi).

B. The principal as a curriculum analyst.
   - Surveying teachers.

C. The principal as a force in the selection or development of a new science curriculum (p. xii).

- Ensuring that all teachers who will use the program have a part in selecting it.

D. The principal as a provider of wherewithal.

- Anticipating costs relating to program selection and teacher attendance at conventions.

E. The principal as a provider of inservice instruction (p.xiii).

- Participating, actively, in inservice programs themselves.

F. The principal as a monitor of progress in science programs.

- Evaluating teachers' performance as science teachers.

G. The principal as a troubleshooter.

- Letting teachers know that science is important and that they must teach it (p. xiv).

Teachers have been identified as the key to science in the classroom (Stake & Easley, 1978). Teachers do affect the direction science takes in childrens' lives (Burke, 1980; Renner & Stafford, 1979). Teachers can be affected by the wishes of parents and students but have been more formally influenced by the principal's decisions and practices in relation to the curriculum and supervision (Munby & Russell, 1983).

Pharis (1979) reported survey results that indicated elementary school principals feel they have a good relationship with teachers in their schools (Pharis, 1979). Teachers in the exemplary science programs regarded principals as "allies" and friends (Penick & Johnson, 1983). Support has been constant theme in the principal's relationship with the teaching staff (Bonnstetter, Penick, & Yager, 1983; Chapman and Lawther, 1982; Sanders & Sanders, 1982). In the study of outstanding teachers of the NSTA's Search for Exemplary Science Education, Bonnstetter, et al. (1983) found that principals rated high on a scale of 1 to 5 with 81% of the teachers rating principals 4 to 5 for support. Ritz (1983) felt it was essential for science teachers to gain the support of the principals at all levels.

Teachers in one study (Marek & Heard, 1983) stated they were supported by the principal but lacked sufficient planning time to make innovations. Other principals have provided teachers release time for curriculum development (Kyle, 1984b). Teachers should be directly involved in curriculum development along with the administrator (Showalter, 1984; Tanner & Tanner, 1980).

However the relationship of the principal and teacher could impede the progress of science in the classroom. Frequently there has been frustration with the administration and lack of support from the building level principal (Tanner & Tanner, 1980). Madeline Hunter has been quoted saying "Great teachers, far from being rewarded, are often the most neglected people in the school. They never get to see the principal for either praise or blame." (Gudridge, 1980, p. 30). A poor attitude could be affected by the principal if he or she felt the teachers were unable to handle the curriculum (Selser & Milliken, 1973). Change would not take place, if the teachers' attitudes were poor (Enochs & Phares, 1982; Mechling & Oliver, 1983a). No change in school science has occurred unless there has been support from administrators (Gega, 1980; Gudridge, 1980).

Principals, Teachers, and Science Inservice Programs

"Staff development is pivotal to curriculum change" said Maben (1980, p. 43) and so it has been acknowledged by science educators and by administrators. The principal has had a key role in supporting (Maben, 1980) and providing inservice education (Coble & Rice, 1982; Mechling & Oliver, 1982 II). The findings of current research in the area of inservice education included the very strong indication that successful inservice programs needed to occur on site in a local school (Kuhn, 1980; Lemon & Minier, 1981; McKeel, 1979; Orlich, 1984) with the principal and teachers as the participants in this staff development. Orlich (1976) has identified that the participation of school principals in very intensive inservice experiences has permitted the successful implementation of the science program (within the Washington State project).

Inservice education has been proposed as the final element in creating a good science program (Orlich, 1985). In North Carolina where less than 20% of the school systems have science supervisors, the principal has had the primary role in inservice education (Coble & rice, 1982). Kearns

(1981) designed a model for elementary school science inservice program and implemented it successfully in a North Carolina school. The design involved the full participation of the principal.

With fewer prospective teachers in college, inservice programs have been considered the only avenue of access of education for a majority of teachers (Pratt, 1981; Tanner & Tanner, 1980). Despite twenty years of improvement in science programs, the elementary teacher has had at best received minimal help (Henderson, 1981). The lack of inservice training in the past has posed a barrier to teaching science in the elementary schools (Coble & Rice, 1982; Lapp, 1980; Kearns, 1981; Mechling, Stedman, & Donnella, 1982). Goodlad (1984) posed the idea that what curriculum organizers did not seem to observe was that student readiness for the exploratory programs was different from the teachers'. The students were ready!

The need for inservice education was reported as critical (Lapp, 1980). School based inservice could be a problem if the school principal was not a strong instructional leader (Kearns, 1981). Failure to consider the teachers' ideas and attitudes could seriously limit any gain hoped for in an inservice program (Harty & Enochs, 1985; Hite & Howey, 1977). One characteristic of all the NSTA Excellence in Elementary School Science programs was the continual involvement of the teachers in inservice programs during the school year and summers (Holdszkom & Lutz, 1984).

In summary, there are now models for identifying good science programs. Research has shown that the principal is an important part of an excellent science curriculum. Guidelines have been developed for principals to assist them with evaluating and improving existing science programs. Financial responsibilities and the relationship with the teaching staff especially in staff development or inservice programs for science are critical to the principal's role in establishing excellence in science teaching.

Elementary School Science In North Carolina

Education in the United States is not centralized (Audeh, 1982; Wirzsup, 1983/84) due to the tenth amendment to the Constitution of the United States which guarantees the rights of states to make decisions about education. The North Carolina legislature, along with other states', have retained this authority through the education code. As in other states, the N. C. legislature in turn has authorized the local school boards to direct the local schools. Ultimately it has been the principals and teachers who have the final decision on how programs are delivered to the students (Hill, 1979).

The science division of the North Carolina State Department of Public Instruction was the first line organization which began to interpret the science curriculum. With the advent of so many sweeping changes and teaching alternatives in the science curricula, Taylor and Welliver (1972) reported that the standard scope and sequence and course of study for North Carolina elementary school science was insufficient. Educators and scientists put together a guide for the science processes and unit organization, as well as descriptions of learning activities. Teachers were to implement this development plan. One major addition was the companion publication for principals and supervisors which was utilized as a guideline to help teachers use the development process (Taylor & Welliver, 1972).

In 1974-75, within the State Assessment of Educational Progress in North Carolina, the science program at grades three and six were evaluated. Test results indicated student knowledge of science was low (Coble & Rice, 1980). Of the principals surveyed at that time, the following is the ranking of factors that handicapped the teaching of science are as follows: lack of supplies and materials, lack of facilities, lack of teacher knowledge, poor student interest, lack of curriculum, poor teacher interest, other needs, and lack of special assistance. The first two in the list were checked by 59% of the principals in the State Assessment (1976b).

Principals estimated that communities donated about

$1500 on average in materals and/or funds into the school programs. Also according to 57% of the principals reporting (State Assessment, 1976a), the school facilities were built before 1946. At the same time, teachers rated the principal high on the support factor. There were 55.7% of the teachers who strongly agreed the principal was cooperative. Another 35.6% of the teachers marked "agreed" (State Assessment, 1976a).

A statewide study of elementary school science was conducted by Coble and Rice (1980, 1982) which involved surveying teachers and principals and conducting an awareness conference. The teachers chosen for this study were selected by their principals as the most effective teacher of science in their schools. What Coble and Rice (1982) learned was that the most effective teachers taught 17 minutes of science per day and the lack of supplies and equipment and insufficent funds were most likely going to affect the teaching of science. The survey also reported that teachers used the lecture-discussion method most often as an instructional strategy. Very few manipulative materials were used. The conclusion in the Coble and Rice study was that science was not considered a basic subject at the elementary level school in North Carolina but if certain conditions could be met a turnaround could occur. Those conditions included:

(1) If more teachers and administrators could be enlightened to the needs and benefits of an activity-oriented science curriculum.

(2) If emphasis could be placed on a more appropriate science education for prospective elementary teachers in the institutions for higher education in North Carolina.

(3) If community and state officials could be helped to understand the urgent need to fund the purchase of science mateials and equipment for elementary schools.

(4) If persons professionally committed to science education in North Carolina...would re-commit themselves to achieving the first 3 "ifs" described above (Coble & Rice, 1982, p.155).

With the attention focused on "excellence" in education, North Carolina started into the Eighties to address the science needs with a number of initiatives. In 1980 Governor Hunt instructed the State Board of Education, the Board of Governors of the Consolidated University and the North Carolina General Assembly to make science and math a priority for the State of North Carolina (Coble, 1985). The NC General Assembly, first, established a math and science residential school for gifted junior and senior high school students (Coble, 1985; SCSC, 1982). The Science Curriculum Study Committee [SCSC] was appointed in 1980 by the State Superintendent of Public Instruction with the purpose

> to thoroughly review and study the status of the state science program and to develop recommendations which, upon implementation, would significantly improve the quality of the total science program in North Carolina, grades K-12 (SCSC, 1982, p. 15)

Three principals served on the 24 person committee but only one principal was from an elementary school. During the study, various problems were identified including those discussed in the 1974-75 State Assessment (6th grade) and the Coble and Rice study (1980). Several recommendations proposed by the Commission addressed elementary school science. First, Recommendation 1 stated "... that science be considered basic to the curriculum and receive the equivalent of a full year of instruction each year in each grade K-8..." (SCSC, 1982, p.3). The committee concluded that science should be taught as a basic in the curriculum because of "its multi-disciplinary nature, motivational potential, career importance, and emphasis on thinking skills" (p. 31). Key personnel for the implementation of this recommendation included principals as well as teachers and central office staff.

The 2nd recommendation stated was

> that The Principals Institute provide staff development activities which identify alternatives for organizing and scheduling a balanced program in which science is assured the time and attention it deserves as one of the basics (Coble, 1985; SCSC, 1982, p. 82).

The Study Committee also recommended the testing of science at grade levels for grades 3, 6, and 9 and that life science, earth science, and the physical sciences be taught in grades K-8. The course of study should include a number of concrete activites and be "transdisciplinary". (SCSC, 1982).

In the area of funding, the Committee asked that state funds be appropriated for the science materials needed adding that supplies for science are an expensive item for school systems. There was also a need for specifications to be written to provide guidelines in developing adequate facilities for all children to learn science.

The committee had also recommended increased inservice programs to improve K-12 science teacher competencies. The SCSC also recognized that administrators needed to be kept up to date on trends in science education especially as they have been often in control of funding allocations. Another area addressed was the preservice requirements in science and certification of teachers in grades 4-6.

Two additional recommendations affecting elementary school science concerned the science support personnel. The committee recommended that each local education agency employ a science specialist and that a science consultant be employed at each of the eight regional centers in the state. This report [SCSC] indicated that only seven Local Education Agencies have fulltime science supervisors and eight have supervisors that have more than one content area including science (SCSC, 1982). Coble and Rice (1982) reported only 20% of the 142 school systems in North Carolina had a science coordinator or supervisor.

Many of the recommendations of the Science Curriculum Study commission have been fully or at least partially met. There is now science testing at grades 3,6 and 8. (Coble, 1985). The 1983 General Assembly at its Extra Session, Summer, 1984 enacted an appropriation for science and math equipment, K-12, under House Bill 80, Chapter 1034, Section 15.

> Of the funds appropriated to the Department of Public Education ... the sum of ...($5,446,515) is allocated for science and math materials and equipment for kindergarten through grade 12. These funds shall be allocated on a an equitable basis per pupil in average daily membership to the extent funds are sufficient to do so, as follows: math and science in kindergarten through grade six, two dollars ($2.00)... (Session Laws, 1984, p.144).

The funding has continued each year since adoption.

A State Basic Curriculum was approved by the State Board of Education in September, 1984 (Coble, 1985). The Teacher Handbook with the statewide competencies, including those for science, K-12, were given to teachers at the beginning of the 1986-87 school year. The state's eight regional centers have science consultants. Also affecting the improvement of science in the schools has been the Quality Assurance Program (QAP) for entering teachers (Coble, 1985). The training needs of principals were also addressed through the Principals Executive Program, the North Carolina Assessment Center, and the Leadership Institute for Principals (Day & France, 1985).

North Carolina has been represented also in the NSTA's Search for Excellence in Science Education program. The first year for elementary science focused on 12 programs, one of which was in the Greenville City Schools. A full description of the program was published in the Focus on Excellence series, Elementary Science issue (Penick, 1983).

In summary, principals have become part of the second wave of science reform. The science education community has recognized along with other educators, the "key" educator for change is the school principal. For an effective science program at the elementary school level, strong instructional leadership is needed from this "key educator".

Although there has been little change in the way science has been taught in the elementary school and funding has decreased in the past years, it has been the responsibility of the principal to address those needs that affected the teaching of science in the elementary school classroom. There are still a number of barriers including the attention given to "basics" such as reading and math and expenditures for science materials which the school principal must solve.

The relationship between the principal and the teachers was a critical factor in developing science instruction. The use of staff development or inservice education including the involvement of the principal should open many doors towards sucess.

The state of North Carolina has taken several initiatives to assist principals in strenthening the local school science program. Now it is up to the LEA's to advance or accelerate the elementary school science program.

CHAPTER III

METHOD

This chapter describes the research methodology and procedures used in this study. Prior to the onset of the study, a review of the literature was made through the resources of Jackson Library at the University of North Carolina--Greensboro and the Z. Smith Reynolds Library at Wake Forest University. The Current Index to Journals in Education, Dissertation Abstracts International, Education Index, and the card catalogues were the major sources of information reviewed. An ERIC and Dissertations Abstracts International computerized search of the literature were also conducted.

Subjects

The population studied was the North Carolina public elementary school principals who administered schools containing any grades from kindergarten to sixth. There were no ungraded public schools or special state schools, such as the North Carolina School for the Deaf, included in the sample. The estimated population was considered to be 1500 principals. A representative sample (455) of the population was chosen by random selection.

The method of drawing the sample was a computerized random sampling from a list of K-6 principals employed for 1985-86 school year obtained through the Director of Management Information Systems of the North Carolina State Department of Public Instruction [SDPI]. (see Appendix B) Based upon a sampling formula which had an estimated incidence of p = .5, to assure no greater than a ± 5% error at the 95% confidence level with a population size of 1500 principals, the sample size would be 384. An additional 66 were added to the sample size, assuming 384 would represent an 85% return. The total number requested for the sample from SDPI was 450. The computerized printout contained 455 names and addresses when received from Management Information Systems. All 455 names were used.

Procedure

A questionnaire was used as the data collection instrument for a mail survey of the elementary school principals. The survey questions were developed to answer the research questions based in part upon the data derived from the Coble and Rice study (1980, 1982) of elementary school science in North Carolina and the checklist for principals, Handbook III, Part A from the NSTA series, "Project for Promoting Science Among Elementary School Principals" (Mechling & Oliver, 1983III).

The format of the questionnaire was designed to examine various facets of the role of an elementary school principal in the administration of the local school relating to the science program. The areas included a) school facilities and events for science, b) science inservice/staff development program, c) local school budget, d) teaching staff and the science curriculum, and e) the principal's professional experiences. Information about age and sex was included under professional background on the questionnaire. The final copy of the survey instrument contained eighty two questions.

The survey instrument was field tested by several North Carolina elementary school principals. The instrument was reviewed, revised and approved for use in collecting the data (see Appendix B).

The guideline utilized, in order to maximize the mail survey response, was Dillman's, Mail and Telephone Surveys: The Total Design Method. The surveys were numbered so that returns and repeat mailings could be made to non respondents. The same number served as an identifying code for entering data into the computer. The respondents were notified of this coding procedure.

The first mailing included a cover letter, copy of the questionnaire, and a self-addressed stamped envelope for return. One week following the first mailing, a postcard went to all principals sampled saying thank you as well as acting as a reminder to complete the survey. The third week, a letter, a second copy of the questionnaire, and another stamped self-addressed return envelope was sent to those who had not yet responded. (see Appendix B)

The Academic Computer Center at The University of North Carolina--Greensboro was used to compile and analyze all the collected data with the exception of the written comments or answers made by the respondents. Assistance was also provided by the University's Statistical Consulting Center. The Statistical Package for the Social Sciences, Version X, (SPSSX) was used in the analysis of the data which included preparing frequency distributions and percentages for each of the questions based on the information received. The data was also subjected to summary statistics of central tendency and variablity. The responses to two questions, the two visual clues, were tabulated by hand due to the qualitative nature of the questions.

The data were reviewed and crosstabulations were computed to determine relationships between pairs of selected variables. The Chi Square statistic was applied to determine the nature of the relationships. Responses to the questions are organized into figures and tables, analyized and summarized in the following chapters and appendices.

CHAPTER IV

RESULTS

Statistical Analysis

The purpose of this chapter is to present the analysis of the data and results obtained from the questionnaires mailed to 455 public school elementary principals in North Carolina. From this number, 379 questionnaires were returned, representing an 83.2% response of the total number sampled. Five of the responses were judged invalid and were not included for coding. Notes on several returns gave reasons such as the principal's demise, retirement, promotion to superintendent, or lack of time for not completing the questionnaire.

Three hundred and seventy-four questionnaires were recorded and analyzed for data supplied by the responding principals about their science program and themselves. The data was subjected to frequency distribution analysis and the application of the appropriate summary statistics for central tendency and variability. The information collected for "visual clues" was not analyzed in the above manner due to its subjective nature. Selected variables were cross-tabulated and the Chi square statistic applied to determine if a significant relationship existed. The relationship was considered significant if $p < .05$.

Results

Characterisitics of the North Carolina Elementary School Principals Sampled

Age and Sex

In this study, 23.5% of the principals were women and 75.9% of the principals were men who responded to the questionnaire. Only two respondents chose not to designate sex. Table 1 reports the distribution of the respondents by age. Both the mode and median age categories for men and women are the same, 40 to 49 years old. Of the 88 women principals, 51.1% are in the median age range as compared to 40.1% of the 284 men principals. More than a third of the sampled principals are over fifty years old. Men principals made up the majority of the sampled population and were older than the women principals.

Principalship Experience

Respondents with one to ten years experience as principals made up 53.8% of the sample. Table 2 illustrates the significant relationship between sex of the principal and experience as a elementary administrator. Among the women principals, 90.9% had 15 years or less experience as compared to 65.7% of men principals in this sample. Men respondents had more longevity as elementary school principals.

Table 1

Percent of Men and Women Elementary School Principals By Age

Age	Percent Women	Percent Men	Row Total
21 to 29 years	0	.5	.5
30 to 39 years	4.6	15.4	20.0
40 to 49 years	12.2	30.5	42.7
50 or more years	7.0	29.8	36.8
Column total	23.8	76.2	100.0

Note. Women: n = 88, Men: n = 282, No response = 4.

Table 2

Years of Experience as a K-6 Level Principal by Sex

Total Years	Women n	Men n	Total n	Valid Percent
Less than one	8	17	25	6.7
1 to 5 years	37	54	91	24.5
6 to 10 years[a]	25	59	84	22.6
11 to 15 years	10	56	66	17.8
16 to 20 years	3	46	49	13.2
21 to 25 years	5	26	31	8.4
26 or more years	0	25	25	6.7
Total by sex	88	283	371	100.0

Note. There were 3 missing observations.
a One respondent gave this experience level but not age.
b $\chi^2(6, N = 371) = 36.89951, p < .0001$

Principals' School by Grade Level

There were twenty-eight possible grade arrangements of the schools administered by the sampled principals. Grades K-6 were the major selection criteria. The grade level information was obtained from The Education Directory of North Carolina, 1985-86 based upon the name of the school of the principal. Twenty-six grade arrangements were represented by the respondents in this sample (see Appendix C-33). The only grade arrangements not received were a K-1 and K-9 school.

Seventy eight percent (78.3%) of the principals had kindergartens in their school. Sixth grades were in 62% of the schools. The two largest organizations of schools represented by the respondents were 30.5% for K-6 and 21.4% for K-5. Principals who administered schools with grades above the sixth made up 24.8% of the sample.

The middle school designation uses a variety of organizational models which may include some of the elementary grades, 4-6. In this sample, 18.1% of the schools had separate organizational arrangements beginning with the fourth and not exceeding ninth. Schools having the sixth grade or lower and housing high school grades comprised 2.6% of the sample. In the total sample, over half of the responding principals administered schools with grades K-5 or K-6. However, less than a third of the schools in the sample had the same organizational arrangement.

Science Qualifications of Elementary School Principals

The Academic and Classroom Teaching Experience in Science

The undergraduate majors of principals listed as physics, biology, earth science, and chemistry were coded "yes" for science. Forty seven principals (12.6%) had undergraduate majors in science. Majors such as health education and physical education were not considered science majors for this study. Nine principals (2.4% of the respondents) did not indicate an undergraduate major (see Appendix C-23).

There was a significant relationship between sex of the principal and the undergraduate major of the principal. Only three (3.4%) of the 88 women principals had an undergraduate degree major in science while 44 (15.9%) of the men principals had science degrees. The chi-square statistic is reported as $\chi^2(1, N = 364) = 8.03345$, $p < .0046$.

Classroom Teaching Experience and Science

There were 85.8% of all respondents who indicated they had been classroom teachers before becoming elementary school principals. Those principals with science certification made up 25.4% of the respondents. This identifies that classroom teaching experience without any type science certification or degree accounts for 62.8% of the elementary school principals in this sample. Only 11.8% of the principals lacked any classroom teaching experience.

Considering only the 47 principals with undergraduate majors in science, there were two respondents without classroom teaching experience of the remaining 45. Only two principals from the 45 reported classroom teaching experience without science certification. Thirty eight (80.9%) of the 47 principals were coded for teaching with science certificates in grades 7-12. More than half the respondents with classroom teaching experience and science certification did not have undergraduate majors in science.

Ninty five principals with classroom teaching experience were recorded as having held a certificate in a science area or a science concentration. The difference in numbers between science degree majors (47) and science certified teachers (95) is attributed to degree majors such as physical education and elementary education that allow for science certification within the undergraduate program. The following statements by respondents verify this difference: "P.E. and health with A cert. in science", "Intermediate Education with science, math...certification" and "Social Studies (certified in science)".

The sex of the principal was found to be a significant factor when related to classroom teaching experience. Table 3 and Figure 1 represent the information and relationship. When each of the five possible answers for classroom teaching experience (see Table 3) were crosstabulated with sex of the principal, the chi square was significant (χ^2 (4,

$\underline{N}$ = 364)= 26.19260, $\underline{p} < .0001$). More men had classroom teaching experience including those with science certification. When the relationship between those principals with no classroom teaching experience and those principals with classroom teaching experience was crosstabulated by sex there was another significant chi square reported, although lower (χ^2 (1, $\underline{N}$ = 364) = 9.77190, $\underline{p} < .0018$). The chi square statistic was also applied to the data of just those principals who reported classroom teaching experience. The crosstabulated relationship was between the principals having science concentrations or certifications and those without those endorsements compared by sex. A significant figure was reported (χ^2 (1, $\underline{N}$ = 320)= 4.60170, $\underline{p} < .0319$). In all of the three aspects of the relationship, sex was significant with the men dominating all relationships. Looking at both Table 3 and Figure 1, there is also another relationship to note. More women had no classroom experience than there were women with classroom teaching experience in science.

The majority of respondents had classroom teaching experience. Men predominated when science was factored with the classroom teaching experience. Of the women principals responding to this question, 22.4% had no classroom teaching experience, while only 9% of all the men principals who indicated no experience in the classroom.

Table 3

Levels of Classroom Teaching Experience of Principals by Sex

Type of Classroom Experience	Women n(%)	Men n(%)
Experience in grades:		
K-6 with science concentration	9 (2.5%)	16 (4.4%)
7-12 with science certification	2 (.5%)	50 (13.7%)
K-12 with science concentration	1 (.3%)	17 (4.7%)
K-12, no science concentration	54 (14.8%)	171 (47.0%)
No Classroom Experience	19 (5.2%)	25 (6.9%)
Totals	85 (23.4%)	279 (76.6%)

Note. Total n = 364, 10 missing cases.
'Certificate' can also be used here.

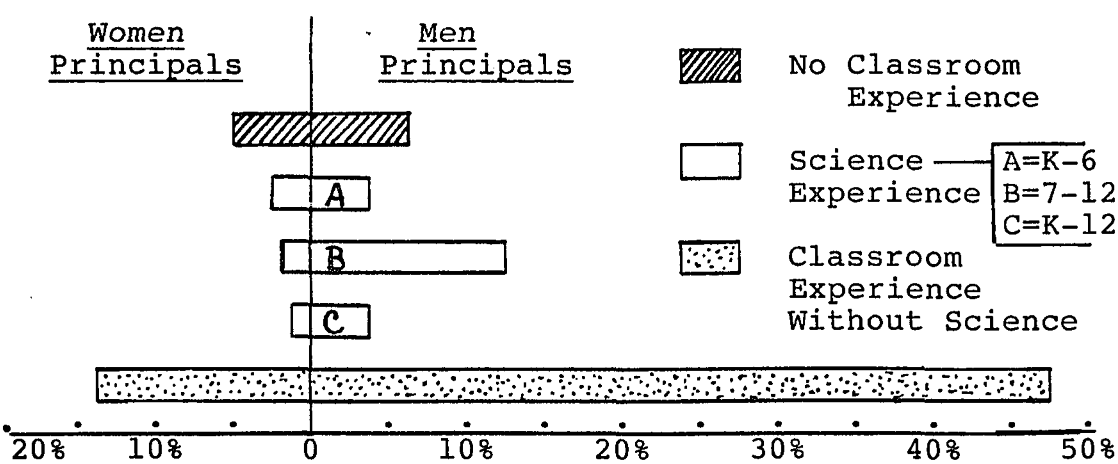


Figure 1. Levels of Classroom Teaching Experience of Principals Contrasted by Sex.

Professional Affliations and Activities in Science

Only 13 (3.5%) of the respondents were members of the National Science Teachers Association [NSTA]. Five of these principals have an undergraduate degree in a science field and four were members of the North Carolina Science Teachers Association [NCSTA]. Four additional principals, making a total of eight (2.1%), were members of the NCSTA. Five of the NCSTA principals held undergraduate degrees in science. No principal in this sample population was a member of the Council for Elementary Science International (CESI).

For the total sample only one principal (a non-member) reported attending the North Carolina Science Teachers Association annual meeting in November of 1985. Eight respondents did check "yes" for attendance at the 1984 NCSTA meeting and 47 principals (12.6%) reported attending NCSTA annual meetings previous to 1984.

One hundred and twenty-six principals (33.7%) are aware of the NSTA series for principals - "Project for Promoting Science Among Elementary School Principals". Three principals reported utilizing the "Project" checklist. The three respondents were principals of schools with 11-21 teachers in different LEA's and one respondent was an NSTA member.

Principals Attitudes Towards Science Teaching

Principals who felt "comfortable" or "very satisfied" about working with the science curriculum made up 74.7% of the sample. Figure 2 gives the frequencies for each rating. The percentage of principals with science majors and those without a science major indicated little differences in the moderately low and very low categories are 23.4% and 25.6%, respectively.

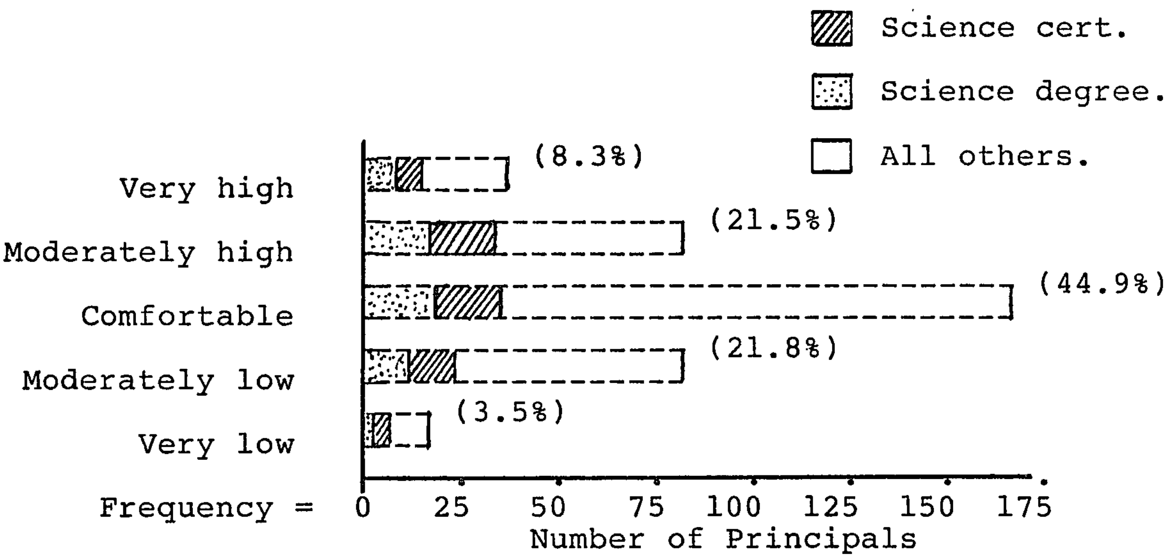


Figure 2. Principal's Satisfaction With Supervising the Science Curriculum Highlighting Principals With Degrees and Certification in Science.

Note. Valid % for 'satisfaction'used, n=372.
Valid % for 'satisfaction/degree',n=364.
Valid % for 'satisfaction/certification',n=364.

The relationship between the "satisfaction" of the respondents and the "providing of recent staff development" is significant.[χ^2 (4, N = 372) = 26.61721, $p < .0001$] (see Figure 3.) A similar relationship was found to exist between satisfaction and attendance at principal institutes having science inservice for administrators. The reported chi-square statistic was χ^2 (4, N = 369) = 10.18180, $p < .0375$. In addition there was a significant relationship between satisfaction and the principal's attendance at inservice programs with teachers. [χ^2 (4, N = 370) = 27.59962, $p < .0001$] Over 74% of the principals who rated themselves very highly satisfied attended inservice with their teachers as compared to none of the principals who felt very low satisfaction with the handling of the science curriculum.

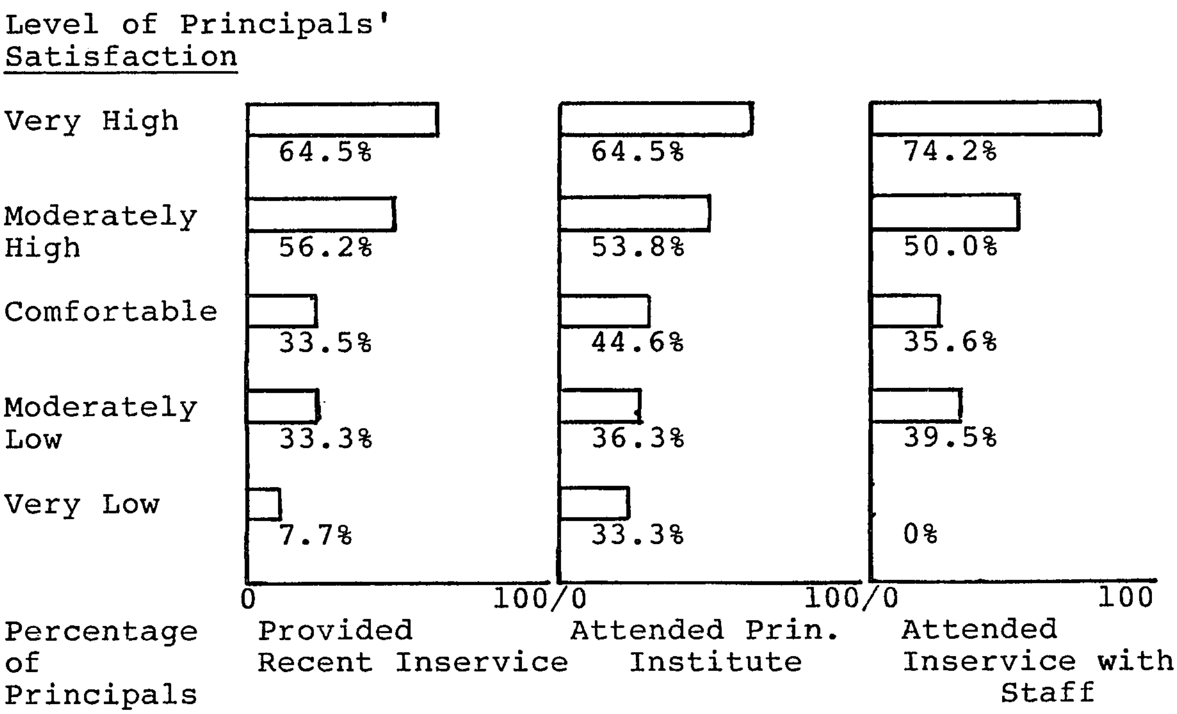


Figure 3. Relationship of Principals' Satisfaction for Handling the Science Curriculum and Inservice/Staff Development Participation.

Fifty four percent (54.8%) of those principals rating themselves with very high satisfaction indicated that an elementary science supervisor was available to assist them. [χ^2 (4, N = 371) = 36.63172, $p < .0001$]

Priority of Science in the Elementary School Curriculum

Reading/language arts and math were ranked number one and two respectively by the respondents. As principals, they also perceived that their teachers would rank the subjects in the same manner. (see Table 4) Three principals (.8%) gave science a one ranking in the curriculum while 64.2% ranked science third.

Table 4

Mean Rank Priority of Elementary School Subjects Given by Principals for Themselves and For their Teachers

Subject	Ranking by Principals for Principal[a]		Teacher[b]	
	M	SD	M	SD
Reading/Language Arts	1.047	.270	1.034	.222
Math	2.030	.325	2.003	.231
Science	3.223	.583	3.356	.580
Social Studies	3.981	.627	3.773	.610
Physical Education	4.719	.602	4.835	.484

Note: Subjects ranked 1 to 5; 1 is highest priority.
aValid cases = 350.
bValid cases = 357.

Principal as Initiator of Science Facilities

There were 29.9% (112) of the principals who reported the initiation of a science facility, such as a nature trail, in the past two years. Two years as a time frame was chosen because the state funding for science began two years ago during the 1984-85 school year. Four principals identified themselves as first year principals or newly assigned to their particular school. A third (33%) of the principals who initiated facilities were administrators of K-5 schools. Over half of the initiators were principals with one to ten years experience (58.1%) and 52.7% had 11-21 classroom teachers on their staff.

A significant relationship was found to exist between those principals who initiated facilities and their self satisfaction with handling the science curriculum. There were 41.4% of the initiators who perceived themselves as being very highly or moderately highly satisfied as compared to the 25.4% of those principals with the same satisfaction that did not initiate any facilities. The chi-square is reported as $\chi^2 (4, \underline{N} = 368) = 17.32806, \underline{p} < .0017$.

Two other variables, use of "hands-on" instructional strategy and the "percentage of staff observed during teaching of science classes" were significant when crosstabulated with "initiating facilities". The chi-square statistic for the principals' observation of the frequency of teachers using the "hands-on" instruction strategy was $\chi^2 (6, \underline{N} = 333) = 18.99642, \underline{p} < .0042$. Initiators reported more frequent use of "hands on" strategy than non-initiators. The chi-square statistic was $\chi^2 (4, \underline{N} = 364) = 13.11333$, $\underline{p} < .0001$. The relationship for respondents who as initiators reported observing more staff members teaching a science class than non initiators.

How Principals Perceived Their Administrative Roles Relative to the Science Program in Their School

Principal and the Local School Budget for Science

The principals were asked to identify the local school funds they had available for specific areas of the science program during 1985-86 school year. (see Table 5) More than half of the sample had some local money for the science program.

Table 5

Percentage of Principals With Local School Monies For Elementary School Science

Budget Area	n	Percent
Field trips	261	69.8
InSchool programs[a]	218	58.3
Release time NCSTA meeting	232	62.0
Science inservice	246	65.8
Science supplies (consumables)	344	92.0

Note. Percentage is for total sample.
a Inschool programs include Snakes Alive, Science Shows,

One principal reported "We can charge children & go." The P.T.A. was identified as a source of funds for field trips at one school. One principal checked "yes" for release time, inservice and supply money but specified that the funding source was "county money". Money was available for supplies if there were "extreme need" according to another respondent.

Principals also identified the P.T.A. or P.T O. as a source of local funds especially for science equipment, as illustrated by the following statements by respondents:

> In addition to State and Local money, our PTA gave $1200 toward science equipment.
>
> Our PTO has assisted with hundreds of dollars in materials/equipment in recent years.
>
> The PTO at my request has provided more than $4000 during the last three years to purchase SCIIS Kits for first and second grades.
>
> The PTA and a grant received by one of the teachers also provided money that went exclusively for science materials.

The only significant relationship found was between the amount of the release time monies for attending the North Carolina Science Teachers Annual Meeting and the grades in the school. [χ^2 (2, N = 373) = 6.00769, $p < .0496$] Over fifty percent (52.4%) of schools with grades three or less had release time funds while 60.1% of the schools sixth grade or less (excluding previous group) had this money. Seventy two (72.0%) of the schools with sixth grade or higher had more money for release time. The higher the grade level, the more funds for release time was reported available.

North Carolina Funding for Science Equipment

It has been two years since principals have had two dollars per child to allocatė for science and math equipment from the North Carolina legislature. Figure 4 compares the percentage of the money spent for science materials in each year as reported by the respondents.

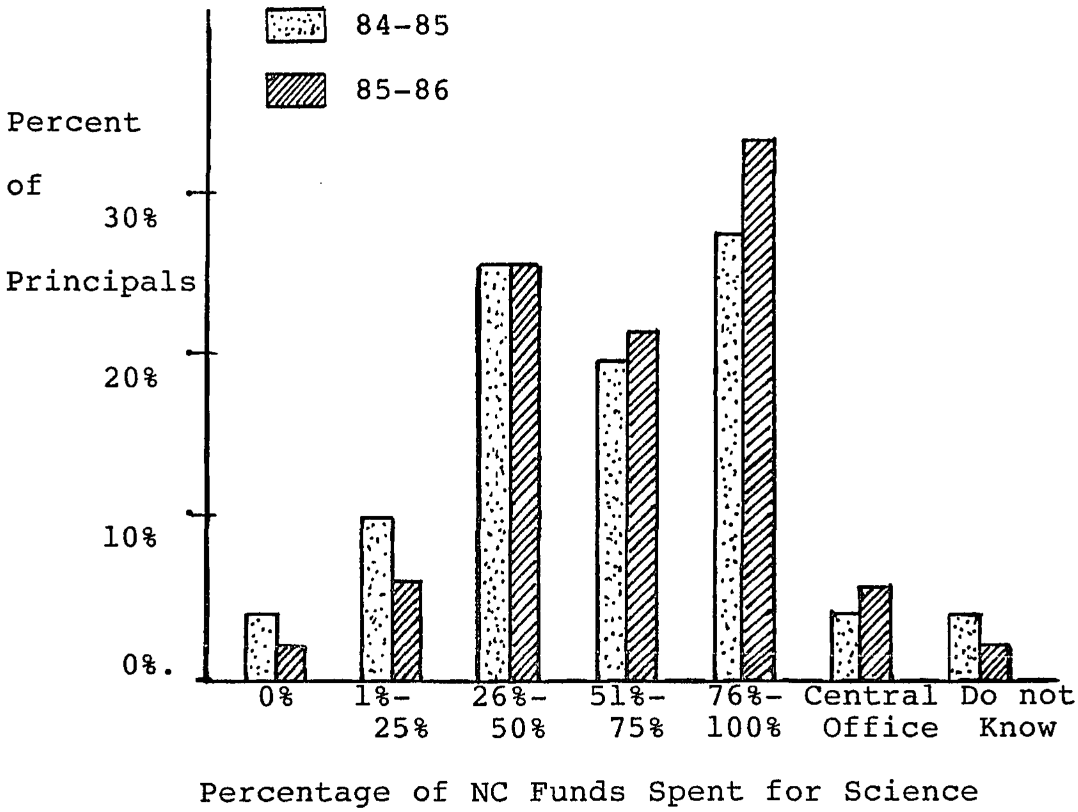


Figure 4. Percentage of North Carolina Science/Math Funds Spent for Science Purchases in 1984-85a and 1985-86b.
a
Note. Valid cases = 371, 10 (2.7%) not a K-6 principal
bValid cases = 370.

Notations by the respondents identified that in addition to the 5.3% of the principals marking "central office decision", an additional nine principals reported that the known percent spent on science was also a "central office decision". This is a total of 7.7% of the funds being decided by central office staff for 1984-85 year. For the 1985-86 year, eight principals made the same notation bringing the total to 8.1% for decisions by the central office staff.

Science materials were purchased with the state funds. Table 6 shows that over half of the responding principals involved teachers in the purchasing decisions for science supplies and equipment. In the "other" category, the central office staff were identified by nine principals as the decision-makers.

Table 6

Percentage of Staff Members Involved in Planning Purchases of Science Equipment with State Monies.

Staff Member(s)	n	Percent
The principal	218	58.3
Teachers with special requests	237	63.4
Media center specialists	181	48.4
Committee of teachers and principal	224	59.9
Other	42	11.2

Note. Respondents could check more than one answer.

Other respondents identified the following personnel: "all teachers", "science teachers", "department heads", "lead teacher in science", "principal", "assistant principal", "regional consultant", "administrative committee", "teacher aides", "parents", and "agriculture teacher". Also reported were "SDPI recommendations" and "teacher selection with principal approval".

The Principal and Local Inservice/Staff Development Program for Science

Less than half of the respondents (40.1%) indicated that they had provided a science staff development program in their school this year (1985-86). In addition, two respondents reported that they had provided staff development in science last year. One principal reported that inservice was "planned at the system level". For those responding "yes", (see Table 7) the school system staff and regional consultants more often provided the leadership for the most recent science inservice/staff development program.

In response to "other" in Table 7, five respondents stated "principal, ...me, principal from another school". Also listed were, central office staff, Department of Forestry, N.C. Wildlife Resource Commission, Carolina Biological, C P & L, API, local resource people and consultants from the State Department of Public of Instruction such as Dr. Bill Spooner.

Science or general supervisors along with principals and central office staff are identified as personnel who are involved in the planning of inservice/staff development programs (see Table 8). The same respondents who checked "yes" for having provided science inservice for this year were the only principals asked about planning.

Table 7

Type of Leadership for Most Recent Science Inservice Programs Principals Provided for Teachers

Leadership Personnel	n	Percent	Valid Percent[a]
University/College Consultant	22	5.9	14.7
Regional Science Consultant	64	17.1	42.7
Textbook Consultant	19	5.1	12.7
School System Staff	72	19.3	48.0
Teachers	53	14.2	35.3
Other:	26	7.0	17.3

Note. More than one response could be made.

[a] Represents the proportion of principals of the 40.1% who responded "yes" to inservice (Q.7).

In the past two years, 41.2% of all the responding principals have been in attendence at science inservice with their teachers. One principal reported, "been on my own-provided for teachers to attend."

A slightly higher percentage of all responding principals (45.7%) were identified as having attended a program for principals during the past two years which included a session for understanding the elementary school science curriculum. Only one principal clarified the response with "PEP, Institute of Government, Chapel Hill".

Table 8

Personnel Who Planned the Most Recent Inservice Program for Science

Personnel	n	Percent	Valid Percent[a]
The principal	32	8.6	21.6
The teachers	5	1.3	3.4
Science/supervisory staff	37	9.9	25.0
Committee of teachers and principal	33	8.8	22.3
State/regional staff	5	1.3	3.4
Principal and Central Office staff	30	8.0	20.3
Other combinations	6	1.6	4.2

Note. Only one answer could be checked.

[a] Represents the percentage of the 40.1% of the respondents who marked "yes" for inservice this year.

For the variable, "providing staff development this year" there were significant relationships identified with local school money for inservice, attendence of principals with teachers at science inservice programs, and attendance of respondents at principal institutes on science. For local inservice funding, $\chi^2(1, N = 372) = 7.99013$, $p < .0047$ is reported. Seventy five percent of the respondents who conducted staff development and 60.3% of those who didn't had funds for science inservice education.

The chi-square statistic for providing inservice in science and attending inservice with the teachers is χ^2(1, N= 372) = 67.91142, $p < .0001$. There were 67.3% of those providing staff development this year who also attended science inservice with the staff. Of all those who responded "yes" to attending inservice with teachers, 65.6% had provided staff development.

The significance was less when attendance at principal institutes was considered. The chi-square reported is χ^2(1, N = 371) = 8.04247, $p < .0046$. The crosstabulation shows that 55.3% of those providing staff development also attended a principal's institute on the science curriculum.

Principals who provided inservice/staff development for teachers would most likely have local funds for inservice programs in science and would have attended the inservice program with their teachers and one for principals on science. These principals would also most likely have a very high or moderately high satisfaction in dealing with the science curriculum as previously noted (see Figure 3).

The Principal and the Instructional Program in Science Teachers.

Over half of the respondents were administrators of schools with less than 22 classroom teachers (see Table 9). The categories were based upon the range used for the salary schedule for administrators of schools in North Carolina.

Table 9

Number of Classroom Teachers in Principal's School

Number of Classroom Teachers	n	Percent	Cumulative Percent
1 to 10 Teachers	46	12.3	12.3
11 to 21 Teachers	178	47.6	59.9
22 to 32 Teachers	99	26.5	86.4
33 to 43 Teachers	37	9.9	96.3
44 or More Teachers	13	3.5	99.8
No response	1	.2	100.0
	374	100.0	

The number of classroom teachers was reported significant when crosstabulated with teacher attendance at the NC Science Teachers Annual Meeting. Schools with 1 to 10 classroom teachers only had 6.5% to attend. The other size schools had the following percentages: 11 - 21 (12.9%), 22 - 32 (21.4%), 33 - 43 (24.3%) and 44 or more classroom teachers (46.2%). The larger the school, the more likely a teacher attended the state meeting for science. [$\chi^2(16, N = 371) = 30.43184, p < .035$.]

Principals' Perception of Teachers' Attitude Toward Science

"Moderately comfortable" or "confident with science material" was the response of 81.7% of the sampled principals (see Table 10) of the attitude their teachers exhibited towards the teaching of science.

Table 10

Principals' Perception of Teachers' Attitude Towards Science Teaching

Principal's Opinion	n	Valid Percent	Cumulative Percent
Confident With Science Material	62	16.7	16.7
Moderately Comfortable With Science Material	242	65.1	81.7
Not Confident With Science Material	53	14.2	96.0
Not Sure How My Teachers Feel Towards Science	11	2.9	98.9
Other	4	1.1	100.0

Note.The valid percent = 372 cases,2 cases missing.

A large chi-square relationship was recorded for the principal's perception of the attitude teachers' exhibited towards the teaching of science and the principals' self satisfaction with the science curriculum. [χ^2 (8, N = 355) = 87.77395, $p < .0001$] Only the factors "confident", "moderately comfortable", and "not confident" were crosstabulated. The response, "not sure" was omitted from the tabulation. Those principals who rated themselves very high or moderately high on satisfaction with science, also perceived their teachers as confident or moderately confident with science material (see Figure 5.). Nine of the 12 principals who rated themselves with very low satisfaction with the science curriculum also rated their teachers not confident with science teaching.

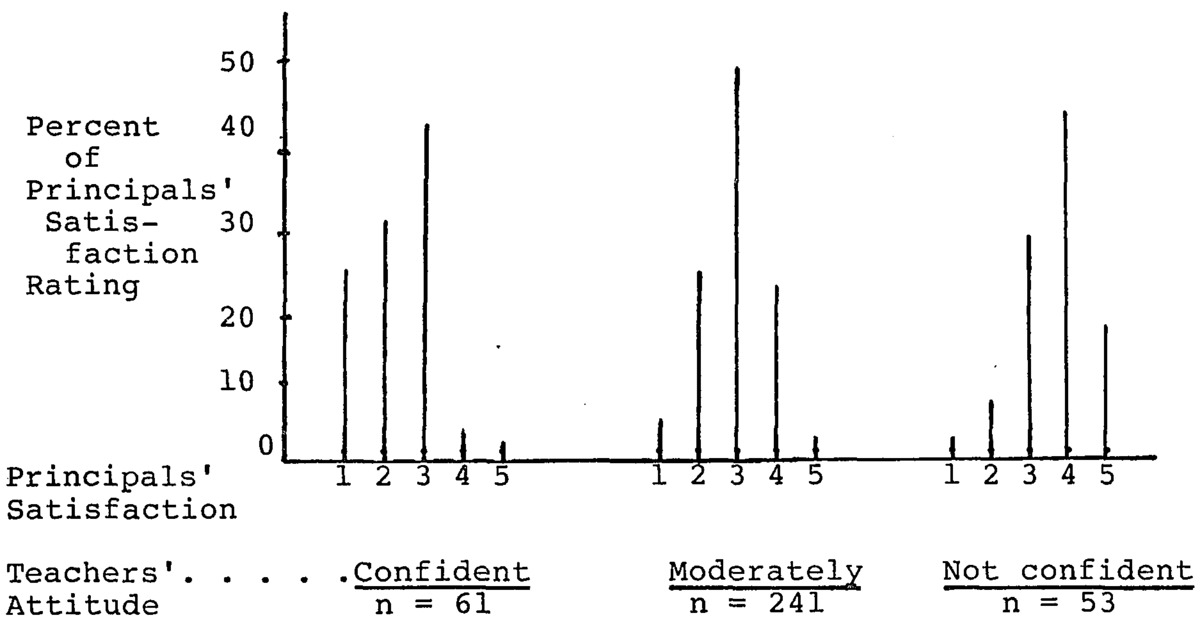


Figure 5. Relationship of Principals' Perception of Teachers' Science Attitude and Principals' Own Satisfaction With Science.

Note. Scale for Principal's satisfaction is 1 = very high, 2 = moderately high, 3 = comfortable, 4 = moderately low, and 5 = very low satisfaction. n = 355.

There was also a significant relationship between teacher attitude and two of the seven instructional strategies. For the frequency of use of "projects (making things)" the chi-square was reported as χ^2 (12, N = 323) = 21.96346, $p < .0379$. There was a greater degree of significance when teacher attitude was crosstabulated with "hands on" student investigations as a teaching strategy.

The statistic was reported as $\chi^2(12, N = 323) = 41.18544$, $p < .0001$. Those principals who perceived their teachers as not confident ranked "hands on" student experiences as a less frequently used instructional strategy observed in teaching science.

Factors Affecting Science Teaching.

Principals were asked to rank order nine factors that have been identified as reasons for teachers not teaching science (Coble and Rice, 1982). Table 11 gives the median, mean, and standard deviation for the average ranking all principals gave to these factors. Bargraphs of the nine categories present a visual illustration of the rankings given by all respondents for each factor (see Appendix A-1 to 9). Seventy three principals (19.5%) did not chose to rank the items or ranked in a manner different from requested. The size of the missing cases does suggest a portion of the sampling population may not be represented in the outcome. There was no trend noted. The question could have been too long or the school might have had a content area teacher.

The emphasis on reading and math ranked number one as a factor which interfered with the teaching of science. The following statements further illustrated the attention to reading and math:

> Science will not be given more consideration by teacher until it is listed like Reading & Math.

In the primary grades we are required to give 50% of instructional time to the language arts vs. 30% to art, music, social studies, and science.

...time mandated by our school board of education. For some years we have had a period of time mandated for language arts/reading and math. Only in the last 2-3 years has more emphasis been put on science/social studies but no time mandate for teaching each day.

Table 11

Mean Ranks of Factors Affecting Science Teaching As Perceived by Elementary School Principals

	Factor	*Md*	*M*	*SD*
Rank 1 - Most likely to prevent science from being taught.				
1	Emphasis on Reading and Math	2.000	2.834	2.474
2	Lack of Understanding of Methods of Teaching Science	4.000	4.508	2.488
3	Insufficient Understanding of Science Concepts	4.000	4.648	2.577
4	Insufficient Time to Teach Science	4.000	4.654	2.536
5	Inability to Improvise Materials & Equipment	5.000	4.681	1.836
6	Inadequate Room Facilities	5.000	4.947	2.304
7	Lack of Supplies and Equipment	6.000	5.452	2.432
8	Insufficient Funds	7.000	6.472	2.314
9	Inappropriate Textbook	7.000	6.814	1.973
Rank 9 - Least likely to prevent science from being taught.				

Note. n = 301, 73 cases not included.

The "hands on" student investigations was the only strategy to relate significantly to other factors as coded. As previously reported in the section about teacher attitudes towards science teaching, the "hands on" strategy was observed more frequently by those teachers who were preceived as confident by the principal. The strategy was also reported to have a significant chi-square statistic when related to principals who had initiated science facilities in the past two years. A higher percentage of those principals labeled "initiators" saw more frequent use of the "hands on" student experiments in the classroom. [χ^2 (6, N = 333) = 18.99642, $p < .0042$]

The Effective Teacher and Science.

The "most effective" teacher of science as chosen by 59.1% of the responding principals would teach science everyday every day. Another 36.6% perceived their teachers teaching science every other day. Only 4.3% of the respondents reported the "most effective teacher" taught science once a week, or only science, all day. The length of a science lesson taught by the "effective teacher" was reported as 30 to 40 minutes by 50.3% of the principals. Forty minutes or more was chosen by 25.1% of the respondents, while 21.9% checked 20 to 30 minutes per day.

Only 10.2% of the respondents reported having teachers who taught science as the only subject at the K-6 level.

Half of those principals were administrators of schools having grades above the sixth. No school with third grade or less had any teachers for science teaching only. Two respondents checked "no" but reported teachers on the staff who taught science with another subject such as math or health.

Professional Meetings for Teachers

For the 1985 North Carolina Science Teachers Annual meeting, 82.6% of the respondents reported they did not have any teachers to attend. Table 12 illustrates the distribution of payment for release time for those who had one or more teachers attending. Respondents were asked specifically if they had local school funds for release time for teachers to attend the state science meeting. Sixty two percent replied "yes". While 16.8% of the principals responded that they had teachers to attend the most recent meeting in 1985, only 4.8 to 5.3% actually indicated payment for teachers release time through local school funds.

Elementary School Science Curricula.

In the late sixties and seventies a number of federally funded elementary curricula for "hands-on" science were developed. Are they being used in the North Carolina elementary schools now? Of the three most commonly recognized programs, SCIS (Science Curriculum Improvement Study) was checked more often by the respondents. SCIIS is currently identified in 26.7% of the schools administered by the principals in this sample. Only 7.2% checked "yes" for ESS (Elementary School Science), while 1.1% of the respondents checked "yes" for S-APA (Science- A Process Approach). Other programs recorded from the questionnaire were "Conservation for Children", "SRA", "Learning to Read Through the Arts - adapted for and integrating science into the program", and "Project Seed".

Table 12

Method of Release Time Payment for Teachers' Attendence At NC Science Teachers Association Annual Meeting

Method of Payment	n[a]	Percent[b]
Release time paid by teacher	1	.3
Release time paid from my local school budget	18	4.8
Release time paid from school system funds	42	11.2
Release time paid partially local and system funds	2	.5
Totals	63	16.8

Note.a Total cases = 374, No = 309, 2 = msg. cases
b82.6% = No, .5% = missing cases.

Science Teaching Strategies

Principals were asked to rank order how often they felt a particular instructional strategy was used in teaching science in their school. Table 13 gives the mean and standard deviation of the average ranking for each strategy.

Bargraphs giving the range and mode for each strategy are found in Appendix A (see Figures A-10 to 16).

Respondents choosing not to answer or not ranking in the manner desired comprised 9.9% of the sample population. Two strategies, "projects" and "hands on" student investigations were found to have a significant relationship with the principals' satisfaction with science and the principals' perception of teachers' attitude.

Table 13

Mean Ranking of Teaching Strategies Used in Science Classes

	Strategy Used	M	SD
Rank 1 - Most frequently used instructional strategy.			
1	Lecture/Discussion	2.169	1.970
2	Demonstration	3.760	1.690
3	Film/Videotape	4.246	1.842
4	"Hands on" Student Investigations	4.294	1.910
5	Projects (Making things)	4.371	1.624
6	Small Group Learning	4.436	1.779
7	Learning Centers	4.724	2.02
Rank 7 - Least frequently used instructional strategy.			

Note. Valid Cases = 337 = Valid Percentage.

School System Support Staff for Science

Principals were asked if their school system had any staff members available to assist them with the science curriculum. The four categories chosen were science supervisor, elementary; science supervisor, K-12; science demonstration teacher; and science consultant. Table 14 shows the number of respondents who had science support outside the school. Thirty seven of the principals checked more than one answer. In this study the data was not coded by the local system number although it is acknowledged that the sample included schools from the same system. The high percentage does not indicate that over half the systems have science supervisors. What can be reported is that 53.2% (199) respondents checked at least one of the staff members listed as available for assistance with the science curriculum.

Table 14

Science Support Staff Available To Principals

Staff Member	n	Percent
Science Supervisor,Elementary	67	17.9
Science Supervisor, K - 12	116	31.0
Science Demonstration Teacher	19	5.1
Science Consultant	46	12.3

Note. Respondents could check more than one answer.

Teacher Observations by Principals

Principals have had the responsibility for evaluating teachers in all instructional areas. Table 15 represents the the percentage of the staff the principal has observed teaching a science lesson during the 1985-86 school year. There were 89.9% of the respondents who observed at least 25% of their staff teaching science this past year.

The relationship between principals initiating facilities and principals' observations of staff members teaching science was significant as reported earlier. For example, 14.6% who initiated facilities observed 51 to 100% of their staff teaching science while only 7.4% of the non-initiators observed over half of their staff.

Table 15

Percentage of Teachers Observed During a Science Lesson By Principals

Portion of Staff Observed	Valid Percent	Cumulative Percent
1 to 25%	66.0	66.0
26 to 50%	14.4	80.4
51 to 75%	3.8	84.2
76 to 100%	5.7	89.9
None	10.1	100.0
Total	100.0	

Note. Valid Percentage = 368 cases, 6 missing cases.

<u>Principal's Perception of Visual Clues to Science In the Classroom</u>

Principals were asked to identify two visual clues found in the classroom that would indicate to them the presence of science as an active part of that teacher's curriculum. As this was a qualitative response, statistical analysis was not applied. A large number of respondents gave more than two visual clues.

The first step was to analyze the first response given in each blank. There were 353 (94%) principals who answered clue one and 347 (93% who responded for clue two. Student projects and centers ranked one and two for the first answer given for clue 1 while student projects and bulletin boards were listed one and two for the second clue.

The second step was to list all responses given by the principals. Key words were identified for counting purposes. A complete listing is found in Table C-22. Table 16 illustrates the grouping of responses and several examples of each. Responses were divided into groups by the following key words: "centers", "bulletin boards", "equipment", "living things", "projects", and "displays". Other categories included lesson schedule, audio visual materials, books and demonstrations which were labeled for "other".

Table 16

Visual Clues Used by Principals to Identify the Presence of Science in the Classroom Teachers' Curriculum

Key Word(s)	Number	Description
"Center"	137	"learning centers" "science center in every room" "science equipment in centers for student use" "'garden centers' on window ledges"
"Equipment" (Include non-living, items,models, charts)	162	"collections (rock, shells) "SCIIS kit" "portable science lab" "plastic models" "presence of a microscope, slides & pondwater."
"Project"	140	"projects" "display of science projects in classroom" "projects done by children" "small project materials such as wire, rocks, etc."
"Bulletin board"	115	"bulletin board" "science bulletin board" "weather bulletin boards" "bulletin board of childrens work"
"Living things"	80	"a terrarium and aquarium in every room" "live animals/plants" "halved-milk cartons with lettuce seeds strewn on top" "live frogs, crickets, and lizards"
"Display"	43	"display of on going experiments" "displays of student work"
Other clues	99	"demonstrations" "science experiments" "following daily schedule"

School Facilities and Special Events for Science

Principals were asked if their schools had the following facilities: a nature trail, science/resource lab, a greenhouse and/or school garden. Table 17 shows that no one facility was recorded in more than 25% of the schools. By the coded returns it was possible to assay that 177 respondents had checked at least one facility. This represents 47.2% of all respondents' schools described. Fifty four (54) respondents checked more than one facility. Of these 54, two respondents checked all four facilities, eight checked three facilities, and 44 checked two facilities.

Table 17

Percentage of Schools with Special Science Facilities

Facility	n[a]	Percentage[b]
Nature trail	88	23.5
Science lab	85	22.7
Greenhouse	19	5.1
School garden	51	13.6

Note. Total cases = 374.
aNumbers of respondents indicated yes.
bPercentage of total cases including non respondents.

In addition, Table 18 shows the facilities arranged by the size of the school according to the number of classroom teachers reported by the principal. There were significant relationships found between the size of the school and two of the facilities, the science lab or resource room and the greenhouse.

Table 18

Percentage of Schools with Facilities by Number of Classroom Teachers

Number of Teachers	Nature Trail	Science Lab	Greenhouse	School Garden	
	n	n	n	n	Total
1 to 10	9	8	0	5	22
11 to 21	42	39	7	27	115
22 to 32	26	22	3	13	64
33 to 43	9	8	2	3	22
44 or more	2	8	7	3	20
Total	88	85	19	51	243
Percentage of Total Sample	23.5	22.7	5.1	13.6	

Note. Total cases = 374.

Size of the schools having a science lab or resource room were found to have a chi-square statistic of $\chi^2(4, N = 367) = 11.62324$, $p < .0204$. The percentages by size for having a lab or a science resource room are as follows: 1-10 teachers, 17.8%; 11-21 teachers, 22.4%; 22-32 teachers, 22.5%; 33-43 teachers, 21.6%; and 44 or more teachers, 61.5%. The largest schools are more likely to have resource or science labs than smaller schools.

The reported chi-square statistic for the greenhouse is $\chi^2(4, N = 366) = 66.35981$, $p < .0001$. The percentages ranged from 0% to 5.4% in schools with one to 43 classroom teachers. The jump to 53.8% for schools with 44 or more classroom teachers demonstrates the chi-square relationship. Seventy three percent of the schools with greenhouses contained the sixth grade and above. The five schools not in this category were one 4-6,two K-8,one K-6, and one K-5.

Table 19

Percentage[a] of Schools by Grade Groupings With Science Facilities

Grade Group	Nature Trail	Science Lab	Greenhouse	School Garden
Grades 3 or Less	31.7	19.5	00.0	20.0
Grades 6 or Less	24.7	16.9	2.1	12.8
Grades and Above	18.7	40.7	15.4	14.1

Note. Percentage of valid cases, excluding missing cases.

Analysis of the data by grouping the schools into grade categories of "only third grade or less", "sixth grade or less" (excluding previous group), and "sixth grade and above" identified the grade levels these facilities were more likely to be found (see Table 19). Although the relationships were not significant, the nature trail and school garden are recorded more often in the primary grade schools.

Science Fairs

Science fairs have been a special event for the science program. There were 61.8% of the respondents who reported a science fair at their school in the past two years. Table 20 shows the relationship between science fairs and the grade level of the school. The higher the grade level in the school, the more likely a science fair will occur.

Table 20

Percentage of Schools by Grade Level Holding Science Fairs In the Past Two Years

Grade Level of School	n	Percent of Grade Group
Third or less only	12	28.6
Sixth or less[a]	144	60.3
Sixth or above only	75	80.6

Note. $\chi^2(2, N = 374) = 33.86478, p < .0001$.

[a] Does not include cases found in "third or less" category.

Summary of the Results

From the results of this study, the average North Carolina elementary public school principal during 1985-86 school term would have been a man in his forties who had been a principal for at least ten years as well as having been a classroom teacher. The school would have been a K-6 or K-5 with 11 to 21 classroom teachers.

One fourth of the respondents reported having had classroom teaching experience with some level of science certification. There were 12.6% of the principals who indicated an undergraduate major in science. Membership in a science education organization was less than 4% of the sample. One third of the respondents are aware of the "Project for Promoting Science Among Elementary School Principals". The majority of principals had "comfortable" to "very high satisfaction" with their handling of the science material.

In the area of the administrative responsibilities, over 50% of the respondents had local monies available for inschool science programs, field trips, science inservice workshops, science supplies, and release time money for teachers to attend the NCSTA annual meeting. Forty eight percent of the respondents allocated $1.00 or more of the $2.00/child state science and math money to science in 1984-85 which increased to 55% in 1985-86.

In the area of inservice education, 40% of the respondents held workshops during 1985-86 with principals responsible for planning and school system staff providing the leadership for the program. Teachers had the least impact on the planning and leadership for inservice programs. The same respondents who provided inservice programs were also most likely to have attended the workshop with their teachers and have attended a principals' institute on science curriculum. Less than 50% of the total sample population participated in any science inservice programs recently.

Principals with high to very high satisfaction in handling the science curriculum also perceived their teaching staff's attitude in the same way. The most effective teacher of science on the respondents' staff is viewed as teaching science every day for 30-40 minutes per day. Ten percent of the respondents had teachers who taught only the subject science. Only 16.8% of the respondents had teachers to attend the 1985 North Carolina Science Teachers Association annual meeting, although 62% of the principals had money for teachers to attend.

Principals rated science third as a subject priority in the elementary school curriculum. They also perceived teachers rating it third as well. Reading and math were rated one and two, respectively. At the same time the emphasis on reading and math are the most likley factor to prevent science teaching from taking place.

Lecture/discussion is the most common form of delivery of science to the children in the classroom.

The majority of the respondents indicated some form of supervisory help was available to them. Most of the respondents observed at least 25% of the staff teaching a science lesson when an evaluation was made. Less than 30% of the respondents had any of the NSF developed curricula in the school science program. Thirty percent of respondents had initiated a science facility in the past two years while 47% of all respondents had at least one of the following facilities for science at their school: nature trail, science room or resource lab, greenhouse, and school garden.

The overwhelming majority of principals answered the question about the visual clues to detect an ongoing science program in a classroom with phrases and lists including in general terms, bulletin boards, students projects and learning centers. Live plants and animals and science equipment were next. Answers written with "activity" or active verbs were expressed by a small minority of respondents.

CHAPTER V

DISCUSSION

Introduction

This study was undertaken to determine how elementary public school principals in North Carolina perceived the science program at their schools and their involvement within the program. The usable return rate of 82% of the principals was the first indication of the interest and attention of these administrators to science as part of the elementary school curriculum.

The study has revealed that approximately 25% of the North Carolina elementary school principal population would be expected to have had classroom teaching experience with science certification. This attribute however didn't appear to have any significant relationship with the principals' involvement in the elementary school science program. At least 30% to 40% of the elementary school principals in North Carolina are directly involved in activities to improve the science program in the school and even more are satisfied with how they as principals supervised the science curriculum.

The principals in this study can be viewed as having characteristics similar to their counterparts in previous studies which included elementary school principals. There appears to have been little change in the principals' role in science over the past 10 to 15 years. The differences that have been detected may be due in part to the North Carolina legislature's initiatives directed towards improving science and math statewide. Two factors seem to be making the greatest impact on elementary school science and the principal, the legislation of funds into the science programs for equipment and supplies and the annual program for testing science in the third, sixth and 8th grades. The discussion of these findings follows the outline of the research questions.

Personal and Professional Profile of North Carolina Elementary School Principals

General Characteristics of the Principals

The principals responding to this questionnaire appeared typical of elementary school principals from across the nation. Table 21 compares the basic demographic data available from studies by Horine (1984) of women elementary school principals in North Carolina, the National Association of Elementary School Principals' national survey for 1978 (Pharis & Zakariya, 1979), Stake and Easley's (1978) *Cases Studies in Science Education*, Audeh's (1982) ten state study of principals' beliefs on science implementation, and Whitla and Pinck's (1973) statewide study of Massachusetts elementary school science programs. The North Carolina elementary public school principals exhibited similar traits that principals have over the last fifteen years. The median age, administrative experience, and classroom teaching experience was consistent throughout the studies.

Table 21

Comparison of Demographic Data on NC Elementary School Principals to Elementary School Principals of Selected Studies from the Past Fifteen Years.

Variable	NC Elem. Prin.	Horine 1982	NAESP 1979	S&E 1978	Audeh 1982	Whitla 1973
Sex (%):						
Women	23.7%	19%	18%			
Men	76.3%	---	82.0%			
Age Median:	40-49yrs	45yrs	46yrs			
Principal Experience:a	6-10yrs	6.6yrs	10 yrs	6-9yrs	* 1-5yrs	** 8-16yrs
No. of Classroom Teachers:	11-21	----	18	----	----	17
School Grades:b	K-6	K-6	K-6	----	K-6	K-6
Classroom Teaching Experience:c	*** yes	10yrs	7yrs	10.9yrs	----	----

Note. Horine's study was of women NC principals only.

[a] * = yrs in post, ** = yrs. in post and yrs. in system.

[b] The school organization most common in the study.

[c] *** = No. of yrs. not given but 85% had been teachers.

Principals' Qualifications, Experiences, and Attitudes in Science

Qualifications:

Undergraduate Degree and Certification in Science

A major question for this study was to identify the science related attributes of NC elementary school principals. One fourth (25.4%) of the North Carolina elementary principals sampled had classroom teaching experience with a science concentration or a science certificate. Of these former science teachers, less than half reported an undergraduate major in a pure science such as biology. The reported findings in the literature for the science background of principals was decidedly limited. However, Whitla and Pinck (1973b) reported one out of seven (14%) principals had taught science full time. Weiss (1978) found only 11% of the principals had majored in science at college. Principals made very few references to their degree or teaching experience on the questionnaire except for noting a higher degree earned in science or previous experience as a teacher.

Sex was a significant variable for principals with a science major and/or science teaching certification. In this sample population, women principals held 6.4% of the science degrees and 12.6% of the science teaching experiences. Men principals, on the other hand, had 93.6% of the science degrees and 87.% of the science teaching experiences with more than 50% of the teaching experience at the 7-12 grade level. This does suggest the question, does high school science teaching experience prepare a principal for elementary school science? This question could be important especially when principals have a profile similar to this expressed by a K-4 male principal,

> I was a high school principal for 14 years and taught biology and physical science for 15 years at _______ high school.

Another principal acknowledged "After coming from a middle school situation there is a vast difference between the curriculum and facilities."

Having more men than women principals with science experience was consistent with the sex ratio that exists in science fields of study. Science has been traditionally a career field for men (Kelly, 1978; Skolnick, Langbort, & Day, 1982). Kahle (1983) reported that only 24% of the women were secondary science teachers. Of all the principals responding, only three women held teaching certificates at the 7-12 or K-12 level in science. An additional nine women indicated science concentrations for a K-6 certificate. Along with 16 men, only 6.9% of the total sample represented K-6 teaching experience with science concentrations. These figures do suggest that principals with elementary school science certification are an extremely "rare species".

The very low figures just reported imply that very little role modeling for science is occuring in the elementary schools. Although the principals were not asked the sex of the teachers in their schools, two national studies have provided figures. Weiss (1978) reported 96% of the K-3 teachers and 75% of the 4-6 teachers were women, while the NAESP study (Pharis & Zakariya, 1979) reported 65.8% of the schools had 80% or more women teachers in grades K through sixth.

Therefore with the high percentage of women as teachers and men as principals, women do not have the role models that encourage the teaching of science unless science was of a special personal interest. The condition could be seen as true for men in some ways. A small percentage of men are teaching at K-6 level and few of the men principals have science expertise. Of course, the belief (Kelly, 1978; Skolnick, et al., 1982) still exists that men would naturally assume the leadership role in science because men have been thought to be better in science and math. Significant relationships between a science major and science classroom experience with other variables in this study were not statistically evident. However the sex of the principal combined with the science experiences should not be overlooked.

Experiences:

Thirteen principals (3.5%) were members of at least one professional science education association. Elementary school principals have been normally members of administration and general curriculum organizations such as NAESP and the Association for Supervision and Curriculum Development [ASCD] (Pharis & Zakariya, 1979). Current or previous membership in the NSTA or NCSTA was apparently due to former science teaching experience as illustrated by these respondents remarks: "I did when I taught" and "as a teacher" in referring to NCSTA membership. The membership percentage was lower than anticipated. It appears that previous membership in NSTA and NCSTA as a teacher does not continue on into the principalship role.

Telephone calls to the National Science Teachers Association and to the U. S. Registry of Teachers revealed that the NSTA did not record membership data by title or position so knowledge of how many of its members are elementary school principals was not available. This information would appear to be useful to NSTA although only a small percentage would be expected to be members if the North Carolina principals responses are any indication. The NCSTA has only an "other" designation for members who might be principals.

A third of the principals were aware of the NSTA series "Project Promoting Science Among Elementary School Principals" but only three principals used the checklist outlined in the series. Apparently this material has not reached the majority of elementary school principals in

North Carolina (Mechling & Oliver, 1983I). There has been a dissemination effort with 24 persons serving as project disseminators including one person from North Carolina.

One administrator (with a science degree) attended the North Carolina Science Teachers Association's annual meeting in November, 1985. Prior to 1984, 47 (12.6%) of the respondents had attended an NCSTA meeting, consequently, it could be assumed that as teachers become principals the content areas of interest become subdued. Although NCSTA is a teachers' organization, there is a supervisors and college educators division that should consider involving the elementary school principal in the proceedings. The elementary schools do not have "a cadre...of special science teachers" (Whitla & Pinck, 1973b, p. 1). Therefore the total responsibility for the science program is in the hands of the principal. This "supervisor" needs to be kept informed of changes in science education.

Attitudes

Principals' Satisfaction with Supervising the Science Curriculum

Over two thirds of the North Carolina elementary school principals were at least "comfortable" with supervising science. Ten years ago Weiss (1978) reported that almost 75% of the principals felt "qualified" for science supervision. The attitude of the principal towards supervising the science curriculum has not seemed to have changed. If the principals are satisfied with their abilities then why hasn't more or better science taken place?

Studies by Audeh (1982) and Whitla and Pinck (1973) found that many principals did not feel their personal interest or expertise really made a difference for the teacher to teach science. This idea coupled with the overall satisfaction of the principals does suggest that science or expertise in a particular field is not visualized as a prerequisite for supervising the curriculum. This raises another question for consideration. Is the satisfaction with the curriculum good because the administrators don't know any differently?

More than 27% of the administrators shared comments on the back of the questionnaire. Several principals expressed their feelings about working with the science curriculum. The following responses reflect a number of the different attitudes and experiences with science. Included are some of the barriers faced by principals, for example, the limitations due to insufficient time,

> Most of my time this year has been spent in training sessions for the Career Ladder plan and in using the new observation instrument which takes a tremendous amount of time. My assistant also teaches so my time is split many different ways. I have a real frustration that I have not been able to help more with curriculum improvment.

or the change in job position, and the general attitude,

> I need to do better!

> Many of my answers reflect the fact that [I] have only been Principal for less than one year. I am interested in and would take opportunities to learn more.
> As a person new to elementary work and new to the principalship, I am not able to give you the kind of information someone else may provide (who has more familiarity with the curricula, etc.) However, I will say that the survey has heightened my consciousness about science programs in the elementary schools.

and the need for knowledge as illustrated here.

> I was horrified to find science books saying butterflies make cocoons. We now have a chrysalis in the library hoping it will turn into a butterfly.

The principals' satisfaction did relate significantly to inservice education and staff development. As the level of satisfaction of the principals increased so did the level of the principals' participation in the leadership for the science program. The majority of principals with "very high" satisfaction also indicated more supervisory help available to assist them with the science program than other principals. These same principals were more likely to have initiated special science facilities for science recently. A third of the principals initiated science learning facilities in the past two years. The attitudes and involvement by principals are illustrated by these statements,

> Since becoming a principal (20 yrs classroom teacher), I have written grant proposals to fund a nature trail, outdoor classroom, amphitheatre, and solar greenhouse. In four years all of these are operational and well used by the staff.

> I wanted to really emphasize the discovery/exploratory approach to science. We have had an Exploratory Week every two months. (pictures were enclosed)
>
> I feel that with greater emphasis from the principal's level, especially mine, science can be upgraded. I have conducted several science demonstrations in an effort to motivate teachers and students and set expectations.

Conversely those principals who had a low statisfaction for science, also rated their teachers in the same manner and were generally not the participants or initiators in developing the science program.

Priority of Science in the Curriculum

Principals were asked to rank how they viewed the priority of subjects in the elementary school curriculum. Science was ranked third by the principals. This is consistent with the results of other studies (Stake & Easley, 1978; Whitla & Pinck, 1973a). The ranking of science by principals was slightly higher than what they as principals discerned teachers would rank science. Principals who were sampled in the State Assessment(1976) rated science seventh out of ten areas of learning. Additional bias would be expected to be in favor of science since the questionnaire was about the science programs.

The principals were more homogeneous in ranking on behalf of the teachers than for themselves. There was no doubt about the priority of reading and math as number 1 and 2 in the curriculum. Science was very closely associated with social studies. If this were a social studies survey, would science still rank third?

Prioritizing the subject matter for the elementary school curriculum seemed to create the most negative feelings or responses for principals. Some of the notations in the margins included "They are all important", "poor question", "not applicable", "I have a science teacher for each grade, 6, 7, 8" and "unrealistic question in a practical world". In addition some principals who ranked the subjects appeared to do so under duress! The following remarks should support this assumption: "This is really not a fair question--all are important!", "Very hard to do this since there are so many interrelationships among disciplines and teachers realize this.", and "I'll rank but I give four basics equal priority".

One principal in response to the Principal's ranking of science (which was a "one") wrote "This year--a 20 hour workshop, see attached (materials)". There were over ten pages attached to the questionnaire. In addition, a number of administrators noted reasons for the priorities with the majority of the comments centered around the North Carolina statewide testing program. Typical remarks were:

> Our curriculum emphasis has been on those areas we were tested on (Lang.Arts - math). I have already seen an additional emphasis on science, since it has been added to the test program (we have a long ways to go!!)

> We are doing much to improve science in the school. It is not the highest priority for the county, but it is gaining rapidly and will be ranked as high.

> My school reflects the priority order of subject areas held and time mandated by our school board of education. For some years we have had a period of time mandated for language arts/reading and math. Only in the last 2-3 years has more emphasis been put on science/social studies but no time mandate for teaching each day.

The possibility does exist that the greatest outside source of influence on the local schools' priority on curriculum was the mandated statewide testing program. With reading and mathematics first and second and science and social studies now added to the list of tests, who's on third? This inning went to science but what about next year?

In review, this study of North Carolina elementary public school principals described the typical elementary school principals. They were generally men in their forties who administered K-6 and K-5 schools with 11 to 21 classroom teachers. The majority did not have an undergraduate degree or a teaching certificate in science nor were they members of the listed science organizations such as NSTA. Most principals were not aware of the NSTA series designed to help principals assess the science program in their schools.

The majority of principals were predominantly satisfied with their ability to handle the science curriculum despite not having science experience. This satisfaction related significantly to those who provided and were involved in science inservice programs.

Principals Administrative Roles in Science Program

The school principal has worn many different "hats" in the supervision of the elementary school. A second research question was concerned with the identification of the role the administrator performed in various aspects of the science curriculum. The discussion described the findings and their implications in relation to the principals' leadership in the financial resources and responsibilities, inservice education, instruction and teacher evaluation.

The Financial Leadership

Local School Budget

Over half of the elementary principals in North Carolina reported local school funds for the science program. Apparently a majority of principals have recognized the need for funds in the local school budget. The items for the local budget in the questionnaire were recommended by Mechling and Oliver (1983III) in their checklist for principals. The monies for inschool programs such as "Snakes Alive", etc. was the least funded but still greater than 50%. More than 60% of the principals had funds for field trips, science inservice programs and for release time expenses for teachers to attend the NCSTA meeting.

An overwhelming 92% indicated funds available for consumables. This percentage appeared high when compared to figures from other studies. Audeh (1982) found 47.7% of the principals had an annual budget for equipment and 73.3% had funds for consumables. Coble and Rice (1982) reported that teachers rated the lack of materials and insufficient funds as factors most likely to interfer with science teaching. Principals in the 1974-75 State Assessment (1976) were in agreement and included "inadequate science facilities" to that list as a handicap to teaching science. The large figure reported for the funds for materials by the principals could have included the $2.00 State Science and Math money. This money was often allocated to each school locally and administrators may have interpreted the question to include those funds.

Sixty two percent of the principals reported money being available for a teacher(s) to attend the NCSTA annual meeting. Yet only 16.8% of the principals indicated they had teachers to attend in 1985. Of these principals only 4.8 to 5.3% reported using local school mondy for the release time expense. This past year, instead of 63 schools being represented from this sample, there could have been 232 schools with teachers attending the meeting. This difference in funding and attendance does raise some questions which the NCSTA organization should address about association's communications with the principals, and the teachers at the elementary school level.

The principals were not questioned about outside sources for funds but based on several responses discussed earlier in the results chapter, the Parent-Teachers organizations have provided funding that has benefited the science program. Another time it might be well to survey this area of funding especially if efforts are needed to increase the $2.00 science and math allotment from the state. How important is the PTA/PTO to the science program in a school?

NC Science and Math Funding

The North Carolina state legislature initiated a funding program which began in the 1984-85 school year. The allocation was for $2.00 per K-6 child for math and science supplies. Principals were asked to indicate how much of the money was an expenditure for science. The local school administrator seemed to have assumed the authority to determine the percentage of funds to be spent for science. Math received a greater proportion of the money in the first year (84-85). The science proportion increased slightly the second year of funding.

Principals who wrote additional remarks about their science programs included remarks about science materials and equipment. Three principals quoted here are representive of several different concerns with the state funding.

> The recent state money should help spur the science curriculum.

> Less restrictions on use of science money--Example purchasing supplies for experiments from local merchants difficult.
>
> The recent "interception" of those state-allocated funds ($2.00 per child, math/science) by central office has affected our school's program(s) negatively. People tend to support those efforts which they helped to develop...

The principals have decided "how much" was spent for science materials but more than half the principals have involved the teachers in the "what" to purchase. A small percentage indicated that teachers with a science interest or certificate had the major responsibility for ordering supplies.

The kinds of science equipment purchased included supplementary materials to accompany new texts, SCIIS kits, and "hands on" materials. The following responses were typical of what principals stated about their finances.

> This year I budgeted and spent more money for science materials and equipment than for any other subject other than reading.
>
> Our media/budget committee had science as a priority last year 1984-85. We equipped primary & elementary mobile labs and built and filled a storage cabinet with materials for hands-on experiments...

<u>Inservice Educationand/or Staff Development Leadership</u>

"More science inservice needed", wrote one principal which expressed what several principals shared as a need. The response was also a reminder that only 40% of the principals had science inservice programs during this past school year. This is seen as low because of the emphasis on science in the past two years including money for science equipment and new textbooks. Coble and Rice (1982) reported 54% of the teachers having great or some difficulty in obtaining inservice education for teaching science. This condition still appears to exist.

In Mechling and Oliver's checklist (1983II), the recommendations to principals for establishing a good inservice program included providing regular inservice, involving teachers in the planning, providing funds, and participating in the program in partnership with the teachers. The positive aspects of this study were that at least 40% of the principals have been meeting a number of these recommendations. These 40% are not on the sidelines but have become members of the science "reform team" (Mechling & Oliver, 1983a).

Principals who sponsored science inservice programs during the 1985-86 school year were asked to indicate who led the most recent of the inservice programs and who was involved in the planning of the program. Figure 6 ranks the personnel who were involved in the leadership and planning of these inservice meetings.

The North Carolina elementary school principal has assumed the major responsibility in planning the experience but actual leadership for the individual inservice program was usually provided by the LEA or regional education specialist. Inservice programs conducted by textbook consultants were reported lower than expected during this first year of the new state adopted science texts. It is possible that the principals did not consider a presentation by the textbook consultant as inservice.

Leadership for Inservice		Planning for Inservice
School System Staff	1	Science/Supervisory Staff
Regional Sc. Consultant	2	Principal & Teachers
Teachers	3	The principal
Other (variety)*	4	Principal/Central Office
Univ/College Consultant*	5	*Other
Textbook Consultant*	6	*State/Regional staff
	6	*Teachers

Figure 6. Comparison of Leadership and Planning Personnel for Principals Who Provided Science Inservice in 1985-86.

Note. Ranking with 1 = most often selected and including only the 40.1% who held inservice for science this year. * represents less than 7% and 1.6% respectively.

Funding has been seen as a barrier for inservice education (Hite & Howey, 1977; Orlich, 1984). As visualized in Figure 7, when principals responded yes or no to the question "Did you provide a science inservice program for your teachers this year?" the difference in the money available to both groups was only 15%. In both cases, the majority of principals had funds. Instead of 40% of the principals having inservice for science during 1985-86, there should have been over 60% if funding had been a reason for the lack of science inservice.

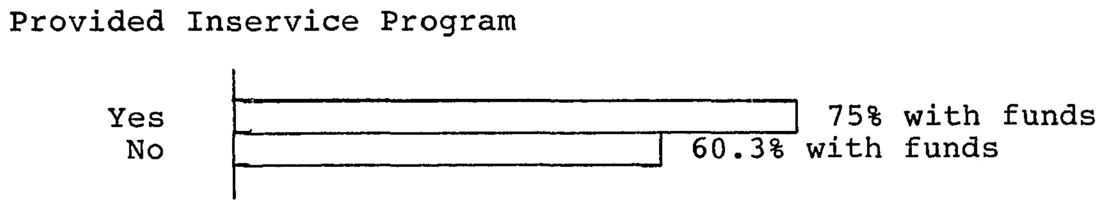


Figure 7. Comparison of Availability of Inservice Funds and Provision of Science Inservice Program.

It was significant that 67.3% of the principals who had provided an inservice program also attended a science inservice program with their staff. There were also 55.3% of the same group who had indicated attendance at principal's institute for information about the science program. Orlich (1980, 1984, 1985) through his studies, has been strongly convinced that effective science programs occured when principals were involved in the implementation through intensive inservice training with the teachers (Boroughs, 1976; Selser & Milliken, 1973). It should also be noted that although a science certificate or undergraduate degree was not significant when related to staff development, half of the principals who had a K-6 certificate with science concentration did participate by a higher percentage in providing science inservice. The K-6 science teachers were 10% better at providing inservice education than the general population of sampled principals.

Several viewpoints on inservice were expressed by principals as illustrated here.

> The entire faculty has had in-service training to encourage hands-on activities. Teachers are doing demonstration lessons on an exchange basis.
>
> I feel our Science curriculum is adequate but could be improved. We are planning an Inservice Workshop for our teachers in Science during Teacher workdays at the beginning of 1986-87.
>
> Quality in-service for the total staff rather than for teachers only has produced a more uniform awareness which, in turn, has culminated in greater student awareness and involvement.
>
> My experience with science educator "experts" who try to help teachers move to teaching techniques to develop concepts through process has been uninviting for the most. There is often a condescending attitude underlying the presentation of needed changes. Few people will be invited to change under these conditions.

Teachers had the least impact on the planning of inservice programs in science. This weakness has apparently not been addressed at the present time by the principals. Yet, throughout the inservice literature, one of the requirements for successful inservice programs was to involve the teacher each step of the way (Hite & Howey, 1977; Jackson, 1980; Tanner & Tanner, 1980). Failure to consider teachers ideas and attitudes could seriouly limit the effectiveness of the science program (Harty & Enochs, 1985).

Several principals elaborated upon the inservice aspect of their programs. A number were developed in cooperation with either adding special programs such as SCIIS or outfitting a science resource room with materials. Three principals enclosed complete outlines of inservice programs and some long range planning which included committments by both teachers and principals.

The Instructional Leadership

The instructional program demands the attention of the school principal if change or improvements are going to occur. The principal has had to identify factors that prevent the improvement and know what the staff was teaching in the classroom (Mechling & Oliver, 1983).

Factors Affecting Instruction

There has been some change in those factors which appeared to negatively affect the science programs in the schools. The changes focused on two events, the statewide science and math funds and the statewide testing program.

A comparison between the rankings in the Coble and Rice (1982) study of teachers' responses and those of the principals, in this study and the 1976 State Assessment Summary are displayed in Table 22. In the earlier studies teachers and principals ranked "lack of supplies and equipment" number one and teachers ranked "insufficent funds" as number two as factors that most affected the teaching of elementary school science in North Carolina. Today these two factors were rated by the principals as number seven and eight respectively. The assumption for the difference would be again the increased flow of money for science into the schools from the State Science/Math funds.

Table 22

Comparison Rankings of Factors Preventing Science Teaching As Seen by Principals in This Study

N.C. Elementary Principals	Factors	State Assessment Principals	K-6 Teachers[a] Coble & Rice Study
Rank = 1	Factor most likely to prevent science teaching		
1	Emphasis Reading/Math	---	7
2	Lack of Science Methods	5	NR[b]
3	Insufficient Understanding of Science Concepts	3	NR
4	Insufficient Time	---	6
5	Inability to Improvise Materials & Equipment	---	10
6	Inadequate Room Facilities	2	4
7	Lack of supplies & equipment	1	1
8	Insufficient funds	---	2
9	Inappropriate textbook	---	5
Rank = 9	Factor least likely to prevent science teaching.		

Note. [a] Teachers perceived by principals as most effective teachers of science in NC, 1978-79 in Coble and Rice (1982).

[b] NR = not ranked beyond ten positions in study.

Emphasis on reading and math as a factor was ranked number one in this study. Teachers ranked emphasis on reading as seventh. This ranking may have changed for teachers. Only a survey of teachers would allow a differentiation to be determined between a direct cause or a difference of perception by principal and teacher (Rowe & Hurd, 1966). From the remarks already shared, the state testing program (CAT) has been a major reason for the emphasis in reading and math.

Lack of adequate facilities ranked #2 by principals in the 1974-75 State Assessment can be assumed to have been improved by the science and math funding or new school facilities. One principal told of a fire destroying the school and while rebuilding was taking place, materials and facilities were limited. Another principal is more fortunate...

> We are moving to a new school which will have a permanent science room. All science equipment will be stored there.

In addition to ranking the factors, some principals shared their views about how these influences affected science in the classroom. The "basics" such as reading and math were previously discussed. It only needs to be reiterated that principals have expressed the lack of choice in having teachers deal with the reading and math curricula in the classroom. The state testing program has been perceived as the "Big Brother" in the matter of "choice" of the subjects taught by the teachers. Now science has been added to the testing schedule and moved up a "notch" in importance as illustrated by this statement from a principal,

> Of course, the major emphasis for the past few years has been in those areas tested by the state. (Reading, LA, & Math) With the beginning of science testing, much more emphasis will be placed on science as the scores reflect this need.

Still voiced by principals was the need for science supplies and storage space and the "Need more information on materials that can be purchased to supplement and/or extend the curriculum". Insufficient time to teach science was addressed in one school with "an extended ... school day beyond the 5 1/2 hours of instructional time to provide adequate time for science (and social st.)".

Although the factor "inappropriate textbook" was ranked last (9th) by principals and fifth by teachers (Coble & Rice, 1982) two very interesting comments were made.

> A major obstacle to teaching science, as I view it, is the use of textbooks. The state curriculum defines concepts and processes to be taught and promotes textbooks. It seems we are in a vicious cycle.

> Our weaknesses in the science curriculum developed over the years that we had such poor science books - many of the students could not read them, nor the teachers teach them.

Based on the responses from the principals between this study and the State Assessment in the 70's, there has been some change in the last few years. Principals still saw teachers' preparation and knowledge of the subject as weaknesses in the science program. Instead of poor facilities and lack of materials this time however, principals ranked the emphasis on reading and math as number one in influence.

Teachers in a previous survey also ranked the need of materials and money as factors influencing the teaching of science. To confirm the change, a questionnaire would have to be sent to teachers asking similar questions.

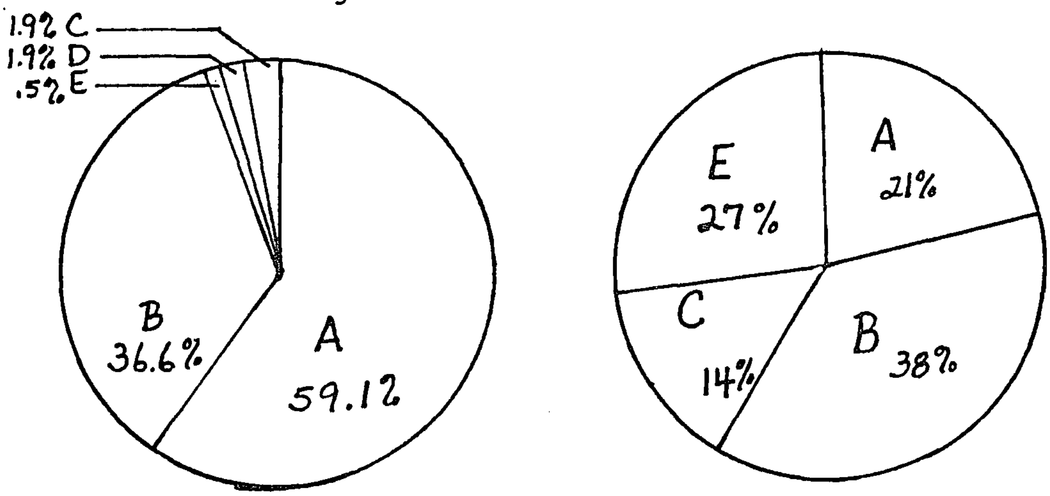
Teaching Staff

Only 10% of principals reported a teacher who had the responsibility to teach science only. The percentage was not expected to be over the 18% which was the number of the schools which had grades where departmentalization might have occurred. This statement serves as an example.

> Our science teachers are assigned and certified to teach one or more periods of 6th grade science. They teach science only or one other preparation.

Principals were asked to select the most effective teacher of science in their school and answer specific questions relating to this teacher. Coble & Rice (1980) had teachers selected in the same manner, although teachers answered the questions. The principals saw their most effective science teacher teaching science every day for a period of 30 to 40 minutes. Coble and Rice (1982) reported that teachers taught science every other day and averaged 17 minutes per day on a lesson. Weiss (1978) reported that teachers taught on an average of 20 minutes of science per day at the level 1-3 and spent 30 minutes per day in grades 4-6. Principals seemed to be much more positive or forgiving by indicating more time for science. Figure 8 illustrates the differences in the principals and teachers' perception of time spent teaching science.

Manning, Esler, and Baird (1982) have suggested that surveying school principals for the time spent in instruction and type of teaching is unreliable. Their reasons for unreliability included the reason that principals do not know what is taking place in the classroom or wish to make their school look good with science teaching everyday. Welch (1979) found that principals appeared to be more positive than teachers about science programs. The data given by the principals are the perceptions they have for the teaching of science. A little bit of Maben's grain of "NaCl" might be useful here!



Principals

Teachers
(Coble & Rice, 1982)

Legend: A = Every day B = Every other day
C = Once a week D = Science only
E = Other frequencies

Figure 8. Comparison of the Frequency Science Is Taught As Perceived by Principals and Teachers.

Science Curriculum

The SCIS (or SCIIS) program was the NSF developed curricula most likely to be found in North Carolina public schools. SCIS was the most well-known and widely adopted (Kyle, 1984a) of the three programs that principals were asked about. ESS and S-APA were the other two mentioned. SCIS was found to be in greater use most in the schools. Table 23 shows the use of the three aforementioned NSF curricula as North Carolina principals reported in comparson to other studies.

Table 23

Percentage of NSF Curricula Being Used in NC Today In Comparison to Other Studies

Study	NSF Curricula		
	ESS	SCIS	S-APA
NC Elementary Principals	7.2%	26.7%	1.1%
Coble and Rice (1982) (Teachers)	1.0%	10.0%	0%
Audeh (1982)	10.2 - 17.4%	5 - 10%	11.9 - 15.3%
Whitla and Pinck (1973a)	61.1%	38%	33%
Weiss (1978)	15%	8%	9%

Since the Coble and Rice study (1982), the usuage of the SCIS program has increased in North Carolina. There appeared to be several reasons for this increase. First, programs such as SCIIS are expensive because of consumable materials so several principals indicated "money was made available for teachers to get supplies for the SCIS program" and "We have 2 SCIIS kits (which are very expensive for small schools)". It would seem that the state science and math money has gone into some of the SCIS materials. This is not documented in this study however.

SCIS or its newer version, SCIIS, increase could also be due to the implementation inservice program sponsored by the Science Division of the State Department of Instruction. Principals have indicated they have attended those programs along with the teachers. Other principals reported that SCIS kits and programs were in the process of being purchased for use in the Fall 1986. Some of the principals were aware of the limitations however. Two indicated the program was no longer in use while another said "The biggest disappointment is in K-3 where teachers indicate that SCIIS projects/demonstrations are very time-consuming."

Instructional Strategies for Science

Principals observed the same instructional strategies being used as teachers did almost eight years ago. Table 24 illustrates the rankings between principals and teachers.

The principals observed the same strategies teachers said they used in teaching science. This comparison despite the time element in between the studies does imply that how teachers are teaching is exactly what the principal is observing. However, the data as presented has also indicated that change in teaching methods has not taken place. Lecture and discussion was still seen as the predominant form of teaching science. In the seventies Weiss (1978) among many researchers, identified lecture as the then current method for delivery of science to children. Ten years later in North Carolina, it still is.

Table 24

Rank Comparison of Instructional Stategies Used in Science As Perceived by Principals and Teachers

Rank of Principals	Strategy	Rank of Teachers[a]
1	Lecture/Discussion	1
2	Demonstration	2
3	Film/videotape	3
4	"Hands on" Student investigations	5 & 7[b]
5	Projects (Making things)	4
6	Small group learning	6
7	Learning centers	9

Note. [a] Coble and Rice study (1982), ranked 10 items.
[b] Coble & Rice reported student experiments and investigations 5 and manipulative materials at 7.

Hands-on student investigations was ranked a little higher this year which could be encouraging. Combined with additional purchasing of SCIIS kits and other science materials from state funds, there should have been an increased use of this strategy. Although not statistically significant, it was apparent for those principals who rated themselves with "very high satisfaction" also perceived the "hands on" strategy as being used more frequently in the classroom. The assumption could be made that these principals were aware of what needs to be done for the science program to succeed.

Science Support Staff

Over half of the principals indicated some staff assistance was available locally. The distinctions between the four selections of support staff, elementary science supervisor, K-12 science supervisor, science demonstation teachers and science consultant were not very clearly expressed in the questionnaire. Some principals did check elementary science supervisor and then noted "a general elementary supervisor". This answer was not coded. The science consultant could have been interpreted to mean the regional center science consultants which was not what the researcher wanted. The percentages cannot be compared to results in other studies since the data for the school system and region were not coded. The only significant relationship was with the K-12 supervisor and the principals who had a "very high satisfaction" level for handling the science curriculum. This area needs further investigation.

Teacher Evaluation

"I required that 1 of 2 formal observations be in science." Just as this principal had made a commitment to evaluating the science program, every school's science program should have a "checkup" for its vital signs. This should be an important part of the principal's role (Mechling & Oliver, 1982II). At least 66% of the principals observed one fourth of their faculty teaching science. Another 14% observed up to half their teachers in a science lesson. For schools where the subject was blocked the percentage of staff observations would be low. There were 37 principals who had not observed any staff members teaching science (almost 10%) while 21 principals reported observing 76 to 100% of their staff teaching science. There was no comparison data available at the present time.

Mechling and Oliver (1982II) suggested that "not only can you evaluate the teacher's performance as you are required to do but you can also assess the condition of the science curriculum" (p. 19). As part of this study, the principals were asked to "list two visual clues found in a classroom that indicated the presence of science as an active part of that teacher's curriculum."

Mechling and Oliver (1982II) phrase these questions as guides for what principals should look for. Are the kids involved in science activities? Do they appear interested in the lesson? Do they have opportunities to investigate? ...

Is there evidence of on-going science activities? Are there science materials or projects around the room? (p. 19)

There were many different words, phrases, and ideas written by the principals. The standard answers were typical "visual" clues that would have described any part of the elementary school curriculum when the word science was removed. For example, "science bulletin board", "science center", "science projects", and "science displays".

Also included in the general clues were those related to childrens' work such as "student projects displayed", "centers with student's displays of experiments", "bulletin board of childrens' work", "student work", and "students pictures".

Clues that identified science as a different subject included those that listed living organisms such as "live organisms-plants, fish, fruit flies, etc.", "aquarium", "terrarium" and active descriptions of living things such as "hatching butterflies", "sprouting seeds" and "plants growing".

Science equipment and, as one elementary teacher put it, non-living and once-living things were given as clues. Anything could be displayed and not used in instruction so the expressions or clues stated in the following would appear to have more meaning: "science equipment present in the classroom without dust on it", "used science equipment", or "science oriented 'things' for children to look at and touch". However the presence of "insect collections", "SCIIS kits", "scales, pulleys, batteries, bulbs, and switches" are signs that materials were available to the students. Even "lawn motor parts" were listed! Only one principal mentioned the computer as equipment for science.

Other clue words including "experiments", "demonstrations", and a few "hands on" did relate to the questions Mechling and Oliver have the principal to ask. Three principals used phrases such as "active involvement of students in hands-on activities", "science experiments being done by students", and "students participating in science activities". Others related clues of areas that could be integrated with science. The math related ideas that accompanied science included these descriptions, "use of graphs" and "results of observations" while reading and language arts were represented by these "Writing lessons on charts--created by students as they write about what they have experienced.", "library or supplementary books", and "vocabulary words on bulletin board".

The principal as the observer must be encouraged to remember what science is. Rutherford stated it well - "science is open, active inquiry ... students should be doing, collecting, pushing and pulling things, asking questions and working together..." (Brandt, 1983/84, p. 24). There was also the consideration that the principals did not have the knowledge for observing the special aspects of elementary school science teaching. As this study indicated a minimal number of principals had elementary school science experience. Because of the subjective nature of the "clue" data, statistical analysis was not performed.

In summary, the administrative roles of the elementary school principal spanned a great part of the school curriculum for science. Over half the principals have indicated the provision of funds for all aspects of the science program. The principal had begun to take the leadership for planning science inservice programs with at least 40% of those principals actually having programs and making the extra effort to attend themselves.

Principals were beginning to observe teachers during a science lesson and to identify those clues that are specifically science related.

School Facilities and Science Fairs

This study also was to identify the facilities available for science and science fairs. Less than half of the principals have had some type of special facility for science. This would be considered resources beyond the classroom (Mechling & Oliver, 1983III).

Three principals indicated they were in the process of establishing or completing nature trails. Two principals who marked "no" indicated that materials and discussions have been held about nature trails. Two principal indicated that the nature trail is in nearby city parks. The science lab or resource room was in some stage of development at several schools.

Of the four facilities chosen for this survey, the greenhouse was the one least expected at the K-3 levels (and the guess was correct). Comparing the data, only larger, upper grade or middle grade schools had a greenhouse.

Nature trails are more common in the schools administered by the principals in the sample. A close second was a science lab or resource room. There were a few small gardens checked. The school garden as a science facility was more evident for K-3 children as interpreted by the principal. Several comments indicated that this activity was more likely to have been started by a teacher. For example, one principal shared "One teacher has planted a small plot."

The greenhouse, which is more expensive operation, was found in the upper grade schools such as 6-8. Greenhouses were usually quite expensive and used in connection with agriculture or vocational programs in the high school. The school garden was a simpler undertaking at lower grade levels.

Almost 30% of the principals initiated facilities in the past two years. Some "have collected materials" on out-door classrooms, and nature trail", "discussed nature trails", and developed "a Marsh trip".

The science fair is seeing a rebirth. Over 61% of the principals have had science fairs in their schools in the past two years. Principals were very proud of the science fairs at their schools especially noting when they have had regional winners. Here are some typical comments:

> Our Science fair is 4 years old and getting better yearly.

> I am pleased with our science curriculum in 4-6 this year. We held the first Science Fair this school has had. Students (41) entered 23 projects with 15 projects being entered in County Competition. Of those 15 projects, 2 received 2nd place, 1 3rd place, and 3 Honorable Mentions.

This next principal's comment was not so typical but did indicate the interest of the local school principal and the problems that might be encountered with science fairs.

> Last year we held the only science fair in the county to my knowledge. This year, science fairs were to be a countywide project cosponsored by Central office. However, it did not materialize & by time we received word in the year it was too late to conduct one locally.

One principal shared a special event held on a continuous basis at the school for all children and included pictures with the questionnaire. The event was called Exploration Week which was held every two months. The principal was quoted "I wanted to really emphasize the discovery/ exploratory approach to science." Themes were chosen by the teachers. The principal continued "...my assistant principal and I prepared a week of pre-visitation, post-visitation activities as a handout. Then we set up the library with many centers ...we manned the centers with volunteer parents."

The principal not only provided the week's activities but also held the effective teacher training with the staff which included 12 new teachers. With all this responsibility the principal still felt "Exploration Week" was rewarding. "Everything was inter-related and has continuity....topics covered included Rocks, Fossils and Dinosaurs; Color, Sound...".

Principals Perceptions of Staff as Teachers of Science

One major question asked was how do principals perceive their staff as teachers of science?

Principals have always regarded teachers' inadequate knowledge of science as an influence on the science curriculum (Audeh, 1982; Rowe & Hurd, 1966; Whitla & Pinck, 1973). Administrators have ranked the factors describing the teachers' lack of skills and understanding in the top five as reasons for the avoidance of teaching science in the classroom. Teachers however did not put the same emphasis on their own lack of knowledge. That factor was not even ranked as one of the top ten factors affecting science teaching in the Coble and Rice study (1982). Obviously if the principals and the teachers were not visualizing the problems in the same way, then the changes made by the principal will not have happened unless the principal convinces the teachers to work on something new.

With regard to teacher preparation, principals said, "Teachers are not able to handle the "hands on" approach" and "...a lack of knowledge by elementary teacher" or "It seems difficult to help teachers to teach science aggressively". Preservice education, another factor in science teaching was addressed by one principal,

> Most of my teachers have had very little science training. Two-thirds of my teachers do not have the ability to comprehend science content or teaching beyond question and answer (Fill in the blank)... Remember, many teachers took Elementary Ed to avoid higher math and science.

Principals must be prepared to help teachers overcome any weaknesses in the science curriculum and provide science education.

Teachers' Science Attitudes

The principals reported that 81.7% of the teachers were "moderately comfortable" to "confident with science material". The greater the satisfaction of the principal, the more confident the teachers were rated.

However, comparing these results (Appendix, Table C-13) with how teachers rated themselves in the Coble and Rice study (1982) Figure 9 illustrates how principals seem to be somewhat consistent in giving teachers less credit for attitude and skill with the science curriculum. Conversely, a comparison of the satisfaction scales from Coble & Rice (1982) and those from principals in this survey show that teachers have a much higher personal satisfaction about science than the principals had. (see Figure 9)

Very Low	1	2	3	4	5	Very High
	1%	7%	52%	34%	6%	

Teachers Satisfaction with Science Teaching
(Coble & Rice, 1982, p. 151)

Very Low	1	2	3	4	5	Very High
	3.5%	21.7%	44.7%	21.4%	8.3%	

Principals Satisfaction with Supervising Science

Figure 9. Comparison of Teachers and Principals Satisfaction with Science in Teaching and Supervising the Science Program.

Some principals elaborated further about teachers. Typical comments were "Children love science. Teachers like it.", "Teachers very interested in science.", and "My staff enjoys teaching science."

> Give me a dedicated teacher who loves science and give her materials to work with, you can have success.

Elementary School Subject Priorities

Principals did perceive the teachers ranking the subjects in the elementary curriculum slightly different. Looking at the measures of variabililty in Table 4, the use of the expression of variance in Table 25 is to emphasize better the differences between rankings. Table 25 compares the two rankings using the variance as a measure of heterogeneity of the principals' scoring.

Specifically relating to the ranking of science, one principal indicated that ranking for teachers "will change due to state test". As the question has been raised earlier in the discussion, the selection of science as third could quickly become a fourth if social studies receives the same emphasis as science. The principals were more homogeneous in ranking on behalf of teachers than themselves. The next step would be to compare these figures with ones from teachers to identify any trend.

Table 25

Variance Scores for Elementary School Curriculum Rankings

Subject	Rank	Principals' S^2	Teachers' S^2
Reading/Lang.arts	1	.073	.049
Math	2	.106	.053
Science	3	.340	.337
Social Studies	4	.393	.373
Physical Ed.	5	.363	.234

Note. Principals ranked as they perceived how their teachers would rank the subjects.

In review, elementary public school principals were involved at different levels of participation, ranging from 30% who have initiated facilities, to 40% who have provided staff development in science to over 50% who missed the opportunity to send a teacher to the NCSTA annual meeting in 1985. Overall, the principals were satisfied they could handle the science curriculum and that their teachers were comfortable with science materials. Stage II of the science reform has begun. This will be a record of its start.

CHAPTER VI

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

Elementary school science has changed little over the past twenty five years. At the time of the launching of Sputnik, large amounts of money were poured into the development of "hands-on" curricula for use in the elementary schools. Weiss (1978) reported that less than 30% of the schools were using the programs and even fewer teachers were involved. The teacher was identified as the "key" to a child's science experiences in the classroom (Stake & Easley, 1978).

When accountability and excellence became a focal point in education in the late 70's, the principal was acknowledged as the "key educator" (Day & France, 1985) for the successful school. Today, it has now been recognized that the "key educator", the elementary school principal, was a major facet missing from the nationwide effort to implement the elementary school "hands-on" science curricula.

New initiatives have begun in North Carolina to improve the science and math programs across the state. Teachers have been involved in inservice for the new basic education plan, students are being tested in science, and funds are being allocated for science equipment but what is happening to the elementary school principal? How does the elementary school principal perceive his or her own participation in the new initiatives in developing the science program for the school?

The purpose of this study was to examine and describe the perceptions North Carolina elementary(K-6) public school principals have of their role and participation in the science programs in their schools. Aspects of the principal's role that were examined and analyzed were the qualifications and experiences in science as well as attitudes towards the science program. The administrative role in the science curriculum including areas of the school budget, instructional program, inservice education, teacher evaluation and school facilities was also investigated.

Questionnaires were mailed to a random sample of 455 elementary school principals whose schools contained any grades from kindergarten to sixth. Of the returned instruments, 374 or 82% were coded and analyzed.

Conclusions

With the data collected and analyzed from the questionnaire, the following conclusions of the research questions can be made.

1. Twenty five percent of the principals had some qualifications and experiences in science. However the majority of principals in the sample population were

satisfied with their handling of the science curriculum at the local school.

- 25.4% of the principals had classroom teaching experience with science concentration or certification.

- 12.6% of the principals had undergraduate majors in a pure science.

- 6.4% of the women principals had science degrees.

- 12.6% of the women principals had classroom teaching experience and a science concentration or certificate.

- 6.9% of principals reported K-6 teaching certificates with science concentrations.

- 3.5% of the principals had NSTA memberships.

- 2.1% of the principals had NCSTA memberships.

- 33.7% of principals were aware of the NSTA series, "Project for Promoting Science Among Elementary School Principals".

- 74.7% of principals were "comfortable" or "very satisfied" with handling the science curriculum.

- Science ranked third in order of priority in the elementary school curriculum by the principal.

- 29.9% of the principals initiated special science facilities in the past two years.

- principals with a high satisfaction in supervising the science curriculum were more likely to have conducted science inservice, attended a principal institute on science and attended an inservice program with the teachers.

- principals who initiated facilities were more likely to observe use of "hands-on" strategies and observe a higher percentage of staff teaching science.

2. Elementary school principals revealed, through their perceptions of their administrative role in the supervision of the science program, a wide and variable range of

participation. These administrative roles were in the areas of local school finance, inservice education, instruction and teacher evaluation that related to science.

- 58% to 92% of the principals are providing funds for science program.
- Principals decided what percentage of the state money will be spent on science.
- 48% of the principals gave science at least a 50% proportion of the state science and math money in 1984-85.
- 55% of the principals gave science at least a 50% proportion of the state science and math money in 1985-86.
- 59% or more principals involved teachers in the decision of the purchase needs for the state money.
- 40% of the principals conducted a science inservice program in 1985-86.
- Principals providing inservice programs in 1985-86 were more likely to attend inservice with the teachers.
- 41.2% of the principals attended science inservice programs with their teachers.
- 45.7% of the principals have attend a program on science at a principals' institute or meeting.
- Principals of larger schools were more likely to have teachers attend the NCSTA.
- Principals of upper grade schools were more likely to to send teachers to the annual meeting of NCSTA.
- 62% of the principals had funds for release time for teachers to attend the NCSTA annual meeting in 1985.
- 16.8% of the principals had teachers to attend the 1985 annual meeting of NCSTA.
- 53.2% of the principals had some type of science support staff in the local school system.

- Principals ranked the factors that affected the science program the most as

    1. Emphasis on reading and math
    2. Lack of understanding of the methods of teaching science
    3. Insufficient understanding of science concepts
    4. Insufficient time to teach science
    5. Inability to improvise materials and equipment
    6. Inadequate room facilities
    7. Lack of supplies and equipment
    8. Insufficient funds
    9. Inappropriate textbook.

- 23.9% of the principals observed more than 26% of the teaching staff during a science lesson.

- Principals observed "visual" clues such as "bulletin boards", "centers", "projects", science equipment and materials, living and non-living things, "demonstrations" as indicators of science being a part of the teacher's curriculum.

3. Over 60% of the principals had conducted science fairs in the last two years but less than 35% had NSF developed "hands-on" curricula and less than 48% had a special science facility for their local school science program.

- Principals reported 26.7% had or used the SCIS (or SCIIS) program.

- 47.2% of the principals indicated a special facility developed for science.

- 23.5% of the schools had nature trails.

- 22.7% of the schools had science labs or resource rooms.

- 13.6% of the schools had a school garden.

- 5.1% of the schools had a greenhouse.

- Larger and upper grade schools had the greenhouses.

- 61.8% of the principals reported conducting science fairs within the past two years.

4. Principals perceived their teaching staff as: (1) comfortable with science material, (2) primarily using the lecture/discussion method of teaching science, and (3) teaching science for more than 30 minutes every day.

- 81.7% of the principals viewed their teachers as "moderately comfortable" or "confident" with handling the science material.
- Principals more likely rated teachers "confident" if they as principals rated themselves "high" to "very high" satisfaction.
- 59.1% of the principals saw their most "effective" teacher of science teach science every day.
- 50.3% of the principals reported their most "effective" teacher of science teaching for a period of 30 to 40 minutes per lesson.
- 10.2% of the principals have teachers who teach science as the only subject matter.
- Principals perceived teachers would rank science third in a list of five elementary school subjects. Reading and math rated one and two, respectively.
- Principals ranked the instructional strategies they most frequently observed teachers using in the following order beginning with the most frequent:

    1. Lecture/discussion
    2. Demonstrations
    3. Film/videotapes
    4. "Hands on" student investigations
    5. Projects (making things)
    6. Small group learning
    7. Learning centers

5. The science experiences of principals did not appear to make a significant difference in the direction or involvement of the principal in the science program.

6. The elementary public school principal in this sample could be described in the following way:

- 23.5% were women principals.
- 75.9% were men principals.
- 78.6% were over 40 years of age.
- 53.7% had been principals for ten years or less.
- 12.6% had undergraduate majors in science.
- 85.5% had classroom teaching experience.
- 59.9% had 21 or less classroom teachers in their school.
- 30.5% administered K-6 schools.
- 21.4% administered K-5 schools.
- Principals administered schools of which there were 26 different organizational arrangements.

Over 78% of the principals were at least 11 years old at the time of the Sputnik launch and 36.4% are assumed to have been in college in 1957. This population of principals has experienced, as students, the national attention given to science during the 60's. Also, for over 63% of the schools represented in this sample, the pupils were born after the first man stepped upon the surface of the moon! This presents an interesting juxtaposition of adults who have lived through the very rapid scientific and technological developments in the United States now educating children who have only known the results of this rapid technological advance.

Recommendations

The following recommendations are based on the findings and conclusions of this study:

1. Principals should be encouraged to hold science inservice and staff development programs each year.

2. More opportunities should be provided for principals to learn about the science programs and how science should be taught.

3. Principals should be provided with guidelines for initiating science inservice programs at their local schools.

4. Principals should be encouraged to include teachers in all phases of planning inservice programs.

5. Principals should participate with their teachers in science inservice programs.

6. Principals should be provided training for observing and evaluating science lessons either through principal institutes or through university courses.

7. The NCSTA should improve communications with the elementary school principal and encourage them to send teachers to the annual meeting and/or attend themselves.

8. Principals should exert a greater effort to obtain local school funding for science.

9. Principals should become more involved with all science supervisory personnel, university and regional science consultants and other science educators in order to obtain the latest research or program findings in elementary school science.

10. Schools with successful or exemplary science programs should be open for principals and teachers to come and observe the programs functioning.

11. The NSTA's "Project for Promoting Science Among Elementary School Principals" should continued to be disseminated across the state. Workshops for principals should be conducted using these materials.

Recommendations for Further Research

This study was based upon what elementary school principals perceived their role and participation in the local science program predicated on their responses to items on a questionnaire. A study needs to be conducted by an independent observer to obtain information from outside observations about the involvement of the principal in the science program.

1. A followup study of this particular investigation should be undertaken in three to five years in order to note any changes or trends that might be taking place.

2. A study similar to this should be replicated for teachers in K-6 schools.

3. Studies should be conducted of the relationship of previous science training especially at the K-6 level to the supervision of the science curriculum by the principal at the elementary school.

4. An indepth or case study of principals who have exemplary science programs should be conducted in an effort to identify how the principals behave in those settings.

5. A study should be conducted to determine what factors principals identify as satisfaction in handling or supervising the science program and how those factors relate to successful and unsuccessful science programs.

6. Studies on the effect of the statewide testing program on the teaching of science must be initiated.

7. A further study should be carried out on identifying the mechanisms the elementary school principal uses to supervise the science program, such as designated "science" coordinator within the teaching staff.

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APPENDIX A

BARGRAPHS

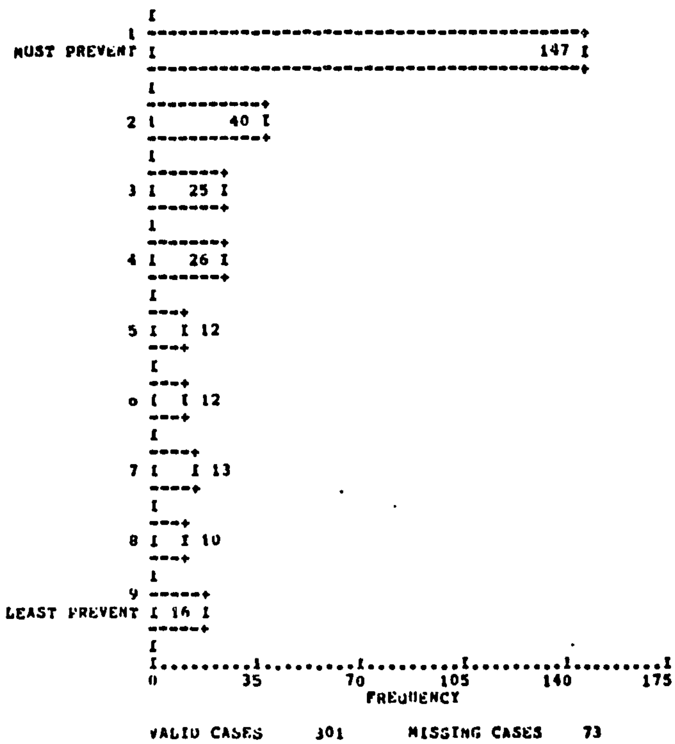


Figure A-1. Ranking of Reading and Math as a Factor Affecting Elementary School Science Teaching as Perceived by the Elementary School Principal.

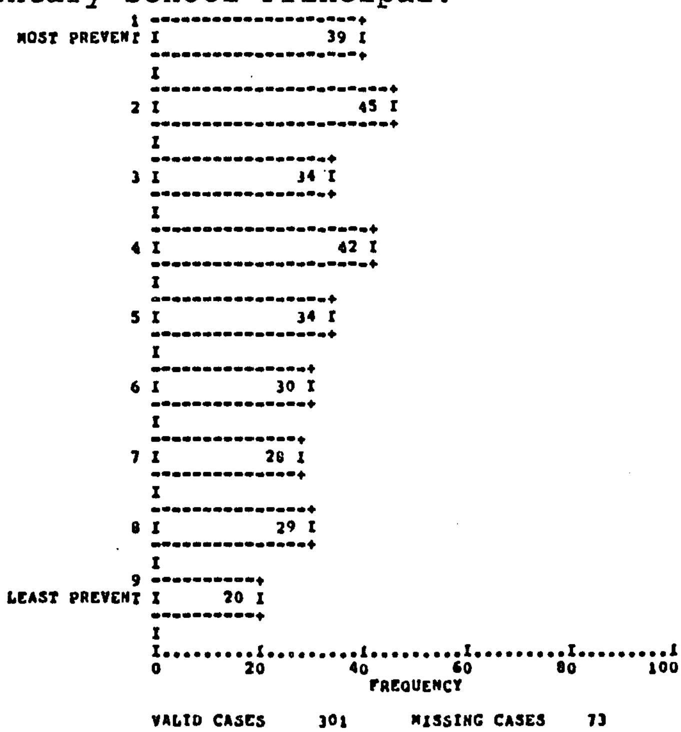


Figure A-2. Ranking of the Teachers' Lack of Understanding of Science Teaching Methods as a Factor Affecting Elementary School Science Teaching as Perceived by the Elementary School Principal.

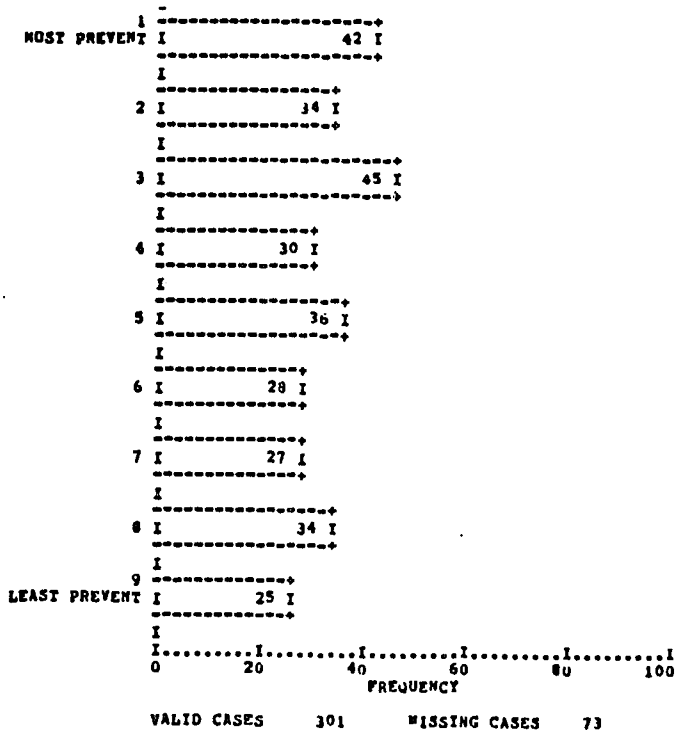


Figure A-3. Ranking of the Teachers' Insufficient Understanding of Science Concepts as a Factor Affecting Elementary School Science Teaching as Perceived by the Elementary School Principal.

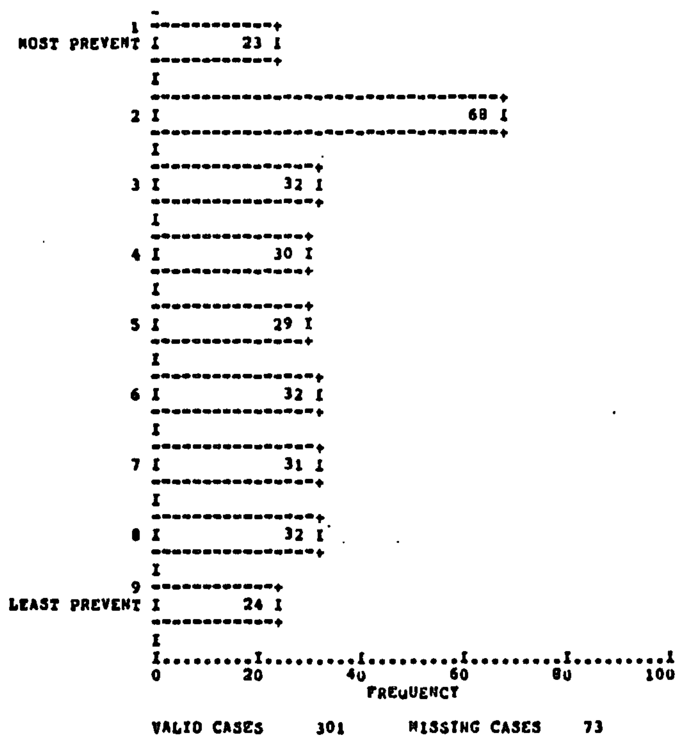


Figure A-4. Ranking of Insufficient Time to Teach Science as a Factor Affecting Elementary School Science Teaching as Perceived by the Elementary School Principal.

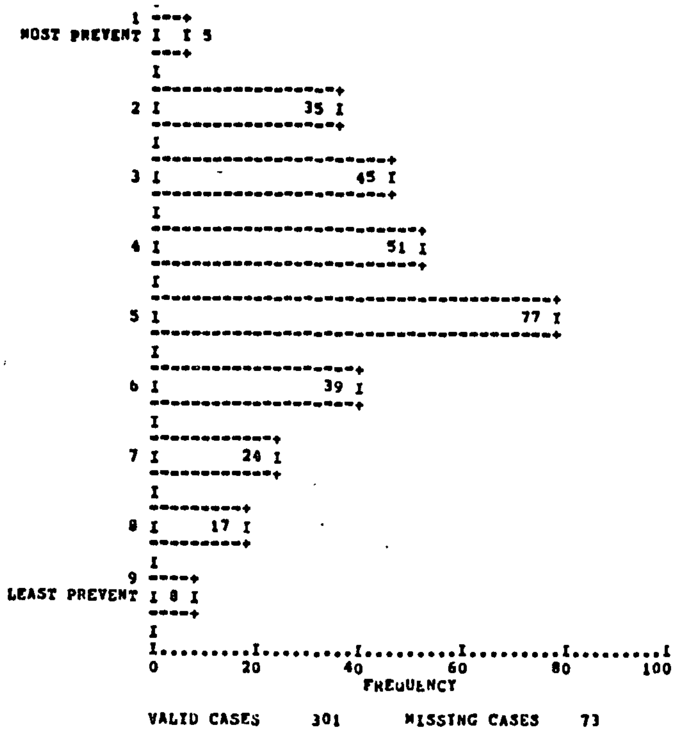


Figure A-5. Ranking of Inability to Improvise Science Materials as a Factor Affecting Elementary School Science Teaching as Perceived by the Elementary School Principal.

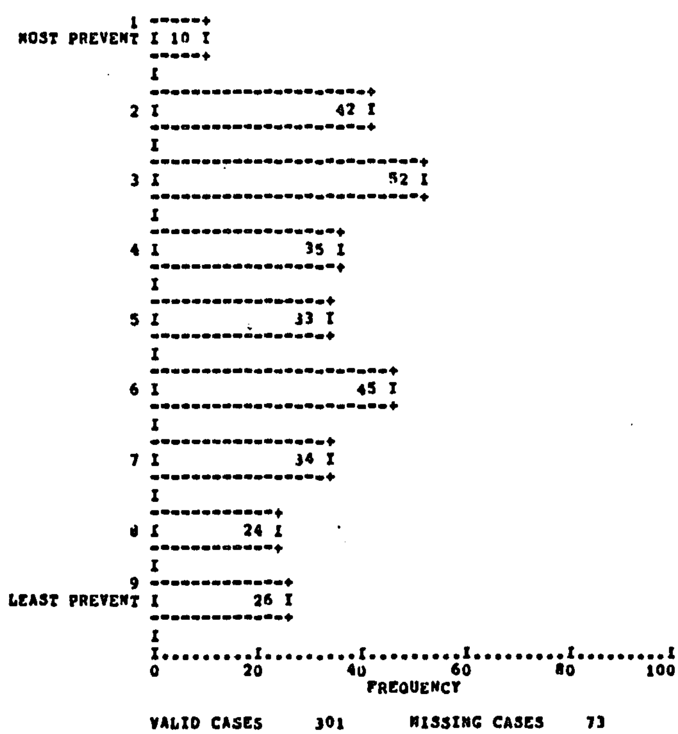


Figure A-6. Ranking of Inadequate Room Space to Teach Science as a Factor Affecting Elementary School Science Teaching as Perceived by the Elementary School Principal.

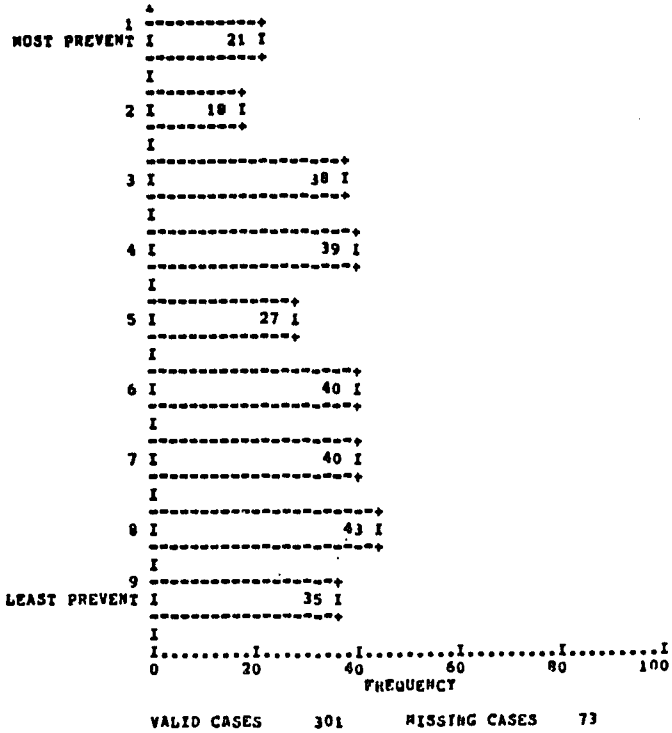


Figure A-7. Ranking of Lack of Supplies and Equipment as a Factor Affecting Elementary School Science Teaching as Perceived by the Elementary School Principal.

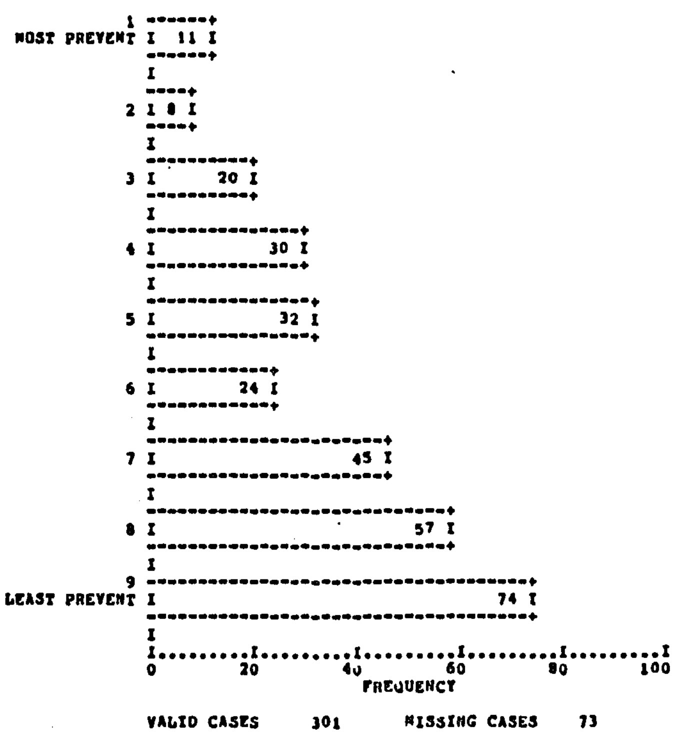


Figure A-8. Ranking of Insufficient Funds as a Factor Affecting Elementary School Science Teaching as Perceived by the Elementary School Principal.

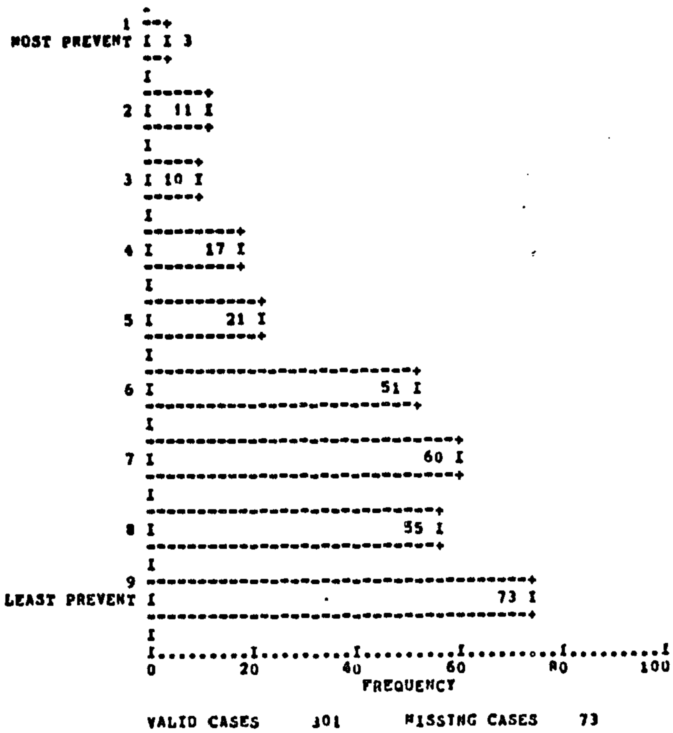


Figure A-9. Ranking of Inappropriate Textbook as a Factor Affecting Elementary School Science Teaching as Perceived by the Elementary School Principal.

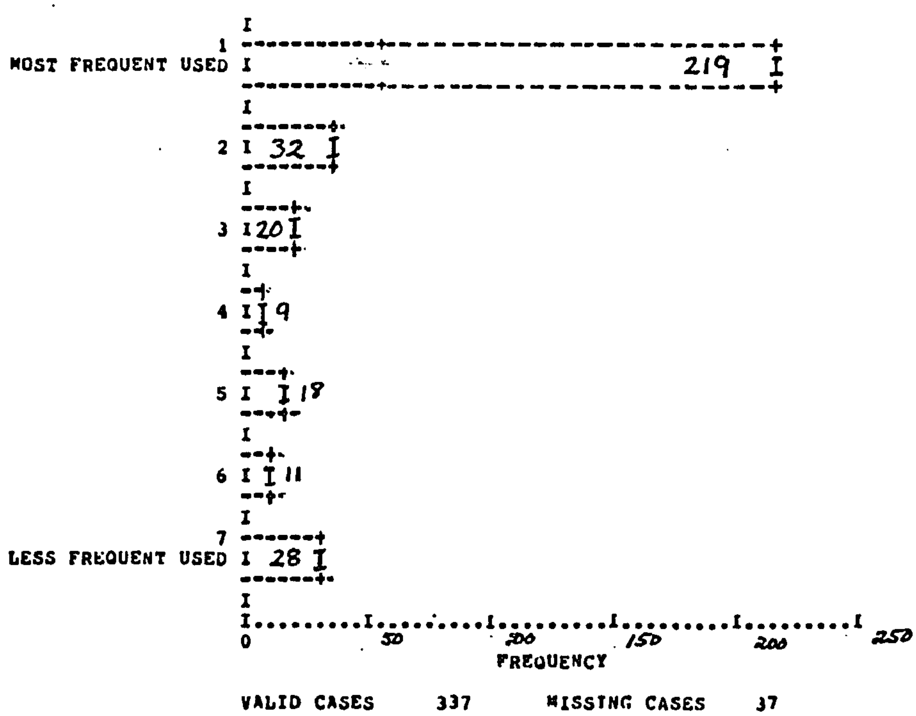
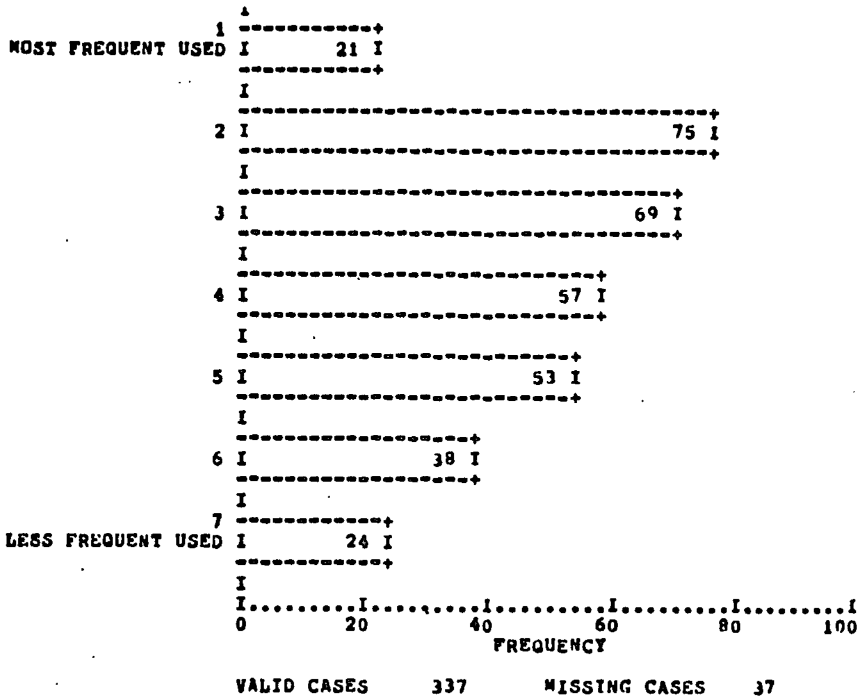
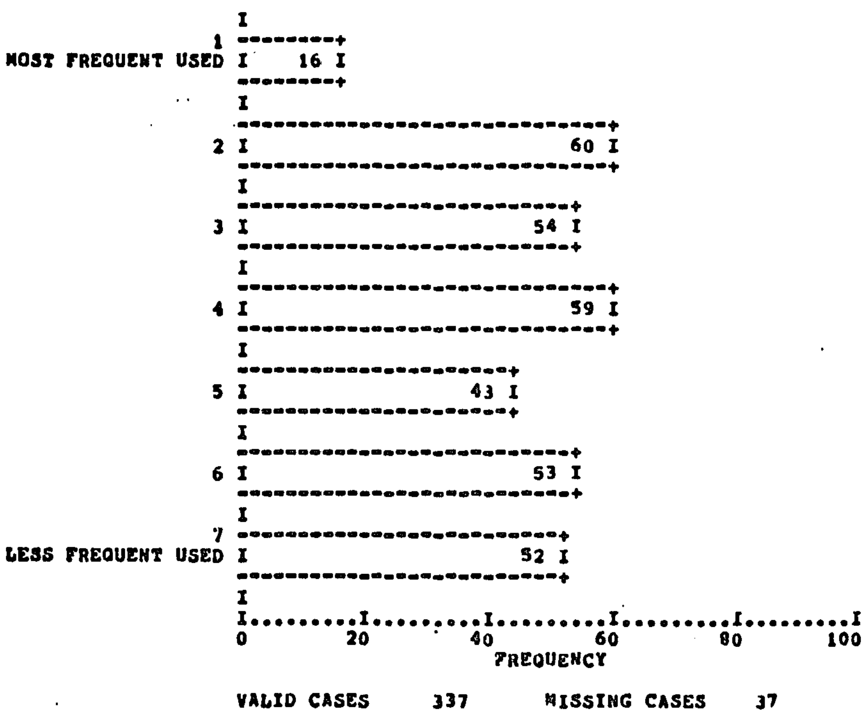


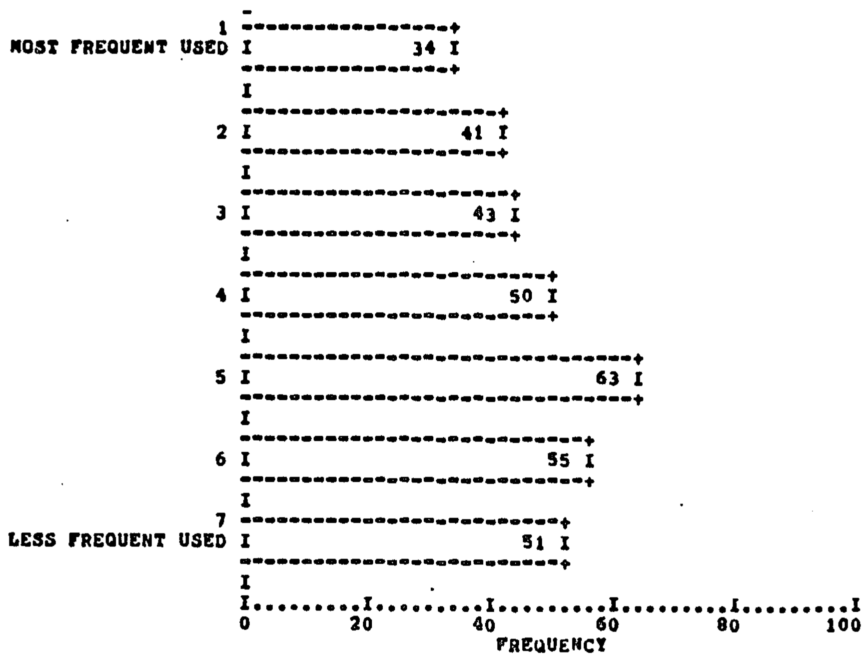
Figure A-10. Ranking of Lecture/Discussion as a Science Teaching Strategy Used in the Classroom as Perceived by the Elementary School Principal.



<u>Figure A-11</u>. Ranking of Demonstrations as a Science Teaching Strategy Used in the Classroom as Perceived by the Elementary School Principal.

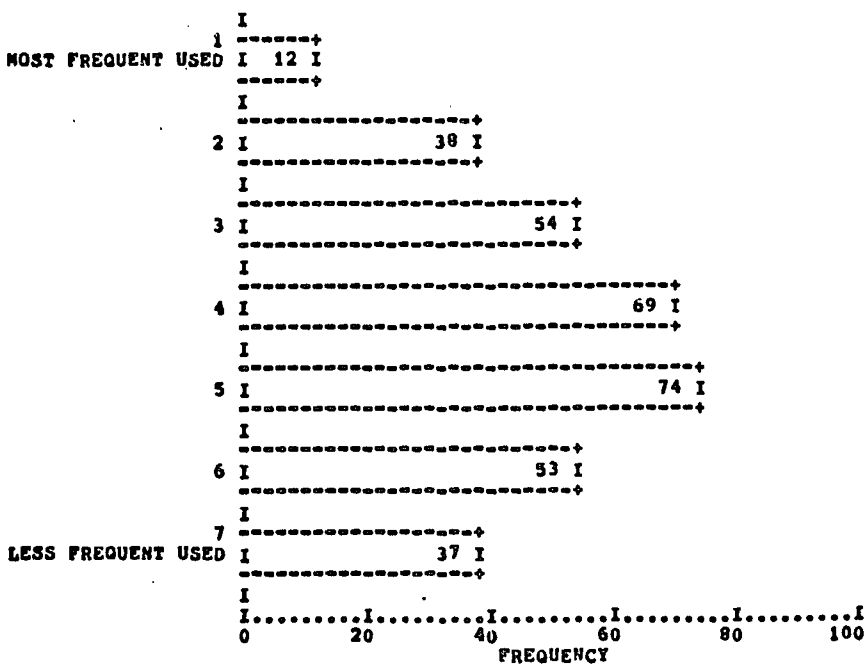


<u>Figure A-12</u>. Ranking of Film/Videotape as a Science Teaching Strategy Used in the Classroom as Perceived by the Elementary School Principal.



VALID CASES 337 MISSING CASES 37

Figure A-13. Ranking of "Hands on" Student Investigations as a Science Teaching Strategy Used in the Classroom as Perceived by the Elementary School Principal.



VALID CASES 337 MISSING CASES 37

Figure A-14. Ranking of Student Projects as a Science Teaching Strategy Used in the Classroom as Perceived by the Elementary School Principal.

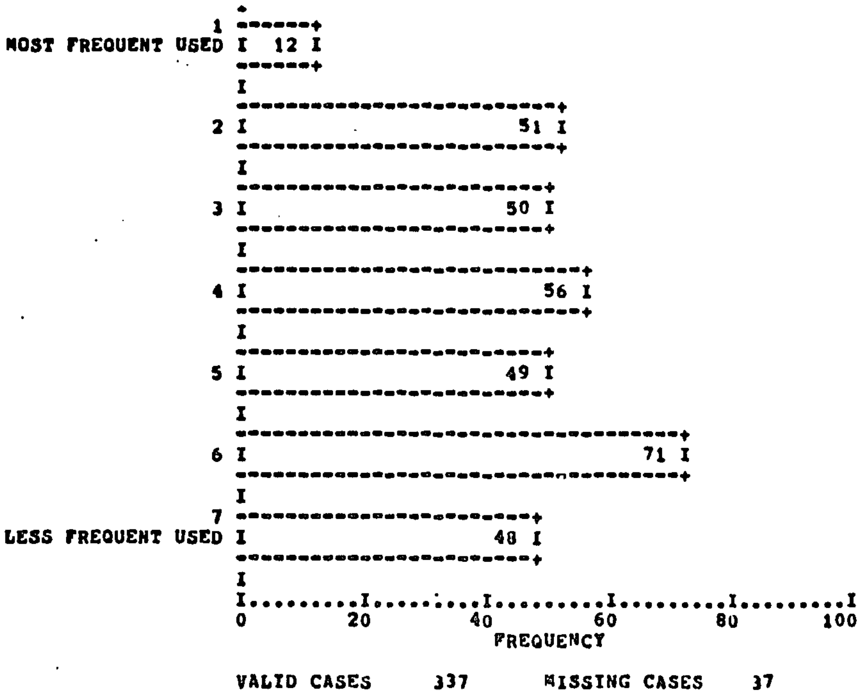


Figure A-15. Ranking of Small Groups as a Science Teaching Strategy Used in the Classroom as Perceived by the Elementary School Principal.

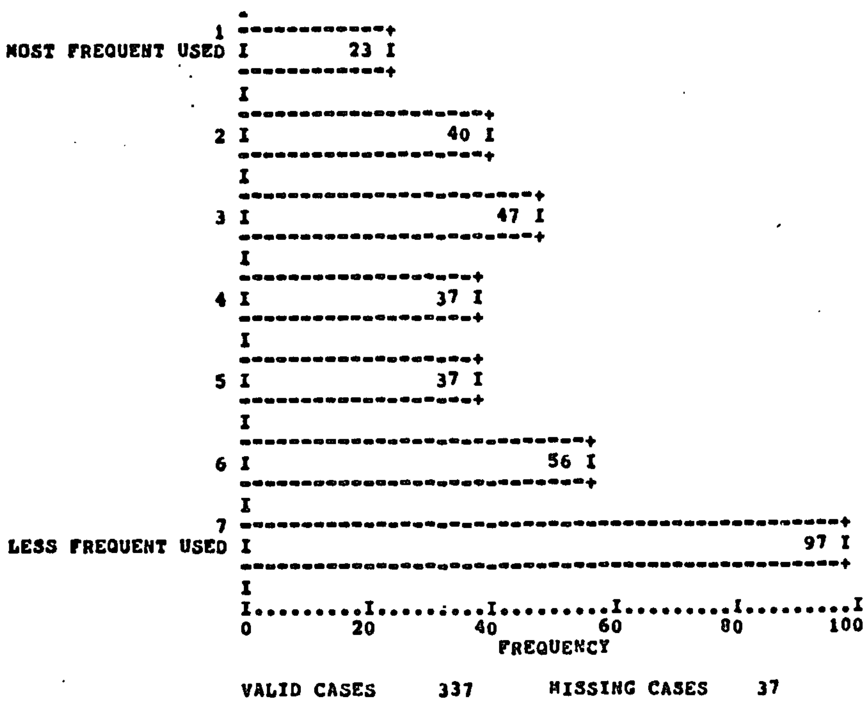


Figure A-16. Ranking of Learning Centers as a Science Teaching Strategy Used in the Classroom as Perceived by the Elementary School Principal.

APPENDIX B

LETTERS AND QUESTIONNAIRE

THE UNIVERSITY OF NORTH CAROLINA
AT GREENSBORO

March 24, 1986

School of Education

Mr Jerry Bland, Director
Management Information Systems
State Department of Public Instruction
Raleigh, North Carolina 27603

Dear Mr. Bland:

Thank you for discussing with me the request I am making regarding a research project we are undertaking relating to elementary school principals and their involvement with science teaching. Lucy Moore has been most cooperative in several phone calls I have had with her.

We are requesting name and school address labels for a random sample of 450 elementary school principals, grades K through 6.

If these address labels can be generated for us we will be glad to provide the labels. I will obtain the necessary information from Lucy Moore.

Of course, any information we obtain from this study will be available to the State Department of Public Instruction.

Thank you for this most beneficial assistance.

Sincerely,

Ernest W. Lee
Associate Professor

THE UNIVERSITY OF NORTH CAROLINA

AT GREENSBORO

April 22, 1986

School of Education

Dear ____________________:

The elementary school science curriculum in the North Carolina public schools has been receiving considerable attention in recent years. Pupils have been tested in science, teachers have participated in staff development, and funds have been allocated for science equipment.

We are currently interested in how the elementary school principal is involved in the science program at the local level. This study is being conducted because we feel the principal, as the instructional leader of the school, should be included in any evaluation of the elementary school science program.

You are being asked to share your opinion on this matter. Your name was drawn from a random sample of all North Carolina public school principals of schools containing any grade from K to 6. In order that the results will truly represent the thinking of elementary school principals across the state, it is important that the questionnaire be completed and returned.

You may be assured of complete confidentiality. The questionnaire has an identification number for mailing purposes only so that we may check your name off the mailing list when it is returned. Your name will never be placed on the questionnaire.

You may receive a summary of the results by writing "copy of results requested" on the back of the return envelope and printing your name and address below it. Please do not put this information on the questionnaire itself.

If you have a question, please call (919) 379-5100.

Thank you for your assistance.

Sincerely,

Dr. Ernest W. Lee — Associate Professor

Barbara B. Leonard — Research Associate

GREENSBORO, NORTH CAROLINA / 27412-5001

April 29, 1986

Last week a questionnaire seeking your opinion about the elementary school science program in your school was mailed to you. Your name was drawn in a random sample of N.C. principals of public schools containing any grade from K to 6.

If you have already completed and returned the questionnaire to us, please accept Dr. Ernest W. Lee's and my sincere thanks. If not, we would appreciate your early response.

This questionnaire has been sent to a small, but representative sample, which makes it extremely important that yours also be included in the study if the results are to accurately represent the opinions of North Carolina elementary public school principals.

Sincerely,

Barbara B. Leonard
Research Associate

THE UNIVERSITY OF NORTH CAROLINA

AT GREENSBORO

May 13, 1986

School of Education

Dear ______________________:

Dr. Ernest W. Lee and I wrote you recently seeking your opinion on the science program in your school. Our study is being conducted because we feel you, as principal, should be included in any evaluation of the elementary school science program. As of today, we have not received your completed questionnaire.

Your name was drawn from a random sample of all North Carolina public school principals of schools containing any grade from K to 6. In order that the results truly represent the thinking of elementary school principals across the state, it is important that the questionnaire be completed and returned.

In the event that your questionnaire has been misplaced, a duplicate is enclosed.

Your cooperation is greatly appreciated.

Cordially,

Barbara B. Leonard
Research Associate

BBL:bhm

Enclosure

GREENSBORO, NORTH CAROLINA / 27412-5001

THE UNIVERSITY OF NORTH CAROLINA *is composed of the sixteen public senior institutions in North Carolina*

an equal opportunity employer

THE ELEMENTARY SCHOOL SCIENCE PROGRAM

IN GRADES K-6

IN NORTH CAROLINA PUBLIC SCHOOLS:

A SURVEY

This survey is examining the elementary school science program in the North Carolina public schools, as viewed by principals, at grade levels K to 6. The areas being assessed include school facilities, school funding, inservice/staff development programs, staffing, and background preparation in science of principals.

NO NAMES are to be attached to the questionnaire. Please answer all the questions. If you wish to comment on any questions or qualify your answers, please feel free to use any free space including the back of this survey. Your comments will be read and taken into account.

Thank you for your help.

You are free not to respond and there is no penalty for not responding. The ID number is strictly for followup mailings. However, please know we feel this study is important and your response would be appreciated.

Please return this questionnaire to:

Barbara B. Leonard
School of Education
University of North Carolina - Greensboro
Greensboro, North Carolina 27412-5001

Please note that all questions apply only to grades K - 6.
Please circle your answers: 1. NO (2.) YES or ✓check the appropriate blanks.

YOUR SCHOOL FACILITIES AND EVENTS FOR SCIENCE

Does your school have any of the following facilities for teaching science?
(please circle an answer for each Q-number)

Q-1. NATURE TRAIL . . . . 1. NO 2. YES
Q-2. SEPARATE SCIENCE LAB OR RESOURCE ROOM. . . 1. NO 2. YES
Q-3. GREENHOUSE . . . . 1. NO 2. YES
Q-4. SCHOOL GARDEN. . . . . 1. NO 2. YES

Q-5. Have you initiated any facilities like those listed above in the past two years? (circle one)

1. NO
2. YES

Q-6. Has your school had a science fair in the past two years? (circle one)

1. NO
2. YES

YOUR SCIENCE INSERVICE/STAFF DEVELOPMENT PROGRAM

Q-7. Have you provided a science inservice workshop or staff development program for your teachers in your school this year? (circle one)

1. NO ⟶ GO TO Q-15
2. YES

(If yes...)
Which of the following personnel provided leadership for the most recent science inservice/staff development program held this year? (Questions 8-13)
(please check all answers that apply)

____Q-8. UNIVERSITY/COLLEGE CONSULTANT
____Q-9. REGIONAL SCIENCE CONSULTANT
____Q-10. TEXTBOOK CONSULTANT
____Q-11. SCHOOL SYSTEM STAFF
____Q-12. TEACHERS
____Q-13. OTHER (specify) ________________________________

Q-14. Who planned the most recent science inservice/staff development program? (please circle one)

1. YOU, THE PRINCIPAL
2. YOUR TEACHERS
3. SCIENCE OR OTHER SUPERVISORY PERSONNEL
4. A COMMITTEE OF TEACHERS AND PRINCIPAL
5. STATE/REGIONAL SCIENCE PERSONNEL
6. YOU, THE PRINCIPAL AND CENTRAL OFFICE STAFF

Q-15. Have you attended a science inservice workshop or staff development program with your teachers at any time in the past two years? (circle one)

1. NO
2. YES

Q-16. Have you attended any workshop/staff development program for principals in the past two years which has included a session for understanding the elementary school science curriculum? (please circle one)

1. NO
2. YES

YOUR LOCAL SCHOOL BUDGET

Do you have local school monies or petty cash for the following science related programs in your school? (please circle an answer for each Q-number)

Q-17. SCIENCE FIELD TRIPS (zoo,museums...) . . . . 1. NO 2. YES
Q-18. INSCHOOL PROGRAMS (Snakes Alive, Science Shows,etc.) . . . 1. NO 2. YES
Q-19. RELEASE TIME FOR TEACHERS TO ATTEND STATE SCIENCE MEETING. 1. NO 2. YES
Q-20. SCIENCE INSERVICE FOR TEACHERS . . . . 1. NO 2. YES
Q-21. SCIENCE SUPPLIES (consumables) . . . . 1. NO 2. YES

The state of North Carolina has allocated two dollars per child in grades K-6 for science and math materials. At your present school, what percent of these funds went towards SCIENCE purchases in the past two years?

Q-22. Last school year 1984-85 (circle one)

1. NONE
2. 1% - 25%
3. 26% - 50%
4. 51% - 75%
5. 76% - 100%
6. CENTRAL OFFICE DECISION
7. DO NOT KNOW
8. NOT A K-6 PRINCIPAL IN 84-85
9. OTHER (specify)__________________

Q-23. This school year 1985-86 (circle one)

1. NONE
2. 1% - 25%
3. 26% - 50%
4. 51% - 75%
5. 76% - 100%
6. CENTRAL OFFICE DECISION
7. DO NOT KNOW
8. OTHER (specify)__________

If NONE for Q-22 and Q-23, please go to question 29.

What staff members had input into the purchasing of science supplies with those state funds? (please circle an answer for each Q-number)

Q-24. THE PRINCIPAL . . . . 1. NO 2. YES
Q-25. TEACHERS WITH SPECIAL REQUESTS. . . . . . . 1. NO 2. YES
Q-26. MEDIA CENTER SPECIALISTS. . . . . 1. NO 2. YES
Q-27. COMMITTEE OF TEACHERS & PRINCIPAL . . . . 1. NO 2. YES
Q-28. OTHER . . .(specify)________________________________

YOUR TEACHING STAFF AND THE SCIENCE CURRICULUM

Q-29. What is the number of classroom teachers in your school? (circle one)

1. 1 TO 10 TEACHERS
2. 11 TO 21 TEACHERS
3. 22 TO 32 TEACHERS
4. 33 OR 43 TEACHERS
5. 44 OR MORE TEACHERS

Based upon your observations, rank the importance your teachers would assign to the following subjects.

Place ranking in blanks. 1 = MOST IMPORTANT SUBJECT TO TEACH
5 = LEAST IMPORTANT SUBJECT TO TEACH

____Q-30. MATH
____Q-31. PHYSICAL EDUCATION
____Q-32. READING/LANGUAGE ARTS
____Q-33. SCIENCE
____Q-34. SOCIAL STUDIES

Q-35. What is your opinion of the attitude <u>your</u> <u>teachers</u> exhibit towards the teaching of science? (circle one)

1. CONFIDENT WITH SCIENCE MATERIAL
2. MODERATELY COMFORTABLE WITH SCIENCE MATERIAL
3. NOT CONFIDENT WITH SCIENCE MATERIAL
4. NOT SURE HOW MY TEACHERS FEEL TOWARDS SCIENCE

A number of factors have been described as possible reasons for teachers not teaching science. On the order of 1 to 9, please rank how you perceive those factors which most likely prevent your teachers from teaching science.

Place ranking in blanks. 1 = MOST LIKELY TO PREVENT SCIENCE FROM BEING TAUGHT
9 = LEAST LIKELY TO PREVENT SCIENCE FROM BEING TAUGHT

____Q-36. LACK OF SUPPLIES AND EQUIPMENT
____Q-37. INABILITY TO IMPROVISE MATERIALS AND EQUIPMENT
____Q-38. INSUFFICIENT UNDERSTANDING OF SCIENCE CONCEPTS
____Q-39. EMPHASIS ON READING AND MATH
____Q-40. INSUFFICIENT TIME TO TEACH SCIENCE
____Q-41. INAPPROPRIATE TEXTBOOK
____Q-42. INADEQUATE ROOM FACILITIES
____Q-43. LACK OF UNDERSTANDING OF METHODS OF TEACHING SCIENCE
____Q-44. INSUFFICIENT FUNDS

Q-45. If you were to choose one teacher from your staff whom you feel is the "most effective" teacher of science, how often do you think this teacher teaches science? (please circle one)

1. TEACHES SCIENCE EVERY DAY
2. TEACHES SCIENCE EVERY OTHER DAY
3. TEACHES SCIENCE ONCE A WEEK
4. TEACHES SCIENCE ONLY, ALL DAY

Q-46. In your judgement, how many minutes would this "most effective" teacher spend <u>per</u> <u>science</u> <u>lesson</u>? (please circle one)

1. 15 TO 20 MINUTES
2. 20 TO 30 MINUTES
3. 30 TO 40 MINUTES
4. MORE THAN 40 MINUTES

Q-47. Do you have any teachers who teach only science in any grade K-6? (please circle one)

1. NO
2. YES

Q-48. Did you have any teachers to attend the North Carolina Science Teachers Association Annual Meeting in Raleigh, November 8 & 9,1985? (please circle one)

1. NO
2. YES WITH RELEASE TIME PAID BY THE TEACHER
3. YES WITH RELEASE TIME PAID FROM MY LOCAL SCHOOL BUDGET
4. YES WITH RELEASE TIME PAID FROM SCHOOL SYSTEM FUNDS

Are any of the following National Science Foundation curriculum projects, developed for elementary school science, currently being used in your school? (please circle an answer for each Q-number)

Q-49. ESS-ELEMENTARY SCIENCE STUDY. . . . . 1. NO 2. YES
Q-50. SCIS-SCIENCE CURRICULUM IMPROVEMENT STUDIES . . . . . . 1. NO 2. YES
Q-51. SAPA-SCIENCE: A PROCESS APPROACH. . . . . 1. NO 2. YES

Does your school system have any of the following staff members available to assist you with the science curriculum? (please check those that apply)

____Q-52. SCIENCE SUPERVISOR, ELEMENTARY
____Q-53. SCIENCE SUPERVISOR, K - 12
____Q-54. SCIENCE DEMONSTRATION TEACHER
____Q-55. SCIENCE CONSULTANT

Please rank how often you feel the following instructional strategies are used in teaching science at your school.

Place ranking in blanks. 1 = most frequently used strategy
7 = least frequently used strategy

____Q-56. DEMONSTRATION
____Q-57. FILM/VIDEOTAPE
____Q-58. PROJECTS (MAKING THINGS)
____Q-59. "HANDS ON" STUDENT INVESTIGATIONS
____Q-60. LECTURE/DISCUSSION
____Q-61. SMALL GROUP LEARNING
____Q-62. LEARNING CENTERS

Q-63. During this year you have made classroom observations for evaluation purposes. What percentage of your staff have you observed teaching a science lesson? (please circle one)

1. NONE
2. 1 TO 25%
3. 26% TO 50%
4. 51% TO 75%
5. 76% TO 100%

Q-64. Please list two visual clues found in a classroom that indicate the presence of science as an active part of that teacher's curriculum.

1.____

2.____

Finally,we would like to ask a few questions about your professional background.

Q-65. What was your undergraduate degree major?______________________

Q-66. Total experience as an elementary school (K-6) principal. (circle one)

1. LESS THAN ONE YEAR
2. 1 TO 5 YEARS
3. 6 TO 10 YEARS
4. 11 TO 15 YEARS
5. 16 TO 20 YEARS
6. 21 TO 25 YEARS
7. 26 OR MORE YEARS

Q-67. Prior to becoming a principal, were you a classroom teacher? (circle one)

1. NO
2. YES IN GRADES K TO 6 <u>WITH</u> A CONCENTRATION IN SCIENCE
3. YES IN GRADES 7 TO 12 <u>WITH</u> A SCIENCE CERTIFICATE
4. YES IN GRADES K - 12 <u>WITH</u> SCIENCE CONCENTRATION OR CERTIFICATE
5. YES IN GRADES K - 12 <u>WITHOUT</u> SCIENCE CONCENTRATION OR CERTIFICATE

A list of professional science education associations is given below. Please place a checkmark by those organizations in which you hold memberships.

____Q-68. NSTA---NATIONAL SCIENCE TEACHERS ASSOCIATION
____Q-69. NCSTA--NORTH CAROLINA SCIENCE TEACHERS ASSOCIATION
____Q-70. CESI---COUNCIL FOR ELEMENTARY SCIENCE INTERNATIONAL

Have you attended a North Carolina Science Teachers annual meeting which is held in November of each year? (please circle an answer for each Q-number)

Q-71. I DID THIS YEAR (1985). . . . . 1. NO 2. YES
Q-72. I DID LAST YEAR (1984). . . . . 1. NO 2. YES
Q-73. I HAVE ATTENDED PREVIOUS TO 1984. . . . . 1. NO 2. YES

Q-74. Have you heard or read about the "Project for Promoting Science Among Elementary School Principals" sponsored by the National Science Teachers Association? (please circle one)

1. NO
2. YES
3. YES AND I HAVE UTILIZED THE "PROJECT'S" CHECKLIST

The elementary school curriculum is multifaceted. As principal, please rank the priority YOU give to each of the following curriculum areas in your school.

Place ranking in blanks. 1 = TOP PRIORITY
5 = LEAST IN PRIORITY

____Q-75. MATH
____Q-76. PHYSICAL EDUCATION
____Q-77. SCIENCE
____Q-78. READING/LANGUAGE ARTS
____Q-79. SOCIAL STUDIES

Q-80. How do you rate your own satisfaction in handling the science curriculum for your school? (circle one)

1. VERY HIGH SATISFACTION
2. MODERATELY HIGH SATISFACTION
3. COMFORTABLE WITH SCIENCE
4. MODERATELY LOW SATISFACTION
5. VERY LOW SATISFACTION

Q-81. Your sex. (circle one)

1. FEMALE
2. MALE

Q-82. Your age. (Circle one)

1. 21 - 29 YEARS
2. 30 - 39 YEARS
3. 40 - 49 YEARS
4. 50 OR MORE YEARS

Is there anything else you would like to share with us about the science program at your school? If so, please use this space for that purpose.

Your contribution to this effort is very greatly appreciated. If you would like a summary of the results, please print your name and address on the back of the return envelope (NOT on this questionnaire). We will see that you get a copy.

APPENDIX C

RAW DATA

APPENDIX C

Raw Data

YOUR SCHOOL FACILITIES AND EVENTS FOR SCIENCE

Table C-1

Percentage of Schools with Special Science Facilities

Facility	n[a]	Percentage[b]
Q 1. Nature Trail	88	23.5
Q 2. Science Lab	85	22.7
Q 3. Greenhouse	19	5.1
Q 4. School Garden	51	13.6

Note. Total cases = 374.
aNumbers of respondents indicated yes.
bPercentage of total cases including non respondents.

Table C-2

Percentage of Principals Who Initiated Facilities and/or Held Science Fairs in the Past Two Years

Principals' Response		n	Percent
Q. 5 Initiated facilities:	yes	112	29.9%
	no	262	70.1%
Q. 6 Held science fair:	yes	231	61.8%
	no	143	38.2%

YOUR SCIENCE INSERVICE/STAFF DEVELOPMENT PROGRAM

Table C-3

Percent of Principals Providing a Science Inservice Program For Teachers This Year, 1985-86.

Principals' Response		n	Percent
Q. 7 Science inservice workshop this year	yes	150	40.1%
	no	224	59.9%

Note. Those principals responding "yes" were only ones to answer Q. 8 - 14.

Table C-4

Type Leadership Provided for Most Recent Science Inservice Program

Personnel	n	Percent
Q. 8 University/College Consultant	22	5.9
Q. 9 Regional Science Consultant	64	17.1
Q.10 Textbook Consultant	19	5.1
Q.11 School System Staff	72	19.3
Q.12 Teachers	53	14.2
Q.13 Other:	26	7.0

Note. Represents those Principals of the 40.2 who responded "yes" to inservice. More than one response could be made. Valid cases = 150. Missing cases = 224.

Table C-5

Personnel Who Planned the Most Recent Inservice Program for Science

Q. 14 Personnel	n	Percent	Valid Percent[a]
The principal	32	8.6	21.6
The teachers	5	1.3	3.4
Science/supervisory staff	37	9.9	25.0
Committee of teachers and principal	33	8.8	22.3
State/regional staff	5	1.3	3.4
Principal and Central Office staff	30	8.0	20.3
Other combinations	6	1.6	4.2

Note. [a] Represents the percentage of the 40.1% of the respondents who marked "yes" for inservice this year.Only one answer could be marked.
Valid cases = 148. Missing cases = 226.

Table C-6

Principals Participation in Inservice Activities

Activity		n	Percent
Q. 15 Participation with teachers in workshop	yes	154	41.2
	no	220	58.8
Q. 16 Participation in a principals workshop for science	yes	171	45.7
	no	203	54.3

YOUR LOCAL SCHOOL BUDGET

Table C-7

Percentage of Principals With Local School Monies For Elementary School Science

Budget Area	n	Percent
Q. 17 Field trips	261	69.8
Q. 18 InSchool programs	218	58.3
Q. 19 Release time NCSTA meeting	232	62.0
Q. 20 Science inservice	246	65.8
Q. 21 Science supplies (consumables)	344	92.0

Note. Percentage is for "yes" ans. Each Q. has n=374.

Table C-8

Percentage of N. C. Science/Math Money Allocated by Principals for Science during 1984-85 School Year.

Q. 22 Funding Level	n	Percent
None	14	3.7
1% to 25%	35	9.4
26% to 50%	96	25.7
51% to 75%	73	19.5
76% to 100%	109	29.1
Central office decision	20	5.3
Do not know	14	3.7
Not a K-6 principal this year	10	2.7
No response	3	.9
Total	374	100.0

Table C-9

Percentage of N.C. Math/Science Money Allocated by Principals for Science during 1985-86 School Year

Q. 23 Funding Level	n	Percent
None	12	3.2
1% to 25%	24	6.4
26% to 50%	96	25.7
51% to 75%	80	21.4
76% to 100%	126	33.7
Central office decision	22	5.9
Do not know	10	2.7
No response	4	1.0
Total	374	100.0

Table C-10

Percentage of Staff Members Involved in Planning Purchases of Science Equipment with State Monies.

Staff Member(s)	n	Percent
Q. 24 The Principal	218	58.3
Q. 25 Teachers with special requests	237	63.4
Q. 26 Media Center Specialists	181	48.4
Q. 27 Committee of Teachers & Principal	224	59.9
Q. 28 Other	42	11.2

Note. Respondents could check more than one answer.

YOUR TEACHING STAFF AND THE SCIENCE CURRICULUM

Table C-11

Number of Classroom Teachers in Principal's School

Q. 29 Number of Teachers	n	Percent	Cum.Percent
1 to 10 Teachers	46	12.3	12.3
11 to 21 Teachers	178	47.6	59.9
22 to 32 Teachers	99	26.5	86.4
33 to 43 Teachers	37	9.9	96.3
44 or More Teachers	13	3.5	99.8
No response	1	.2	100.0
	374	100.0	

Table C-12

Principals Perceptions of How Teachers Would Rank Five Elementary School Subjects

Subject	Rank by Percentage								
	1	1.5	2	2.5	3	3.5	4	4.5	5
Q. 30 Math	2.1	-	91.2	-	1.9	-	.3	-	-
Q. 31 Physical Education	-	-	-	-	4.5	-	6.7	-	84.2
Q. 32 Reading/ Lang.arts	93.0	-	1.6	-	.8	-	-	-	-
Q. 33 Science	.3	-	1.9	-	59.1	.8	30.7	.3	2.4
Q. 34 Social studies	-	-	.8	-	28.3	.8	56.7	.3	8.6

Note. n = 374, No Response = 17 or 4.5% added to each Q.

Table C-13

Principals' Perception of Teachers' Attitude Towards Science Teaching

Q. 35 Principal's Opinion	n	Valid Percent	Cumulative Percent
Confident With Science Material	62	16.7	16.7
Moderately Comfortable With Science Material	242	65.1	81.7
Not Confident With Science Material	53	14.2	96.0
Not Sure How My Teachers Feel Towards Science	11	2.9	98.9
Other	4	1.1	100.0

Note. The valid percent = 372 cases, 2 cases missing.

Table C-14

Principals' Ranking by Percent of Factors Affecting the Teaching of Science.

	Rank								
Factor	1	2	3	4	5	6	7	8	9
Rank 1 - Most likely to prevent science from being taught.									
Q. 36 Lack of supplies and equipment.									
	7.0	6.0	12.6	13.0	9.0	13.3	13.3	14.3	11.6
Q. 37 Inability to improvise.									
	1.7	11.6	15.0	16.9	25.6	13.0	8.0	5.6	2.7
Q. 38 Insufficient understanding of science concepts.									
	14.0	11.3	15.0	10.0	12.0	9.3	9.0	11.3	8.3
Q. 39 Emphasis on reading and math.									
	48.8	13.3	8.3	8.6	4.0	4.0	4.3	3.3	5.3
Q. 40 Insufficient time to teach science.									
	7.6	22.6	10.6	10.0	9.6	10.6	10.3	10.6	8.0

Table C-14 (Continued)

Factor	Rank 1	2	3	4	5	6	7	8	9
Q. 41 Inappropriate textbook.									
	1.0	3.7	3.3	5.6	7.0	16.9	19.9	18.3	24.3
Q. 42 Inadequate room facilities.									
	3.3	14.0	17.3	11.6	11.0	15.0	11.3	8.0	8.6
Q. 43 Lack of understanding of methods of teaching science.									
	13.0	15.0	11.3	14.0	11.3	10.0	9.3	9.6	9.6
Q. 44 Insufficient funds.									
	3.7	2.7	6.6	10.0	10.6	8.0	15.0	18.9	24.6

Note. n = 301, missing cases = 73 (19.5% of total sample).

Table C-15

Perception of Frequency and Time the Principal Observed the "Most Effective" Teacher of Science Spending.

Category	n	Percent
Q. 45 Frequency of teaching science[a]		
Teaches science every day	221	59.1
Teaches science every other day	137	36.6
Teaches science once a week	7	1.9
Teaches science only, all day	7	1.9
Other teaching times	2	.5
Q. 46 Time spent teaching science per lesson[b]		
15 to 20 minutes	8	2.1
20 to 30 minutes	82	21.9
30 to 40 minutes	188	50.3
More than 40 minutes	94	25.1
Other responses	2	.6

Note. a n = 374 b n = 374.

Table C-16

Percentage of Principals With Teachers Who Taught Only Science In Any Grade K-6

Response	n	Percent
Q. 47		
Yes	38	10.2
No	336	89.8

Table C-17

Method of Release Time Payment for Teachers' Attendence At NC Science Teachers Association Annual Meeting

Q. 48 Method	n[a]	Percent[b]
Release time paid by teacher	1	.3
Release time paid from my local school budget	18	4.8
Release time paid from school system funds	42	11.2
Release time paid partially local and system funds	2	.5
Totals	63	16.8

Note. [a] Total cases = 374, No = 309, 2 = msg. cases
[b] 82.6% = No, .5% = missing cases.

Table C-18

Percentage of Reported Use of NSF Science Curricula

Curriculum	n		Percent
Q. 49 - ESS (Elementary School Science)	27	[yes]	7.2
Q. 50 - SCIS (Science Curriculum Improvement Study)	100	[yes]	26.7
Q. 51 - S-APA (Science--A Process Approach)	4	[yes]	1.1

Note. n = 374 for each questions. [no] was other choice.

Table C-19

Support Staff in Science Available To Principals

Staff Member	n	Percent
Q. 52 Science Supervisor,Elementary	67	17.9
Q. 53 Science Supervisor, K - 12	116	31.0
Q. 54 Science Demonstration Teacher	19	5.1
Q. 55 Science Consultant	46	12.3

Note. Respondents could check more than one answer.

Table C-20

Principals' Perceptions by Percentage Rank of Use of Instructional Strategies for Science

Strategy	Most often 1	2	Percent By Rank [Observed Use] 3	4	5	Least often 6	7
Q. 56 Demonstration	6.2	22.3	20.5	16.9	15.7	11.3	7.1
Q. 57 Film/videotp	4.7	17.8	16.0	17.5	12.8	15.7	15.4
Q. 58 Projects	3.6	11.3	16.0	20.5	22.0	15.7	11.0
Q. 59 Hands-on Exp	10.1	12.2	12.8	14.8	18.7	16.3	15.1
Q. 60 Lecture/ discussion	65.0	9.5	5.9	2.7	5.3	3.3	8.3
Q. 61 Small groups	3.6	15.1	14.8	16.6	14.5	21.1	14.2
Q. 62 Centers	6.8	11.9	13.9	11.0	11.0	16.6	14.2

Note. Valid cases = 337, Missing cases = 37.

Table C-21

Percentage of Teachers Observed During a Science Lesson By Principals

Q. 63 Proportion of Teachers	n	Percent
1 to 25%	243	65.0
26 to 50%	53	14.2
51 to 75%	14	3.7
76 to 100%	21	5.6
None	37	9.9
No response	6	1.6
Total	374	100.0

Table C-22

<u>List of Visual Clues in a Classroom Reported by Principals Indicating Presence of Science In The Teacher's Curriculum</u>

Key Word and Number	Descriptive Phrase	
Centers	"learning centers"	"resource centers"
	"'used' science centers"	"centers in classrooms"
137 responses	"science learning centers"	"science centers (plants growing, rock collections, etc.)"
	"science interest centers"	"science centers or areas"
	"centers"	
	"interest centers"	"science display centers"
	"centers with science as a major topic"	"learning center activities"
	"science activities in centers"	"active science center"
	"science centers planned on a regular basis"	"student displays of student made centers"
	"activity centers"	"centers with student's displays of experiments, etc."
	"'hands on' science learning center"	"center-an on-going going experiments"
	"science center in every room"	
	"science center(instructional, on-going"	"centers with actual objects"
		"'garden centers' on window ledges"

Key Word and Number		Descriptive Phrase
[centers] [con't]	"science equipment in centers for student use" "science centers with "hands on" equipment available"	"science centers with a microscope, magnifying galss,etc."
Science Equipment 162 responses	"models" "equipment" "SCIIS kit" "manipulatives" "lab equipment set up"	"Halleys Comet" "science equipment and materials being used" "portable science labs" "Portolab"
(Materials, models, specimums.)	"a microscope" "a test tube" "systems of body (human) displayed" "collections" "lab equipment"	"SCIIS projects set up" "science kits accessible" "bunsen burner" "exhibits of science collections -insects, minerals, etc."
	"scales,pulleys,batteries, bulbs,switches" "microscopes-equipment-materials" "rock collections"	"used science equipment" "science materials. i.e. microscopes,micro-slide viewers & text folders"
	"animal or insect displays" "science equipment present in the classroom without dust on it" "materials on hand..."	"some utensils" "resource materials--charts, posters, pictures" "science tables"

Key Word and Number	Descriptive Phrase	
[science equipment] con't.	"displays of students' science projects and/or papers" "a particular area of a room in which 'science' objects i.e. "hands on science manipulatives" "chart of earth's crust"	"science lab being established in fourth grade." "sharks teeth, shells & skeleton" "plastic organs" "soil samples/bacteria "portable science lab table"
	"science tables" "collections (rock,shells,etc) "science oriented things for children to look at and touch. "insect collections" "collections (rock,shells,etc.)" "science equipment"	"science laboratory is being "SCIIS kit" established in the fourth grade" "micro computers" "area with 'discovery' materials such as magnets, magnifying glasses, etc."
	"visible science/discovery learning tools" "paraphernalia" "speciumums such as frogs, snakes" "science equipment and supplies"	"science equipment" "adequate equipment" "science equipment visible" "science 'objects': models,..." "sound vibration equipment"
	"science related charts and posters" "a large variety of science materials" "astronomy display" "model of human body" "charts, maps and graphs with reference to science"	"science kit, weather report & observation chart" "charts" "posters" "science charts" "availability of science equipment"

Key Word and Number	Descriptive Phrase	
[science equipment] con't	"active use of apparatus" "concept charts" "dissecting equipment and jars of worms" "lawn motor parts" "equipment for observing monitoring, testing,etc."	"science posters/art work" "presence of a microscope, slides, pond water, etc." "charts & maps & graphs" "clay dinosaurs" "science-oriented 'things' for children to look at and touch"
Living Organisms 80 responses	"live animals/plants" "aquarium" "plant life" "live fish, insects, animals" "displays (living animals)"	"flowers" "live frogs, crickets, and lizards" "halved-milk cartons with lettuce seeds strewn on top"
	"live organisms-plants, fish, fruit flies, etc." "courtyard plantings" "ant farms" "plants" "plants and animals"	"plants in different stages" "gerbils" "plants and animals growing" "animals, plants, rocks, etc." "small greenhouses, plants" "reptile"
	"nests around room" "baby chicks hatching" "plants growing (seeds planted by students" "plants in classroom"	"terrariums" "live animals and insects" "living plants and animals" "a terrarium & aquarium in every room"

Key Word and Number		Descriptive Phrase
Living Organisms [con't]	"animals - earthworms - crickets - chameleon" "sprouting seeds" "live animal studies" "growing plants in milk cartons"	"presence of pond water..." "live plants" "hatching butterflies" "larva box" "aquariums (fish & plant), hamster cages"
Project(s) 140	"projects" "science projects" "students science projects" "student projects" "student projects on display"	"plant projects" "projects displayed in centers" "projects exhibited or on going" "class projects"
	"student projects displayed" "NASA projects/pictures" "projects by students" "science projects on display" "science fair projects"	"SCIIS projects set up" "small project materials such" wire, rocks... " "projects made by students and/or teachers"
	"projects or activities being displayed" "students projects and work" "science projects--6th grade" "projects displayed" "display of science projects in classroom" "projects in progress"	"projects on display in classroom and in media center" "presently one teacher has projects around the room" "various types of projects in" each room" "projects (plant beds, aquarium, science fair, etc.)

Key Word and Number		Descriptive Phrase
[projects] con't	"several science projects used for decor of room" "displays of students' science projects and/or papers"	"projects done by children"
bulletin board 115 responses	"science bulletin board" "bulletin board of childrens work" "boards" "student bulletin boards" "bulletin boards with science themes"	"functional science bulletin board" "student bulletin boards" "bulletin boards in science areas" "related bulletin boards"
	"bulletin boards reflects concentration on science as a discipline" "bulletin boards on science concepts"	"bulletin boards on science and health (usually combined)" "bulletin boards indicating unit study" "weather bulletin boards"
	"vocabulary words on bulletin board" "bulletin boards reflect science units"	"bulletin board displays" "bulletin boards depicting science concepts" "bulletin boards related to science"

Key Word and Number		Descriptive Phrase
display 43 Responses	"sketches displayed in rooms and and hallways" "student displays"	"displays" "science displays"
Other	"following daily schedule" "on-going experiments" "science articles posted" "field trips" "lesson plans available on a regular basis"	"daily schedule-I see it taught. "experiments" "student activities" "artifacts (science)" "science experiments" "student drawings"
	"books, materials" "textbook" "observed experiment" "exhibits and etc." "directions posted"	"film" "lab work" "lesson plans" "availability of science books and materials"
	"assignment list" "demonstrations" "films and filmstrips" "student written work" "pupil-made mobiles"	"audio-visuals" "classroom library containing science books" "detailed lesson plans" "library books"
	"teacher plan book" "Books on Science (I require)" "posted science objectives"	"students participating in science activities" "Experiments in progress"

Key Word and Number		Descriptive Phrase
[Other]	"Writing lessons on charts- created by students as they write about what they have experienced."	"demonstration teaching"
		"drawing"
		"science experiments being done done by students"
	"learning modules/areas"	"hands on"
	"demonstrations in evidence"	"requirements on assignment board"
	"active involvement of students in hands on activities"	"students' readiness"
	"development of a lab"	"teachers(2) employed to teach science in grades 5 & 6"
	"frequent science experiments"	
	"supplmentary books"	"science notebook"

Table C-23

Percentage of Principals with Undergraduate Majors in Science*

Q. 65 Undergraduate Major	n	Percent
Science	47	12.6
Other	318	85.0
No response	9	2.4
Totals	374	100.0

*Biology, Physics, Chemistry, and Earth Science.

Table C-24

Years of Experience as a K-6 Level Principal

Q. 66 Total Years	n	Percent
Less than one	25	6.7
1 to 5 years	91	24.3
6 to 10 years	85	22.7
11 to 15 years	66	17.6
16 to 20 years	49	13.1
21 to 25 years	31	8.3
26 or more years	25	6.7
No response	2	.6
	374	100.0

Table C-25

Percent of Principals With Classroom Teaching Experience

Q. 67 Classroom Experience	n	Percent
No Classroom Experience	44	11.8
Grades K-6 With Science	25	6.7
Grades 7-12 With Science	52	13.9
Grades K-12 With Science	18	4.8
Grades K-12 Without Science	226	60.4
No Response	9	2.4
Total	374	100.0

Table C-26

Percentage of Principals with Membership in Science Education Professional Associations.

Professional Association	n	Percent
Q. 68 National Science Teachers Association	13	3.5
Q. 69 NC Science Teachers Association	8	2.1
Q. 70 Council for Elementary Science, Intl.	0	0.0

Table C-27

Principals' Attendance at NC Science Teachers Association Meetings.

Year of Attendance	n	Percent
Q. 71 November, 1985 (This year)	1	.3
Q. 72 November, 1984 (Last year)	8	2.1
Q. 73 Previous to November, 1984	47	12.6

Table C-28

Principals' Awareness and Use of "Project for Promoting Science Among Elementary School Principals" Series.

Q. 74 Condition of Awareness	n	Percent
"No, I have not heard of it."	240	64.2
"Yes, I have heard of it".	123	32.9
"Yes and I have utilized the checklist".	3	.8
No response	8	2.1
Totals	374	100.0

Table C-29

Principals' Ranking of Five Elementary School Subjects

	Rank by Percentage				
Subject	1	2	3	4	5
Q. 75 Math	2.4	86.4	4.0	.3	.3
	[.3]				
Q. 76 Physical Education	0	0	7.5	11.2	74.6
				[.3]	
Q. 77 Science	.8	3.7	64.2	22.2	1.6
			[.8]	[.3]	
Q. 78 Reading/ Lang.arts	90.1	2.4	.5	.3	0
	[.3]				
Q. 79 Social studies	0	.8	16.6	58.3	16.6
			[.8]	[.5]	

Note. n = 374, None response = 24 or 6.4% to each Q.
[] represent a fractional rank such as 1.5,2.5,3.5,& 4.5.

Table C-30

Principals Satisfaction on Ability to Supervise the Elementary School Science Curriculum

Q. 80 Rating	n	Percent
Very high satisfaction	31	8.3
Moderately high satisfaction	80	21.4
Comfortable with science	167	44.7
Moderately low satisfaction	81	21.7
Very low satisfaction	13	3.5
No response	2	.4
	374	100.0

Table C-31

Sex of Principals

Q. 81 Sex	n	Percent
Female	88	23.5
Male	284	75.9
No response	2	.6
	374	100.0

Table C-32

Age of Principals

Q. 82 Age	n	Percent
21 to 29 years	2	.5
30 to 39 years	75	20.1
40 to 49 years	158	42.2
50 or more years	136	36.4
No response	3	.8
	374	100.0

Table C-33

Grade Level of Principals' Schools

Grade Level	n	Percent	Cumulative Percent
K-2	10	2.7	2.7
K-3	31	8.3	11.0
K-4	12	3.2	14.2
K-5	80	21.4	35.6
K-6	114	30.5	66.0
K-7	2	.5	66.6
K-8	39	10.4	77.0
K-12	5	1.3	78.3
1-3	1	.3	78.6
1-6	3	.8	79.4
2-5	1	.3	79.7
2-6	1	.3	79.9
3-5	1	.3	80.2
3-6	4	1.1	81.3
3-8	1	.3	81.6
4-5	6	1.6	83.2
4-6	14	3.7	86.9
4-7	3	.8	87.7
4-8	11	2.9	90.6
5-6	3	.8	91.4
5-7	2	.5	92.0
5-8	3	.8	92.8
5-9	1	.3	93.0
6-7	3	.8	93.9
6-8	22	5.9	99.7
6-12	1	.3	100.0
Total	374	100.0	