1984

Elementary teacher science background and interest: The relationship with science teaching patterns

Larry E. Johnson

California State College

San Bernardino

ELEMENTARY TEACHER SCIENCE BACKGROUND AND INTEREST: THE RELATIONSHIP WITH SCIENCE TEACHING PATTERNS

A Project Submitted to

The Faculty of the School of Education

In Partial Fulfillment of the Requirements of the Degree of

Master of Arts

in

Education: Elementary Option

By

Larry E. Johnson

San Bernardino, California

May 30, 1984

APPROVED BY:

[redacted]

Advisor

[redacted]

Committee Member

ELEMENTARY TEACHER SCIENCE BACKGROUND AND INTERESTS: THE RELATIONSHIP WITH SCIENCE TEACHING PATTERNS

Larry E. Johnson
California State College, San Bernardino, 1984

Statement of the Problem

Research indicates that teaching patterns in elementary science are inconsistent and generally unsatisfactory. It is possible that deficiencies in college preparation are a factor in the apparently poor state of the nation's elementary science programs. In addition, there are indications that teachers may avoid science because they lack confidence in their knowledge and do not feel a strong need to give science the same priorities as basic skills subjects.

The purpose of this project was to determine if there is a correlation between elementary teacher college preparation in science, practical experience, and/or special interests in science related topics and the number of minutes teachers spend teaching science in their classrooms.

Procedure

A questionnaire was circulated among 106 intermediate grade elementary teachers to collect data about teacher professional science preparation, practical science experience, interests in science related areas, and minutes per week spent teaching science. Eighty-nine teachers provided usable responses and the data was subjected to statistical test for significance by Chi-Square procedures.

Results

The statistical analysis of the data showed a statistically significant relationship at the .01 level of confidence between the time devoted to science and the amount of professional preparation, special science interests, and/or non-professional experiences involving science.

Conclusions and Implications

The study indicates that teachers who have strong professional science backgrounds or who exhibit interests in science related activities, tend to teach more minutes of science per week than their counterparts who do not. This does not correlate necessarily with teacher effectiveness or student achievement, but the nation's elementary science programs are the subject of frequent unfavorable comments in critiques of education in America.

State certification agencies may have to re-examine their criteria for awarding teacher certificates. More science may be needed.

Teacher education institutions could increase their standards to ensure that teacher candidates enter the ranks of teachers with full confidence to teach all subjects.

Administrators need to make sure that science programs are fully supported with clear guidance as well as with materials. Boards of education and school administration should expect the same high standards of excellence in science as they do in basic skills areas.

Teachers can use the results of this study to become fully aware that vast differences exist in science teaching patterns within school districts, and even within schools. Each teacher should be aware of his or her individual strengths and weaknesses and must take the necessary measures to make sure that elementary school children are not deprived of any part of the education they are entitled to.

TABLE OF CONTENTS

INTRODUCTION

Public education has always been a subject of major concern for American society. Recently, test scores across a broad range of academic subjects have been steadily declining and Scholastic Achievement Test results of high school seniors, a predictor of academic success in college, are significantly lower than those of a generation ago. Media attention has generated intense interest in discovering the causes for the apparent decline in the quality of American education. Studies and reports from various governmental and academic sources seem to reach some common conclusions; that American students are less skilled than their foreign counterparts in their ability to communicate effectively, to understand what they read, and to employ mathematics and scientific processes.

Various reasons for the general decline have been listed in the conclusions and findings of the reports. These range from lack of financial support to education, to problems with the family, and failure by public education to maintain high standards. One inference seems to be common throughout all the opinions and study results. Teachers seem to lack the quality and preparedness of those of earlier times. In fact, most of the remedies espoused in public contain recommendations of higher pay and stricter professional standards to attract higher quality people to become teachers.

One area that has received a great deal of attention in criticisms of education is the steady decline of science emphasis in schools. When the Soviet Union launched Sputnik

in 1957, America was jolted into the realization that someone else, our potential enemy, no less, had overtaken her in space technology. It was also clear that other areas of scientific leadership might be in jeopardy. This created a sense of urgency that a renewed commitment to academic excellence was in order. Science training became a high priority item and a high level of government support went into development of packaged training to assist teachers in upgrading the quality of science education. There were three prominent programs that evolved from this era.

"The Elementary Science Study" (ESS) emphasized a study of the relationships between man and his physical and biological environments. The authors felt that the most productive means for children to develop useful concepts of science as well as cognitive skills, was through free experiences with highly motivating science materials. Also, they believed that science concepts and cognitive skills should develop concurrently. As children interact with instructional materials, they acquire the strategies for handling observations as well as forming science concepts based on these experiences.[1]

The American Association for the Advancement of Science project called "Science - A Process Approach" (SAPA) was a total program, structured and sequential. This program was organized around process skills.[2]

---

[1]Gene D. Shepherd and William B. Ragen, Modern Elementary Curriculum (New York: Holt Rinehard, and Winston, 1982), p. 336.

[2]Ibid.

A third program, the "Science Curriculum Improvement Study" (SCIS), was also a total program, but less structured than SAPA and emphasized both process and content. It was designed to provide a sequential, articulated program of elementary science. Instruction was designed to reach students at their level of development and help them to acquire the concepts of science as seen by scientists. The instructional strategy consisted of providing laboratory experiences and allowing children to explore natural phenomena on their own. But instead of leaving them to their own devices, where erroneous ideas could emerge, children were guided toward the acquisition of certain concepts. The teacher provided ideas to help children organize and understand their experiences and then offered opportunities to apply these concepts in new contexts so that children could discover relationships and broaden their experiences.[3]

The three programs described above, as well as others, seemed to be moving science education in the right direction. What happened, then, to cause the alarming report "Our Nation is at Risk" because of education failures in reading, communication skills, mathematics, and science?

The root of the failure seems to lie elsewhere rather than in the post-Sputnik developed programs. These programs have received almost universal praise, but the foundations for implementation were weak. The programs were developed in

---

[3]Paul D. Hurd and James J. Gallagher, New Directions in Elementary Science Teaching (Belmont, California: Wadsworth Publishing Company, Inc., 1969), p. 101.

modular form, so that teachers could have the necessary materials and instructions conveniently at hand. Unfortunately, the materials proved to be costly, and often, as the original supplies were exhausted, they were not replaced. Many school districts did not purchase these programs at all because of the costs.[4]

In addition to the high cost of science materials, the teaching of science has remained at low priority at some schools and school districts for other reasons. Many school districts, in response to pressures brought by low scores on standardized tests in reading, language, and mathematics, have instituted "back to basics" education. These programs seem to emphasize the teaching of so called "basic skills" and place low priorities on science, social studies, health, and art. Principals feel the pressures of the need to improve "basic skill" areas because test results are published by local media, and their schools are compared with others. Therefore, many do not convey to the teachers they supervise their concern for solid programs in other areas. Elementary teachers, in general, are not well prepared to teach science, and since little emphasis is placed on it by school boards and administration, they have done little to improve their skills in this area.

The elementary teacher has a great deal of freedom in deciding what to teach and how to teach it. While instruction must generally follow certain guidelines or frameworks,

---

[4]Marjorie Gardner, "10 Trends in Science Education," The Science Teacher 46 (January 1979): 30-32.

teachers are not usually closely supervised in their day to day practices. Research has revealed great discrepancies in the amount of science instruction elementary children receive and the degree of effectiveness in its presentation. In fact, in reviewing three studies in 1979, DeRose, Lockard, and Paldy found that "fewer than half of the nation's elementary school children are likely to have even a single year in which their teachers will give science a significant share of the curriculum, and do a good job of teaching it."[5]

There seems to be a problem then, that rests with the elementary teacher. There are innuendos that elementary teachers are not drawn from the highest strata of university students for various reasons, including pay and prestige. There are also those who point out that teacher preparation does not include strong emphasis on science or the scientific thinking processes. It is against this background that a more closely defined problem begins to come into focus. Among other things, is lack of science background among elementary teachers a major factor in the apparent inconsistency of teaching patterns in elementary science? How important is it that elementary teachers be conversant in the terminology and processes of science? Are teachers who have received training in science more likely to teach science than those who have not? This study will attempt to find if there is a relationship between teacher background concerning science in terms of

---

[5]Judy R. Franz and Larry G. Enochs, "Elementary School Science: State Certification Requirements in Science and their Implications," Science Education 66 (April 1982): 287-292.

college courses taken, practical experience in science related field, or a special interest in science and how much science is taught in the elementary classroom.

REVIEW OF THE RELATED LITERATURE

There has been a great deal of research done recently in the area of elementary science education and many problems have been identified. They range across a broad spectrum, but one element seems to be present in almost every research article. It is extremely rare to find a consistently good science program in any school, or for that matter, in any district. Three studies were commonly referenced in the literature reviewed by this writer. These studies, (Fitch and Fisher, 1979), (Stake and Easley, 1978), and (Weiss, 1978) attributed the dearth of science in the elementary school to poor teacher preparation. According to these authors, teachers do not feel adequately prepared to teach science and do not feel comfortable with it. In the Weiss survey, less than one quarter of the elementary teachers felt "very well qualified" to teach science, while in other subjects such as reading, 63% felt they were "very well qualified." Stake and Easley found that the teaching of science had very low priority in most of the elementary schools they visited and reported that teachers were not confident about their knowledge of science, in particular, their understanding of science concepts.[6]

The review of the literature resulted in narrowing the teacher portion of the problem into three categories. There appears to be a lack of administrative support for the teaching of elementary science. There is insufficient teacher

---

[6] Ibid.

preparation both in pre-service programs and lack of incentives to upgrade skills once established in the classroom. The third category is a general lack of facilities for science in the elementary schools and an unwillingness to budget funds for necessary materials and equipment.

The lack of administrative support for science in elementary schools is obvious when surveys show that instruction in science has almost ceased, usually amounting to no more than a few minutes each week of reading from textbooks. Principals tend to accept this minimum effort due to their perceived need to focus on reading, language and mathematics.[7] Another aspect of the problem seems to be that principals often do not see themselves as qualified to provide leadership for dynamic and innovative science programs. The 1980 National Science Foundation Survey showed that principals usually settle for superficial science arranged according to textbook chapters because they do not feel well qualified to implement and supervise science programs which included demonstrations or experiments.[8]

Teacher preparation, or lack of it, has received by far the most attention in the literature. While this problem appears to be the most severe, there are questions about the need for teachers to have extensive training in science. The main problem appears to boil down to how teachers perceive

---

[7]Warren T. Greenleaf, "Uncle Sam Wants You: New Federal Science Improvement Program Aims to Recruit Principals," Principal 62 (September 1982): 18-21.

[8]Kenneth R. Mechling and Donna L. Oliver, "The 4th R: Science - Stepchild of the Elementary Curriculum," Principal 62 (November 1982): 28.

themselves as being able to present science effectively.

A survey of a random sample of elementary teachers in Kansas showed data that was consistent with earlier studies by Stake and Easley, 1978, and Weiss, 1978. The problems in elementary science as perceived by teachers were lack of teacher planning time, teachers inadequately prepared, not enough time for science, belief that science is less important than other subjects, and lack of teacher interest.[9]

Another survey which looked at a sample of science education in Illinois schools was consistent with the study outlined above. Teachers listed the inadequate preparation of teachers, lack of physical facilities, and lack of materials as obstacles to teaching science.[10]

An interesting feature of all the surveys listing the problems in teaching science was that lack of student interest was not mentioned; but instead, instructional problems rested with the teacher and the adequacy of the teacher's background.

The several articles which focused on teacher preparation confirmed that science has low priority in elementary schools. Student teachers in four states were surveyed after completing their student teaching assignments. Over 80% taught science, to some extent, in their classrooms, but 19% did not. Of those that did teach science, over 70% taught it after 1:30 P.M. and

---

[9]Jerry G. Horn and Robert K. James, "Where are We in Elementary Science Education?" School Science and Mathematics 82 (March 1981): 205-214.

[10]Thomas Fitch and Robert Fisher, "Survey of Science Education in a Sample of Illinois Schools: Grades K-6 (1975-1976)," Science Education 63 (July 1979): 406-416.

over 49% taught science less than two days per week. The reasons for not teaching science included, not enough time, science is not an important subject, and science is taught later. Other reasons were that the school was involved with team teaching, science was not scheduled, and there were no materials available. Seventy percent of the student teachers reported that science was being taught before their experience began, and 30% said that it was not.[11]

Another aspect of problems in elementary teacher preparation was articulated in an article on Science Preparation of the Elementary Teachers at Indiana University. While Indiana University required elementary teacher candidates to take science courses, there were problems in relating the content of these courses to the elementary curriculum. The courses did not result in the students being able to perform the scientific process skills necessary for understanding and teaching science. Also, most of the students do not understand, or they think they do not understand, the science content in existing elementary curriculum. The teacher candidates cannot relate the science being learned to science lessons they may use as elementary teachers. The authors proposed a remedy whereby candidates would take a course in basic science skills, and then take three courses, one each in biological science, physical science, and earth science.

---

[11]Harry F. Fulton and Richard W. Gates, "An Analysis of the Teaching of Science at this Point in Time: 1978-79," School Science and Mathematics 80 (December 1980): 691-702.

The latter three courses would be taken concurrently with methods courses to associate the concepts closely with the elementary curriculum. They recommended that the science content be included in these courses that should prepare the student to teach science according to the existing elementary curriculum, take advantage of local settings rich in science, and to discuss the science presented daily in local media.[12]

While the literature appears to be in general agreement that elementary teachers are not usually well endowed with strong science preparation, a look at state certification requirements may provide the most important reason they are not. There are only eleven states that require more than six semester credit hours in science for certification to teach. (California is among these states.) Seventeen states require greater than zero, but less than or equal to six semester credit hours for certification. And shockingly, twenty-two states require no science training at all to receive certification to teach in elementary schools.[13]

Another approach to overcome lack of teacher preparation in the teaching of science is to employ a teacher on special assignment. One study cited a 1978 survey in Oregon where it was reported that 50% of the teachers devoted less than six

---

[12]Hans O. Anderson and Dorothy Gabel, "Science Preparation of the Elementary Teacher at Indiana University," School Science and Mathematics 81 (January 1981): 61-69.

[13]Franz and Enochs, "Elementary School Science: State Certification Requirements in Science and their Implications," p. 287-292.

minutes per day to science and 83% less than one hour per week. The thrust of this program is for the teacher on special assignment to provide assistance to the classroom teachers and a version of a continuing inservice training. The author feels that teachers would be more comfortable working with a "peer" expert in science because teachers tend to be awed, threatened, and generally feel inadequate when faced with a "supervisor's" science skill and knowledge.[14]

The National Science Board's report on Education in Science and Technology also stated that "many of the teachers in elementary schools are not qualified to teach mathematics and science for even thirty minutes a day." The report recommended that teachers have a strong background in liberal arts and college training in mathematics, biological and physical sciences. They also called for a limited number of effective education courses and practical teaching experience under a qualified teacher.[15]

The third major problem impacting on science in the elementary school is a lack of materials and funds to implement hands-on, activity based programs.

The post-Sputnik emphasis on science produced some promising curriculum trends. The modular approaches to

---

[14]Donald A. Sanders and Judith A. Ssnders, " A Plan for Increasing Teaching Time in Elementary School Science Utilizing a Teacher on Special Assignment," School Science and Mathematics 82 (March 1982): 235-246.

[15]K. McDonald, "Science Panel Urges Emphasis on Teacher Training," Chronicle of Higher Education 27 (September 21, 1983): 1.

science in the elementary schools represented by SCIS, SAPA, and ESS seemed to offer the flexibility necessary to meet the widely varying needs of individual students, teachers, and school systems. Unfortunately, these programs proved to be expensive and less than 15% of the school districts purchased them. The economic realities of education today have prevented the production and dissemination of the necessary materials.[16]

There are many references throughout the literature by teachers that they do not teach science because there are no facilities or materials. Administrators do not deny this and tend to shrug off the problem as being beyond their scope to solve. The costs of providing good facilities and supplies, when balanced against other priorities, seem to keep science in the textbook and at the mercy of the imagination, or lack thereof, of individual classroom teachers.

Generally then, the review of research of problems in elementary science seems to place a major share of responsibility with the teacher. This may be unfair. Teachers are being expected to do something they are not trained for, and apparently are not being supported administratively or with proper facilities and materials. But does teacher training and prepartion make all that much difference at the elementary level? A Summary of Research in Science Education

---

[16]Robert G. Shrigley, "Persuade, Mandate, and Reward: A Paradigm for Changing the Science Attitudes and Behaviors of Teachers," School Science and Mathematics 83 (March 1983): 204-215.

1979, by Butts, indicates some conflicting conclusions. Fitch and Fisher found that teachers and administrators believed that lack of science knowledge by the teacher was the greatest obstacle to science instruction at the elementary level. Simpson reported that a teacher's knowledge was directly related to pupil desire and ability to learn. Brummett's conclusion was that teacher understanding of the science content of a lesson and attitude toward that content were significantly related to pupil achievement and attitude. However, Hough found no relationship between what teachers knew and the achievement of their pupils. Thoman found no relationship between the general science knowledge of fifth-grade teachers and the science gains by their pupils.[17]

It would seem that teachers should not be able to teach something that they do not know well. There is evidence, however, that students can learn equally well, regardless of the professional preparation of the teacher. Further investigation of these conflicting conclusions is in order.

---

[17]David P. Butts, "A Summary of Research in Science Education 1979," Science Education 65 (September 1981): 17-25.

STATEMENT OF THE HYPOTHESIS

The Problem

Research has shown that teaching patterns in elementary science are inconsistent and generally unsatisfactory. Are deficiencies in college preparation for elementary teachers a factor in this problem? Since, within limits, elementary teachers are free to choose their own curriculum, are those with stronger science backgrounds, or those who have developed interests in science likely to teach more minutes of science?

The Hypothesis

There will be no statistically significant relationship at the .05 level of confidence between time devoted to science and amount of professional science preparation by the teacher, special science interests, or non-professional experiences which involve science.

Definition of Key Terms

Professional Science Preparation: Teachers were classified according to college courses in science. Four categories were assigned as follows: 0-2, 3-4, 5 or more, and those holding a bachelor's of science degree.

Special Interests in Science: Teachers were considered to have had special interests in science if they were subscribers to science oriented materials, belonged to the National Science Teachers Association, or other organizations which promote science or science teaching, or read journals or articles concerning science.

Non-Professional Experiences: Teachers were considered to have had non-professional experiences in science if they had been employed at some time in a scientifically oriented endeavor, such as a laboratory technician, geology helper, or weather observer. Hobbies, such as ornithology, rock collecting, or taxidermy also qualified some teachers as having non-professional experience in science.

TBI: Abbreviation for teacher background and interests.

DESIGN AND PROCEDURES

Design

The study was an effort to discover if there is a statistically significant relationship at the .05 level of confidence, between classroom time spent teaching science and the extent of professional science preparation, practical science experience, or special interests in science by teachers. The population was limited to intermediate elementary teachers, fourth through sixth grades, in the Fontana Unified School District. The sample consisted of 89 of the 106 teachers who responded to the request to complete a questionnaire. Two others responded, but their questionnaires were not fully completed and were unusable. The design was a post-hoc study of teacher backgrounds and practices. No treatment was involved.

Procedures

A questionnaire was developed to collect the data from teachers about their backgrounds and interests and how many minutes of science they teach in an average week. The questionnaire was evaluated for validity by five experts in the field of science education. Four of the five, after recommended changes were incorporated, verified the validity of the questionnaire. The fifth response was not usable because the validity comments were not related to the questionnaire.

After receiving approval to circulate the questionnaire from the Director, Elementary Education, Fontana Unified School District, 106 questionnaires were delivered to the intermediate teachers at thirteen elementary schools. Responses were made anonymously, placed in a stamped envelope addressed to the writer of this project and mailed. Of the 106 questionnaires distributed, 91 were returned. Two were unusable because the teachers did not include answers to the question concerning minutes of science taught per week.

The questionnaires were evaluated and assigned a point value according to responses made to questions concerning professional preparation, science interests, and non-professional science related experience. In addition, teachers were asked to state how many minutes of science they teach per week.

The data were organized into a contingency table and subjected to statistical analysis by complex Chi-Square. Chi-Square was used because the data to be analyzed was in frequency form. The independent variable was the backgrounds and interests of teachers, and the dependent variable was the amount of time spent teaching science.

The contingency table was constructed according to the following rationale. Teachers were categorized as having a low, medium, or high level of background and/or interest in science by their responses to items on the questionnaire. The response choices on the questionnaire were graded on a Likert scale and possible scores could range from 0 to more

than 20. Those scoring 2 points or less were placed in the low category, 3 to 5 points was medium, and those with 6 or more points were considered high. See Appendix A for a sample questionnaire and scoring procedures. The columns of the table labeled minutes of science taught weekly were developed according to the writers perception of average time spent on science in those programs generally rated as acceptable in the articles in the review of the literature. Seventy minutes appeared to be a mid-point, therefore, the complex Chi-Square was organized to use 45 minute time blocks as dividing points. The seventy minutes falls approximately in the middle of the time columns. The results of the statistical analysis is displayed on the following diagram.

Categories of Responding Teachers

Minutes of Science Taught Weekly

TBI	91 or more	46 to 90	45 or less
Low	10	9	12
Medium	6	19	8
High	12	12	1

$x^2 = 13.965$ C = .368 $p < .01$

Results

The null hypothesis is rejected because the analysis of the data by complex Chi-Square shows a statistically significant relationship at the .01 level of confidence between the time devoted to science and the amount of professional preparation, special science interests, and/or non-professional experiences involving science. There is a statistically significant correlation between teacher background and interests and minutes taught per week in science as approximately 14% of the variation in the number of minutes of science taught weekly can be accounted for by the differences in teacher background and interests.

Limitations

1. All teachers did not respond to the questionnaire.
2. There is a tendency for those who teach science on a regular basis to be more likely than others to respond to the questionnaire, therefore some sampling bias exists.
3. This study is limited to amount of time spent teaching science, and does not address teaching effectiveness or student achievement.
4. The study was confined to grades 4-6, in the Fontana Unified School District.
5. The complex Chi-Square provides only gross indications of relationships and does not allow for regression analysis to determine finite predictive values.

CONCLUSION

Analysis of the data collected by questionnaire from 89 of 106 teachers indicates that teachers who possess strong science backgrounds or who exhibit interests in science related activities, organizations, or topics, tend to teach more minutes of science per week than their counterparts who do not possess the same attributes. This does not imply that instruction from those teachers is more effective than that of other teachers or that their students learn more. However, there is a positive correlation between background and interests and tendency to teach science. This conclusion has strong implications when viewed in the light that elementary science is one of the weakest areas in many of the critiques of American education.

Educational Implications

While the study showed that teachers in Fontana are teaching science at satisfactory rates, there is strong evidence that teachers who received more than the minimum science training or who have, for one reason or another, developed special interests in science are likely to spend more time teaching science than their counterparts who have not. This evidence has implications for state teacher certification agencies, for institutions responsible for training teachers, administrators responsible for implementing curricular programs and supervising teachers, and for teachers who may not be aware that some students are being short changed in one area of the curriculum.

State certification agencies should re-examine the criteria for awarding teaching certificates. Perhaps more solid science courses should be required for teacher candidates. The literature reviewed for this study clearly shows that an important reason that teachers do not teach science is lack of confidence. People who receive multiple subjects credentials should be prepared to teach all subjects with full confidence. This should include science, art, music, and physical education as well as the basic skills areas of language, mathematics, and reading. If the states begin to require more effective training in all of these areas, then teacher education institutions will rise to the challenge of providing the appropriate training for teacher candidates.

Administrators, including school boards, could benefit from examining the evidence presented in this study. First, they should examine the support given to teachers in terms of clear guidance and material support. They should ensure that teachers have a fair opportunity to teach science and effective science programs are recognized and encouraged. Secondly, administrators could utilize those teachers who have strong backgrounds or special interests to assist in school science projects and the development of school programs. Site administrators might strengthen the overall effectiveness of science teaching by displaying more interest in what is being taught in science and how. They should expect the same excellence in science teaching that they do in the other areas that may be evaluated by state or national tests.

The implications for teachers in this study lie in recognizing that there is vast differences in the attention paid to science by various teachers, even within a small district, or a school. Each teacher has weaknesses and strengths and these are reflected with individual instructional programs. Teachers should be aware of the possibility that children could be short-changed in a very important area of their elementary education if teachers do not make an effort to present the entire curriculum with enthusiasm and care.

Further Research Potential

A more detailed study might further refine what backgrounds and interests might be that lead to more and better science instruction. More sophisticated data collecting procedures would increase its validity and reduce the amount of bias present in the study.

TEACHER QUESTIONNAIRE AND LETTER OF TRANSMITTAL

3997 Mountain Avenue
San Bernardino, CA 92404
May 15, 1984

Intermediate Grade Teacher
Fontana Unified School District
Fontana, CA 92335

Dear Teacher:

I need your help! I am a sixth grade teacher at Randall-Pepper Elementary School in Fontana and am finishing the Masters of Arts, Elementary Education Option at California State College, San Bernardino. My project is a broad review of elementary science teaching and requires obtaining some data from teachers. I have received permission from the Director, Elementary Education to circulate a short questionnaire which will provide the information I need.

The project has no evaluative features. The information you provide will not be used to draw any conclusions about the schools in Fontana, teacher effectiveness, or student achievement. Your individual responses will be anonymous and there will be no attempt to report information by school or by grade level.

For the information to be generated by this questionnaire to be considered unbiased and representative of a large cross-section of teachers, it is essential that a high percentage of teachers respond. I have placed a list in your teachers' lounge of those whom I have requested to participate. Please check your name when you have mailed your response. In this way, I can follow up to account for the rate of return which must be achieved in order for the college to accept my project as valid.

Since this is the final portion of my program, a prompt response will enable me to complete the project in June. Therefore, I will be deeply grateful if you will mark your responses and seal it in the addressed envelope and mail it today.

Thank you very much for your consideration.

Yours truly,

Larry E Johnson

Larry E. Johnson

1. My college background in the sciences (biological, physical, or earth) was: (Do not include mathematics)

   a. 0 - 2 courses.

   b. 3 - 4 courses.

   c. 5 or more courses.

   d. I have a bachelor's degree in science.

2. I engage in hobbies which are associated with science. (Examples: Ornithology, hiking if associated with biology or other science interest, taxidermy, building and flying model airplanes.)

   a. Seldom to never. If you do, please list them.

   b. Occasionally _____

   c. Frequently. _____

3. I am a member of a group or club which has a science related orientation. (Example: Sierra Club)

   a. No

   b. Yes Organization(s) _____

4. I belong to a professional association which promotes science and science teaching. (Example: National Science Teachers Association)

   a. No

   b. Yes Association(s) _____

5. I subscribe to journals or magazines which have science or science teaching as a primary focus.

   a. No

   b. Yes Name of publication(s) _____

6. I read journals or magazines which have science or science teaching as a primary focus.

   a. Seldom to never.

   b. Occasionally

   c. Frequently

7. Outside my teaching experience, I have been employed in a job which required some knowledge of a scientific nature. (Examples: medical technician, electronics techician, geology helper)

   a. Never

   b. Less than one year.

   c. More than one year.

8. How effective was your college teacher training program in preparing teacher candidates to teach elementary science?

   a. Poor

   b. Fair

   c. Good

   d. Excellent

9. I use a science textbook in the presentation of science lessons:

   a. Never

   b. Occasionally

   c. Most of the time.

   d. Always

10. Materials for science observations and experiments are:

   a. Not available from school sources.

   b. Available if requested.

   c. Readily available at the school site.

11. If I had a choice of which subjects to teach: (circle all that apply)

   a. I would choose health, nutrition, human body, etc.

   b. I would choose biology: plants and animals.

   c. I would choose earth sciences such as geology.

   d. I would choose chemistry, physics, electricity, etc.

   e. I would not choose any of the science areas.

12. On average, I teach science _____ times per week, and the periods are _____ minutes each.

SCORING KEY FOR QUESTIONNAIRE

Question 1. a = 0

b = 1

c = 2

d = 3

Question 2. a = 0

b = 1

c = 2

Question 3. a = 0

b = 1 for each group or club.

Question 4. a = 0

b = 1 for each association.

Question 5. a = 0

b = 1 for each journal or magazine.

Question 6. a = 0

b = 1

c = 2

Question 7. a = 0

b = 1

c = 2

Questions 8, 9, and 10 were not scored, but were used for general information.

Question 11. One point was counted for each a,b,c, or d.

Question 12. Raw frequency data was placed on the Chi-Square contingency table.

Appendix B

VALIDITY QUESTIONNAIRE AND LETTER OF TRANSMITTAL

3997 Mountain Avenue
San Bernardino, CA 92404
April 18, 1984

Dr. Richard W. Griffiths
School of Education
California State College, San Bernardino
San Bernardino, CA 92407

Dear Dr. Griffiths:

I am a candidate for a Master's of Arts degree in Elementary Education at California State College, San Bernardino. I am engaged in a research project to examine whether or not teacher background and interests in science influence the amount of time spent teaching science in the elementary classroom.

In researching the problem, I have found no instrument which has been tested for validity to elicit the data I need from teachers in order to perform the appropriate statistical tests. Therefore, I have developed the attached questionnaire which hopefully will establish the extent of college preparation of teachers, and identify those with special interests or backgrounds.

As an expert in the field of science education, your opinion concerning the validity of this questionnaire will be greatly appreciated. Please make suggestions as you deem appropriate on the questionnaire itself. In addition, please complete the validity appraisal.

Thank you very much for your consideration in responding to this request. A self addressed envelope is enclosed to expedite receipt of your comments.

Yours truly,

Larry E. Johnson

Appraisal of Validity

The objective of the questionnaire is to gather information sufficient to allow categorization of teachers according to these criteria:

a. Teachers with only minimum college preparation and no special background or interests in science.

b. Teachers with slightly more than minimum college preparation, 3 or 4 courses, and/or moderate interest in science.

c. Teachers with considerably more than minimum college preparation, 5 or more courses, and/or a high interest in science related topics.

Directions: Please indicate whether or not you believe the questionnaire will provide the data as described in the objective. Your comments are greatly appreciated.

1. The questionnaire will provide the data required to determine the extent of college science preparation.

   a. Yes b. No Suggested changes. _____

_____

2. The questionnaire has a sufficient sample of questions to allow categorizing teachers according to the stated objective.

   a. Yes b. No Suggested changes. _____

_____

3. The questionnaire will allow determination of the time spent teaching science.

   a. Yes b. No Suggested changes. _____

_____

4. The questionnaire is clearly written.

   a. Yes b. No Suggested changes. _____

_____

5. The directions are clear.

   a. Yes b. No Suggested changes. _____

_____

Appendix C

LETTER REQUESTING PERMISSION TO CIRCULATE QUESTIONNAIRE

3997 Mountain Avenue
San Bernardino, CA 92404
23 April 1984

Mr. Earl S. Davis
Director, Elementary Education
Fontana Unified School District
9680 Citrus Avenue
Fontana, CA 92335

Dear Mr. Davis:

I am a candidate for a Masters of Arts degree in Elementary Education at California State College, San Bernardino. My Masters project is an examination of whether or not teacher background and interests influence the amount of time spent teaching science in the elementary classroom. The study does not address teacher competence, student achievement, or school policies.

In order to gather the data I need from teachers to perform the appropriate statistical tests, I have developed a short questionnaire which is aimed at the extent of college preparation, interests in science, and finding the number of minutes per week spent teaching science by intermediate elementary teachers. The purpose of my study is to find if there is a correlation between these factors.

I request permission to circulate the questionnaire to all intermediate teachers in the Fontana Unified School District. They will be printed and dispatched at my expense and the respondents will remain anonymous. The study will draw no conclusions concerning the effectiveness of the science instructional program in Fontana, but will remain limited to any relationship between the backgrounds of teachers and the time spent teaching science. The questionnaire will be returned to me by a self-addressed stamped envelope by mail, thus not engaging the district distribution system.

Your approval of this request will be greatly appreciated.

Yours truly,

/s/

Larry E. Johnson

Bibliography

Anderson, Hans O. and Gabel, Dorothy. "Science Preparation of the Elementary School Teacher at Indiana University." School Science and Mathematics 81 (January 1981): 61-69.

Anderson, Ronald D. and Druva, Cynthia Ann. "Science Teacher Characteristics by Teacher Behavior and by Student Outcome: A Meta Analysis of Research." Journal of Research in Science Teaching 20 (May 1983): 467-479.

Butts, David P. "A Summary of Research in Science Education 1979." Science Education 65 (September 1981): 17-25.

Enochs, Larry G. and Phares, Donna. "Why Not Teach Science?" Science and Children 20 (October 1982): 22-24.

Fitch, Thomas and Fisher, Robert. "Summary of Science Education in a Sample of Illinois Schools: Grades K-6 (1975-1976)." Science Education 63 (July 1979): 407-416.

Fulton, Harry F. and Gates, Richard W. "An Analysis of the Teaching of Science at this Point in Time: 1978-79." School Science and Mathematics 80 (December 1980): 691-702.

Franz, Judy R. and Enochs, Larry G. "Elementary School Science: State Certification Requirements in Science and their Implications." Science Education 66 (April 1982): 287-292.

Gardner, Marjorie. "10 Trends in Science Education." The Science Teacher 46 (January 1979): 30-32.

Greenleaf, Warren T. "Uncle Sam Wants You: New Federal Science Improvement Program Aims to Recruit Principals." Principal 62 (September 1982): 18-21.

Horn, Jerry G. and James, Robert K. "Where are We in Elementary Science Education?" School Science and Mathematics 82 (March 1981): 205-214.

Hurd, Paul D. and Gallagher, James J. New Directions in Elementary Science Teaching. Belmont, California: Wadsworth Publishing Company, Inc., 1969.

McDonald, K. "Science Panel Urges Emphasis on Teacher Training." Chronicle of Higher Education September 21, 1983. p. 1.

Mechling, Kenneth R. and Oliver, Donna L. "The 4th R: Science - Stepchild of the Elementary Curriculum." Principal 62 (November 1982): 28.

Mechling, Kenneth R., Stedman, Carlton H., and McDonnellman, Kathleen M. "Preparing and Certifying Science Teachers." Science and Children 20 (October 1982): 9-14.

"A Nation at Risk: The Imperative for Educational Reform." The Chronicle of Higher Education. May 4, 1983, p. 11-16.

Sanders, Donald A. and Sanders, Judith A. "A Plan for Increasing Teaching Time in Elementary School Science Utilizing a Teacher on Special Assignment." School Science and Mathematics 82 (March 1982): 235-246.

Shepherd, Gene D. and Ragan, William B. Modern Elementary Curriculum. New York: Holt, Rinehard, and Winston, 1982.

Shrigley, Robert G. "Persuade, Mandate, and Reward: A Paradigm for Changing the Science Attitudes and Behaviors of Teachers." School Science and Mathematics 83 (March 1983): 204-215.