

ELEMENTARY SCIENCE: THE NEGLECTED SUBJECT

A THESIS

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To the Associate Vice President for Research and Dean of the Graduate School:

I am submitting herewith a thesis written by Evelyn Edington entitled "Elementary Science: The Neglected Subject." I have examined this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirement for the degree of Master of Science in Science Teaching.

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ABSTRACT

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The purpose of this study was to investigate reasons why elementary teachers are avoiding science instruction and to identify any differences that might be found between urban and rural districts. Classroom teachers of grades kindergarten through fifth were asked to respond to a questionnaire and two surveys. On these instruments teachers were asked to rate their feelings toward teaching science and to relate this to the depth of their background in science. The questionnaire was examined for like responses. The Teacher Professional Survey was checked for frequency of response and then cross referenced with the Teacher Background Survey. A percentage base analysis was used. The results from the urban district were compared to the results from the rural district. Although teachers have a good attitude about teaching science, they do have some concerns about their lack of knowledge. It appears that outside influences, such as other curriculum priorities and time, are the leading causes of the neglect of science teaching.

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CHAPTER I

INTRODUCTION

Concerns about science instruction and the lack of or neglect of science instruction have been a topic for discussion and research for many years. The National Science Foundation reported in 1980 that "less time was spent on the teaching of science than any other subject" (cited in Westerback, 1982, p. 937). Statements like "science has yet to be legitimized as a subject in the elementary schools throughout the nation" (Shrigley, 1977, p. 317), and "science is not a priority for elementary school teachers" (Westerback, 1984, p. 937), help to paint a vivid picture of a very real problem with science instruction in the elementary classroom.

Children's natural curiosity about their world would seem like an obvious hook for elementary teachers to connect learning throughout the curriculum (Tilgner, 1990). However, Richard Duschl (1983) reports that "science instruction at the elementary level, if occurring at all, is low in quality and too infrequent to be effective" (pp. 475-476). Manning, Esler, and Baird (1982) reveal the alarming facts that 25% of the teachers they surveyed spent

no time at teaching science. The other 75% spent less than 2 hours per week on science instruction.

Researchers feel that this problem is due to several overlapping reasons. However, does it exist across boundaries? In other words, is there a substantial difference in the neglect of science teaching between rural and urban areas? This would seem a viable area for added research.

Rationale

Teacher attitudes and anxiety have been linked to the neglect of science in the elementary classroom. "A teacher's attitude toward a subject determines if and how it is taught" (cited in Fraser-Abder, 1989, p. 561). Fraser-Abder goes on to say, "that teachers need to feel that they have an adequate knowledge of science" and that they "can teach it without fear" (p. 561). One of the key issues affecting teacher attitudes toward science is a lack of confidence. Miller (1992) reports that, "Regardless of state regulations, some generalist elementary-level teachers admit to not teaching mathematics and science every day, often because they do not feel confident in teaching these subjects or do not like teaching these subjects" (p. 231). Shrigley (1976) sums it up by saying that there seems to be a general agreement among

researchers that "elementary teachers have a less than positive attitude toward the teaching of science" (p. 449).

A lack of confidence in the teaching of science has been connected to anxiety and even a fear of teaching science. According to Flick (1993), the use of unfamiliar methods can cause a teacher to feel "overwhelmed by the task of teaching science" (p. 8). Other researchers agree that "conflicting pedagogies" can contribute to science anxiety. Even the language of science seems to be very demanding on elementary teachers who often feel that they do not have a command of the language of science (Duschl, 1983).

Tilgner (1990) concluded in her studies that even after 20 years teachers were still listing the same reasons for avoiding science. The first reason cited was an inadequate background in science. Wildy and Wallace (1995) have surmised that good science teachers are able to help students connect real world experiences with prior knowledge to form a basis for understanding. If teachers are unable to make this connection, is it reasonable to expect them to be able to assist students in this process? According to Roychoudhury, Tippins, and Nichols (1995), most women don't make this connection. They state that women are "strangers to science" because it is

traditionally taught from a male perspective. Why is this significant? Eighty-six percent of the teachers in elementary schools are women (Nelson, Weiss, & Capper, cited in Roychoudhury et al., 1995).

These alarming findings would lead us to wonder what colleges and universities are doing to support the elementary science teacher in a world where science and technology are rapidly increasing. And, even more important, how are districts bridging the gap that already exists? Zeitler (1984) indicates in his findings that not only do preservice teachers have a lack of science background, but they may also perpetuate their negative attitude on to their students. Westerback (1982) reveals that a national survey found that only 22% of the responding teachers felt very well qualified to teach science. At a time when every discipline is calling for specialists, Orlich (1980) suggests that "elementary school teachers are expected to be, really, the last of the encyclopedists" (p. 54). He goes on to say that most elementary teachers need more science training during their careers.

Purpose of the Study

The purpose of this study was to examine reasons why elementary teachers are neglecting the teaching of science

and to determine if the evidence varies from an urban to a rural district. The goal of this research was to provide teachers and districts with information that will lead to some resolution of this problem.

Research Question

Will the urban elementary classroom teachers' avoidance of science mirror that of the rural elementary classroom teachers'?

CHAPTER II

REVIEW OF THE LITERATURE

The neglect of science teaching in the elementary school is an area of great concern for educators, parents, and the corporate world. If science is not nurtured in the elementary school and students are not encouraged to explore their world, then it stands to reason that they would steer away from science in the upper grades. Hence, there would be few employees to fill science related positions. Newport (1990) suggests that not only are students not being encouraged, but about "50 percent of students are being turned off to science by age 9" (p. 69). Newport's assessment has been supported by other researchers. "Mittlefehldt believes the current practices in elementary science education turn off effective and cognitive learning" (cited in Tilgner, 1990, p. 421). It's very curious as to why teachers are avoiding teaching a subject that would seem relatively natural and engaging for the elementary student. This literature review will focus on three areas that relate to this curiosity. The three areas for discussion are lack of instruction, teacher anxiety, and professional development.

Lack of Instruction

The lack of science instruction running rampant in today's elementary schools is almost at ridiculous proportions. Almost 20 years ago Shrigley (1977) concluded that "science has yet to be legitimized as a subject in the elementary schools throughout the nation" (p. 317). Some years later, Duschl (1983) blamed the back-to-basics movement and its exclusion of science as a core subject for the decline of science instruction in the elementary school. The numbers reporting this neglect have been recorded by several researchers. According to the National Science Foundation, in 1980 less time was spent on the teaching of science than any other subject (cited in Westerback, 1982). Tilgner (1990) reports that "researchers have shown that over half of elementary teachers rank science fourth or fifth out of five subjects" (p. 422). And Manning, Esler, and Baird (1982) reveal that about 25% of the teachers they surveyed spent no time at all teaching science, and about 75% spent two hours or less per week on science related activities. Around 70% of the teachers in their survey reported that their students spent only one hour or less per week using manipulatives. Teachers are openly admitting that science is a back burner subject. In 1994, elementary teachers in Texas held their

breath as the state piloted a TAAS Science Test which was based on both objective and performance criteria (TAAS Science, 1994). However, since no apparent action was taken, Texas Elementary Teachers have been able to breathe a sigh of relief and once again relax in the avoidance of teaching of science. Westerback's (1984) statement "science is not a priority for elementary school teachers" still seems applicable for today's teacher (p. 937).

The lack of science instruction in the elementary school seems to be an age old topic. Orlich (1980) reports that back in the 1960s and 1970s, with our nation on the verge of the Space Age, national concern for science was at a record high. In the past, the emphasis in science was placed on the development of curriculum, giving little direction toward its implementation. Shrigley (1977) cited several possible reasons for a lack of implementation of science curriculum. He feels that it could be possible that "teachers are not as reinforced by the school community for teaching science as they are for teaching reading, math, and other subjects" (p. 318). He also notes that educators could believe that some subjects are of more value than others. And, finally, he states that "perhaps females, who make up 85% of the elementary school

faculties, believe science to be a male enterprise in our culture" (p. 318). Gender difference appears to be a huge issue in the field of science. Many women are strangers to science, state Roychoudhury, Tippins, and Nichols (1985) because the logic of science is incompatible with women's standpoints.

Teacher attitudes are also closely linked to the amount of time designated for science instruction. Watters and Ginns (1995) allude to the idea that the amount of time teachers spend teaching science is related to a teacher's science knowledge base, "issues in teaching science," and in their attitude toward both. Harlen (cited in Fraser-Abder, 1989) also agrees that "a teacher's attitude toward a subject determines if and how it is taught" (p. 561). Some teachers simply do not like science. Flick (1993) states that "the poor quality and quantity of teaching in elementary science is usually cast in terms of aversion to the subject matter and ignorance of its importance" (p. 1). Westerback (1982) points out that many researchers agree that "negative attitudes are commonplace among elementary teachers." The outcomes of these attitudes are far-reaching. They include "avoidance of teaching science, the passage of negative attitudes to students, and interference with the learning process" (p. 604). Fraser-Abder's (1989) research shows how a

negative attitude relates to a lack of instruction. Some teachers felt unfamiliar with the use of hands-on science and others equated the use of equipment with noise and untidiness. Without support, teachers seem unwilling to overcome these obstacles. Westerback's and Fraser-Abder's findings concur with an earlier study done by Yager (1978) who believes that "teachers are a most significant component in any teaching." He states that a teacher's "self-image" and their "images of science" affect the actions and outcomes in the classroom (p. 102).

Researchers are consistently finding that science in the elementary school just does not seem to be occurring. As Duschl (1983) surmises, science in elementary schools, if it happens at all, tends to be of poor substance and quite often ineffective.

Teacher Anxiety

Anxiety, according to Webster's New World Dictionary, "is a state of being uneasy, apprehensive or worried about what may happen" (1994, p. 62). Many researchers have theorized that the lack of science teaching in our country is related to the anxiety teachers have toward science. Duschl (1983) explains that "teacher apprehension toward the teaching of science and the learning of science account for both the quality of science instruction and the length of time given to science instruction" (p. 746).

Orlich (1980) refers to the teaching of science as a fear. He believes that "we think of science as a discipline exemplified by Albert Einstein's famous equations--understandable by just a handful of people in the world, and totally abstract to the rest of us" (p. 5). If teachers feel that science is so abstract that only a few gifted can attain understanding, then their anxiety and avoidance toward teaching science is understandable. Anderson and Clawson (1992) relate that there is a fear of learning science which is widespread, affecting large numbers of people. They conclude that "people are not bored with science, they are frightened by it" (p. 8). They further state that women in particular are affected by science anxiety which does not bode well for elementary schools since they have such a high percentage of women teachers. Mallow (cited in Anderson & Clawson, 1992), professes that this anxiety could result in frustration, a lack of self-confidence in science, and "ultimately disliking and avoiding anything scientific" (p. 9).

Over the years researchers have established several reasons as to why they believe these anxieties exist. One reason that many have examined is a lack of confidence in the teaching of science. Fifteen years ago Morrissey (1981) (cited in Watters & Ginns, 1995) stated that "the extent to

which teachers will teach science in elementary school, is influenced by the teacher's knowledge of science and the issues in teaching science as well as their feelings or attitudes towards those cognitions" (p. 2). Duschl (1983) agrees. He feels that the knowledge component is very threatening and that teachers feel a need for a command of the language of science. He hypothesizes apprehensions about science could be the result of a confusion about what science is supposed to be. Westerback (1984) also finds that "teachers feel unprepared to teach science" (p. 937). And Tilgner (1990) explains that teachers who lack knowledge and experience may "rely more and more on the textbook to provide the knowledge they think they are to dispense" (p. 422). In a prior article, Westerback (1982) also cites knowledge as an area of concern for many "beginning" teachers. She further indicates that anxiety may be detrimental to teachers and students alike. This feeling of a lack of knowledge seems understandable since elementary teachers tend to have "stronger backgrounds in language arts and reading" (Flick, 1993, p. 1). He believes that teachers "unfamiliar with the process of inquiry teaching" may "feel overwhelmed by the task of teaching science." "They lose track of what they want to teach and fear that the instructional process does not converge on answers to scientific questions" (p. 8).

Fraser-Abder (1989) cites a national report that reveals that only 22% of elementary teachers feel very well qualified to teach science. However, almost 66% of the teachers feel very well qualified to teach reading. Westerback and Primavera (1992) state that the correlation between content knowledge and anxiety is not always clear. However, throughout their studies they confirm that after teachers took science content courses designed for them, anxiety was reduced.

Personal efficacy has also been identified as an issue that appears to be tied to anxiety levels in teachers. Personal efficacy as defined by Czerniak is "a measure of belief that you personally have the ability to affect student learning in science" (cited in Westerback & Primavera, 1992, p. 13). In a 1992 study, Westerback and Primavera found a correlation between high personal efficacy and low anxiety levels. Another study showed that past teaching and learning experiences could influence the belief of one's ability to teach science. This belief was labeled as Personal Science Teaching Self Efficacy (Watters & Ginns, 1995).

The anxiety of teaching science has also been related to a feeling of failure teachers may have experienced in their course work as students. Anderson and Clawson (1992)

believe anxiety is the product of a "lack of a framework of prior knowledge," not from the lack of self-confidence. Their study shows that students connect feelings of science anxiety with "memories of painful or humiliating experiences in classrooms." These negative experiences lead students, who eventually become elementary classroom teachers, to choose courses in areas other than science. Science anxieties have also been related to lack of equipment, time constraints and inadequate teacher training (Tilgner, 1990). Researchers agree that science anxiety, for whatever reason, is prevalent among many elementary classroom teachers.

Professional Development

An evaluation of college preparatory classes for prospective teachers may show some insight as to why science is being neglected in the elementary school. In a survey of elementary school teachers in Central Florida, 12% of the teachers had taken no courses in science content. Twenty percent had taken no science methods courses, and 65% had never attended a science inservice seminar. The appalling results of this survey reveal that 12% of these teachers had no foundation whatsoever for teaching science (Manning, Esler, & Baird, 1982). Zeitler (1984) points out that in a national survey of preparation

programs for elementary teachers, the median number of semester hours required for science was eight. And only about 8% of the programs require courses in all three science areas. A need for the improvement of instruction at the pre-college level was also emphasized. Tilgner (1990) identifies further studies conducted in 12 states in which most of the teachers felt that their undergraduate course work in science was inadequate, especially in the area of hands-on activities.

It has been said that teachers tend to teach the way in which they were taught. On this basis researchers have called for a restructuring of teacher preparation courses in science. If preservice teachers are not experiencing science in their methods courses through means of hands-on activities, then it is fruitless to expect them to be able to implement those types of activities effectively later on in their classrooms. College professors propose one style of teaching, then rely on straight lecture with little or no student involvement. In a study conducted by Berg, Huinker, and Neuman (1993), only two of the five faculty members attempted to implement the standards recommended by professional organizations in science. Their actual knowledge of elementary school practices was described as "uneven." The redesigning of science experiences for

preservice teachers is not a new idea. In 1976, Shrigley claimed that science courses for preservice elementary teachers were taught in lecture sessions and some were taught without any laboratory experiences. He made the assumption that "if manipulative, hands-on experiences with scientific phenomena is stimulating for children why could we not assume that open ended, small group, laboratory experiences in college science courses would provide affective science learnings for teachers" (p. 149). Duschl (1983) agrees that new strategies for training science teachers are in order. He feels that they need broader experiences. Zeitler (1984) feels that the emphasis in teacher preparation should be aimed toward children and not the informational aspects of science.

In another study, Shrigley (1976) states that it is well founded that in science education "the teaching of science content is not a primary objective of methods courses" (p. 452). He feels that there should be a close coordination between science method and science content. Zeitler (1984) puts it this way: "the mutual interdependence between content and process should be exemplified more extensively at the preservice level" (p. 517). Baird, Fensham, Gunstone, and White (1991) concur, they say that "whatever the subject, learning is

more than acquisition of content." Research strongly suggests that reformation of elementary school science needs to begin with the improvement of instruction used at the preservice preparation level as well as in pre-college level. These efforts should help to improve the science background of future teachers (Zeitler, 1984).

The plight of the preservice teacher does not seem to change once they become an inservice teacher. In other words, the statistics are just as startling. Tilgner (1990) cites that in a national survey 65% of the responding teachers claimed that they had never taken a graduate-level science course, and 70% stated that they had never attended any science inservice programs offered. This lack of training may lead to a confusion about what is expected of an elementary science program. Duschl (1983) refers to this confusion as an "antagonistic dilemma" which pits science process against science content. The solution Duschl offers is to provide teachers with "experiences which have an impact on the perceptions they hold toward the nature of science" (p. 753). Tilgner (1990) points out that unless teachers are given the opportunity to explore their ideas about the world then it is unlikely that they would be able to help clear up the misconceptions of their students (p. 427). Barman, Barman, and Shedd (1989) found

that elementary teachers believe that they are mainly accountable for the success of their students in reading and math. They have gotten the message that science is not as important. The districts are not providing them with funds for equipment and that seems to make the message even more clear. Shrigley (1977) conveys,

That the attitude of elementary school teachers, and therefore the improvement of the teaching of science, rests primarily in forces outside the control of teachers themselves. School officials, from the board of education to the building principals, seem to be the forces that could provide teachers with the necessary professional reinforcement to teach science.
(p. 321)

Tilgner (1990) says that until principals become actively involved in providing workshops and promoting science programs to the public, teachers will not emphasize science in their classrooms.

Inservice programs in science have tended to give teachers activities instead of a philosophy of teaching science. One-shot inservice sessions have proven to be ineffective. Barman et al. (1989) think that inservice should be on-going and that teachers should be given time to reflect and share new ideas with their peers.

Reflection seems to be a key component to an inservice program. Baird et al. (1991) allow that reflection is an important part of intellectual development. Barksdale-Ladd (1994) also sees the value in teacher reflection and sharing with their peers. These are two of the necessary elements for teacher empowerment. Teacher empowerment is "the confidence in personal knowledge and the ability to make decisions and take actions based on that knowledge" (p. 1). For teachers to feel empowered to teach science, the face of current inservice programs will need to undergo vast improvements. Teachers need to feel that they are supported by their principals, districts, and communities before they can take on the burden of change.

CHAPTER III

METHODOLOGY

Subjects

The subjects involved in this study were classroom science teachers of kindergarten through fifth-grade in an urban and in a rural school district. The urban district has a student population of approximately 18,000 students; of those, about 10,000 are elementary students. There are about 1,100 teachers in this district and approximately 575 are elementary classroom teachers. There are 17 elementary schools within this district. The urban focal elementary school has a student population of about 850 students and 36 classroom teachers.

The rural school district has a student population of about 630 students, and there are approximately 45 classroom teachers. There is one elementary school which has a student population of approximately 300 students and 18 classroom teachers.

Procedures

The study in the rural district took place during a 45-minute faculty meeting. The surveys and questionnaire were distributed to the classroom teachers after a brief

question and discussion period. All of the 18 teachers in the rural district responded to the survey.

In the urban district the surveys and questionnaire were distributed in individual grade level meetings that took place during the teachers' 45-minute planning period. Some grade levels chose to respond to the survey after a brief question and answer period. Other grade levels chose to respond and turn them in to the researcher at their convenience. Thirty-four of the 36 urban teachers responded to the survey.

Instruments

To examine why elementary classroom teachers neglect the teaching of science, two surveys and a questionnaire were developed by the researcher. These instruments were piloted with 32 elementary teachers enrolled in a master's program. Based upon their responses, the wording of a few statements and questions were revised.

The "Teacher Professional Survey" contains 12 statements. Respondents are asked to choose the appropriate response such as strongly agree, agree, undecided, disagree, and strongly disagree. The 12 statements are divided into 4 categories. There are 3 statements directed toward the principal and the administration. Three statements concern the personal

feelings of the respondents. Two statements deal with prior experience, and the last 4 statements regard the professional development of the respondent.

The "Teacher Background Survey" is composed of 12 questions. In this survey the respondents are asked to fill in, check, or circle an appropriate response. There are 3 questions pertaining to the teachers' experience. Three questions are directed to the number of formal science courses taken in high school and college. Three of the questions relate to the amount of hours spent in science related staff development and the last 3 questions deal with personal feelings.

The "Teacher Questionnaire" is composed of 3 questions. Two of the questions are fill in the blank and relate to the actual amount of time spent teaching science. The last question is an essay question in which respondents discuss factors that lead to the exclusion of science from their daily routine.

Both of these surveys and the questionnaire are presented in the Appendix.

Evaluation

After each campus completed the surveys and questionnaire, the instruments were collected for analysis. Anonymity of the respondents was maintained as no names

were required on the surveys and questionnaire. Each answer on the surveys, and the objective answers on the questionnaire, were itemized and recorded. The data gathered from the fill in the blank questions on the questionnaire were categorized and recorded. The open-ended question was examined for common threads that appeared. The Teacher Professional Survey was analyzed for frequency of response. The results of the Teacher Professional Survey were cross referenced with those of the Teacher Background Survey. The results of each district were then compared to that of the other district using a percentage base analysis.

CHAPTER IV

RESULTS AND DISCUSSION

When an elementary teacher announces that it is time for science class, the atmosphere of the classroom changes to excitement and interest. The students are ready to engage in the wonder of exploration. Why then would an elementary teacher avoid such a fascinating and interesting subject?

Results

This study question was evaluated using a Teacher Professional Survey, a Teacher Background Survey, and a Teacher Questionnaire which were administered to the elementary teachers. The Teacher Professional Survey has 12 items. The Teacher Background Survey also has 12 items. The Teacher Questionnaire has 3 items, one of which is an open-ended question.

Teacher Professional Survey

The surveys were analyzed using a percentage of response to each survey item. The results, presented in Table 1, attempt to give insight to this phenomena. In reporting the results, the strongly agree and agree categories were collapsed together, and the disagree and strongly disagree were collapsed together.

Table 1

Percentage of Response to Professional Survey Items

Item	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
1	24.50%	64.20%	1.90%	5.90%	1.90%
2	9.40%	28.30%	15.10%	34.00%	11.30%
3	1.90%	18.90%	20.80%	41.50%	15.10%
4	0.00%	41.50%	22.60%	26.40%	5.70%
5	1.90%	30.20%	9.40%	49.10%	7.50%
6	1.90%	32.10%	11.30%	47.20%	5.70%
7	0.00%	35.80%	22.60%	32.10%	7.50%
8	0.00%	13.20%	67.90%	11.30%	5.70%
9	7.50%	32.10%	22.60%	28.30%	7.50%
10	0.00%	30.20%	28.30%	34.00%	3.80%
11	7.50%	35.80%	11.30%	39.60%	3.80%
12	13.20%	67.90%	5.70%	9.40%	0.00%

Eighty-eight percent of the respondents reported in item 1 that they enjoyed teaching science. However, 45.3% stated in item 2 that their undergraduate science courses did not provide them with a good conceptual understanding in science, and 56.6% also felt that their science education courses had not prepared them to teach science in the elementary school (item 3).

The study revealed that 32.1% of the teachers felt that their district did not provide sufficient professional development in the science content area (item 4), and 22.6% were undecided on this issue. Fifty-six percent of the teachers surveyed felt that they are not given the

opportunity to meet with their peers and discuss strategies and concepts that have been used in the classroom as a follow-up to professional development (item 5). And another 9.4% were undecided. The table shows in item 6 that 52.9% of those surveyed do not feel that their district is supplying them with enough science activities, and 11.3% were undecided on this item.

For item 7, 39.6% disagreed with the statement that their district sends interested teachers to science conventions and conferences. Another 22.6% were undecided on this question. Most of the respondents were unsure if their district sends interested administrators to conventions and conferences as 67.9% chose undecided (item 8). The survey recorded 35.8% of the teachers felt that their principal is not interested and supportive of a strong science curriculum (item 9), and 37.8% also feel that their district is non-supportive (item 10).

About 43% of the respondents revealed in item 11 that they felt that they have a good knowledge base in all the science disciplines, while that same percent felt that they did not. However, 81.1 percent of the responding teachers stated that they feel that they are qualified to teach science in the elementary school (item 12).

This survey supports the study question by revealing several reasons why elementary teachers may be avoiding science.

A further research question asked if there would be differences between the responses of urban elementary teachers and rural elementary teachers. Table 2 reflects that data.

Table 2 reveals some significant difference in items 4 and 5. While 55.5% of the rural teachers saw a lacking in professional development within their district, only 21.2% of the urban teachers were in agreement. Of the urban teachers, 66.7% felt a need for more time to discuss with their peers, and only 42.1% of the rural teachers felt this need.

The table reflects a marked difference in the questions pertaining to sending interested teachers (item 7), and administrators to conventions and conferences (item 8). Over 63% of the rural teachers felt that interested teachers were not being sent to conventions and conferences and 42.1% said that administrators were not being sent either. Only 27.3% of the urban teachers felt that interested teachers were not being sent to conventions and conferences. And only 3% felt that interested administrators were not being sent.

Table 2

Teacher Professional Survey Response by School

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Item 1					
Urban	18.20%	66.70%	3.00%	9.10%	3.00%
Rural	36.80%	63.20%	0.00%	0.00%	0.00%
Item 2					
Urban	3.00%	42.40%	15.20%	30.30%	9.10%
Rural	21.00%	5.30%	15.80%	42.10%	15.80%
Item 3					
Urban	3.00%	24.20%	27.30%	33.30%	12.10%
Rural	0.00%	10.50%	10.50%	57.90%	21.10%
Item 4					
Urban	0.00%	51.50%	27.30%	18.20%	3.00%
Rural	0.00%	27.80%	16.70%	44.40%	11.10%
Item 5					
Urban	3.00%	24.20%	6.10%	60.60%	6.10%
Rural	0.00%	42.10%	15.80%	31.60%	10.50%
Item 6					
Urban	3.00%	45.50%	6.10%	45.50%	0.00%
Rural	0.00%	10.50%	21.10%	52.60%	15.80%
Item 7					
Urban	0.00%	39.40%	33.30%	27.30%	0.00%
Rural	0.00%	31.60%	5.30%	42.10%	21.10%
Item 8					
Urban	0.00%	18.20%	78.80%	3.00%	0.00%
Rural	0.00%	5.30%	52.60%	26.30%	15.80%
Item 9					
Urban	3.00%	33.30%	27.30%	33.30%	3.00%
Rural	15.80%	31.60%	15.80%	21.10%	15.80%

Table 2--continued

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Item 10					
Urban	0.00%	40.60%	31.30%	25.00%	3.10%
Rural	0.00%	15.80%	26.30%	52.60%	5.30%
Item 11					
Urban	3.00	45.50%	12.10%	39.40%	0.00%
Rural	15.80%	21.10%	10.50%	42.10%	10.50%
Item 12					
Urban	9.10%	72.70%	6.10%	12.10%	0.00%
Rural	22.20%	66.70%	5.60%	5.60%	0.00%

The breakdown by school supports the research question by revealing some variation between urban and rural responses. However, there were some items that did not show significant differences. For instance, 81.8% of the urban teachers felt that they have a good knowledge base in all the science disciplines, and 88.9% of the rural teachers were in agreement (item 12).

Teacher Questionnaire

The teachers in this study were also asked to respond to a Teacher Questionnaire which contained an open-ended question that asked what would be the main factor(s) that would cause them to exclude science from their normal routine. In reviewing responses to this question, several

common threads became evident. The two leading causes were lack of time and a feeling that other subjects were more important. Many teachers reported a lack of materials, equipment, and space. They also saw a need for quick and easy hands-on experiments. Several stated a lack of background and training, as well as a lack of confidence, or feeling of inadequacy. Some teachers recorded that their principal or district encourages devotion to reading and math. Only 3 of the 52 respondents reported a lack of interest in science. These common threads reveal several reasons why teachers are avoiding science in the elementary school.

Teacher Background Survey

As part of the Teacher Background Survey, respondents were asked to check science disciplines in which they felt they were weak. Table 3 combines those weaknesses with items 11 and 12 from the Teacher Professional Survey.

Table 3 reveals that 19.2% of the respondents who felt that they had a good knowledge base in all the disciplines recorded a weakness in Physical Science. It also shows that 15.4% stated they had a weakness in the areas of Physical and Earth Science, but few (1.9%) said they had a weakness in all three areas of science. Of the teachers who responded that they felt qualified to teach

science in the elementary school, 44.2% reported a weakness in the area of Physical Science. Another 19.2% reported a weakness in Physical and Earth Science. In all three disciplines, fewer respondents (5.7%) recorded a weakness. These data support the study question by revealing another reason why teachers may be avoiding the teaching of science. If teachers feel weak in a discipline, they may choose to avoid that area.

Table 3

Weak Science Disciplines by Knowledge and Qualification of Teachers

Item 11	Un-			Item 12	Un-		
	SA/A	decided	D/SD		SA/A	decided	D/SD
WEAKNESSES				WEAKNESSES			
Physical	19.20%	9.60%	17.30%	Physical	44.20%		1.90%
Earth	1.90%			Earth	1.90%		
Life	1.90%		1.90%	Life	1.90%		
Phy & Earth	15.40%		13.40%	Phy & Earth	19.20%	5.70%	3.80%
Phy & Life	1.90%			Phy & Life	1.90%		
Earth & Life	1.90%	1.90%	1.90%	Earth & Life	5.70%		
All Three	1.90%			All Three	5.70%		3.80%

In the Teacher Background Survey teachers were given a choice of subjects, and asked which they would most like to teach. Table 4 reflects the combining of subject choice with responses to item 1 on the Teacher Professional Survey which asked if they enjoyed teaching science.

Table 4

Subjects Teachers Like to Teach

Enjoy Teaching Science	Choice of Subject		
	Social Studies	Math	Science
Item 1			
Strongly Agree	5.70%	5.70%	13.50%
Agree	21.60%	38.50%	5.70%
Undecided		1.90%	
Disagree	3.80%	1.90%	
Strongly Disagree		1.90%	

Table 4 reveals that of the respondents who stated that they enjoyed teaching science, only 19.2% chose science as the subject they would like to teach, while 71.5% chose either math or social studies as their preferred subject. These data support the study question by showing teacher preference of subjects other than science.

Summary of Results

The results of this study showed that 88% of the respondents enjoy teaching science, but 56.6% felt that their science methods courses did not prepare them to teach science in the elementary school. It also revealed that 35.8% of the teachers felt that their principal was not

interested or supportive of a strong science curriculum, and that 37.8% felt that their district was not supportive.

The study revealed differences between rural and urban districts. In the rural district 57.9% of the respondents saw a need for more science professional development, while only 21.2% of the urban teachers felt the same need. Also, in the rural district, 35.7% more of the respondents felt that interested teachers were not being sent to science conventions and conferences.

The open-ended question reflected several common threads. The most recurring factors were lack of material, equipment and space, and a lack of time. Teachers reported that most of their time was spent on the more important subjects like math and reading, due to the testing in those areas.

The study also revealed that 36.5% of the respondents saw Physical Science as an area of weakness, although they had recorded they felt they had a good knowledge base in all the science disciplines. Of the teachers who reported they felt qualified to teach science in the elementary school, 69.1% recorded Physical Science as an area of weakness.

The Background Survey showed that only 19.2% of the respondents chose science as the subject they would prefer

to teach. About 72% of the teachers chose math or social studies over science as their preferred subject.

Discussion

It is interesting to note that although teachers admit to exclusion of science from their normal routine, over 88% in this survey stated they enjoy teaching science. This evidence is in conflict with the findings of Flick (1993) in which the statement was made that elementary science is usually cast in terms of aversion to the subject matter. Westerback (1982) also reported that negative attitudes are commonplace among elementary teachers. However, although the respondents in this study overwhelmingly report the enjoyment of teaching science, over 71% chose either math or social studies as the subject they would prefer to teach. It would seem that although they like science, they do not prefer science. These findings reflect the research of Tilgner (1990). Tilgner reported that researchers have shown that over half of elementary teachers rank science fourth or fifth out of five subjects. Even though the subjects in this survey did not rank their teaching preferences, there appears to be some correlation between this study and that of Tilgner (1990).

Over 45% of the teachers in this survey reported that their undergraduate science courses did not provide them

with a good conceptual understanding in science. Of the responding teachers, over 56% stated that their undergraduate education courses did not prepare them to teach science in the elementary school. These data reflect the findings of several researchers. Zeitler (1984) emphasized a need for the improvement of instruction even at the pre-college level. Tilgner (1990) identified studies in 12 states in which most of the teachers felt that their undergraduate course work in science was inadequate, especially in the area of hands-on activities. In the questionnaire portion of this study, several respondents mentioned a need for more hands-on activities.

According to this study, over 43% of the respondents reported that they feel they have a good knowledge base in all the science disciplines. However, in the Teacher Background Survey section, all respondents noted a weakness in at least one discipline. Over 36% named Physical Science as a weakness. These findings correlate with Westerback (1982) and Flick (1993). Westerback (1982) cited knowledge as an area of concern for many new teachers. Flick (1993) stated that a lack of knowledge was understandable since most elementary teachers tend to have more of a background in reading or language arts. One of the common threads found in the questionnaire portion of

this study was lack of background or knowledge. This would support the earlier work done by Westerback and Flick.

Over 80% of the teachers in this survey stated they feel they are qualified to teach science in the elementary school. One hundred percent of the rural teachers made that statement. These findings are in conflict with those of Fraser-Abder (1989). Fraser-Abder reported that only 22% of elementary teachers feel very well qualified to teach science. It would seem that although teachers feel qualified to teach science, they still see areas in their knowledge base that needs improvement.

The respondents in this study seem to have healthy attitudes toward the teaching of science and they also report they feel qualified to teach science. Their neglect in the teaching of science appears to be linked to what they consider a lack of time. Several reasons were cited for this lack of time. Many felt their district or principal encouraged them to focus on reading and math, due to the testing in these subjects. Also, a lack of time was linked to gathering materials, equipment or space that had to be shared. Some teachers stated that if they had access to quick or easy hands-on experiments their science instruction would improve.

The respondents overwhelmingly noted a need for improved undergraduate science courses, science methods courses, and professional development. This need for improvement seemed to be tied to a lack of knowledge or confidence. All the teachers named at least one area of personal weakness in the science disciplines. However, these weaknesses did not seem to be the reason for their neglect of science.

Most of the teachers in the upper elementary grades felt the pressure of the testing system. They feel that their teaching ability is linked to their students' performance on the state-mandated test. In the primary grades, the emphasis stressed was on getting their students to read. They also felt that their teaching ability was tied to their students' ability to read on grade level. These outside forces seem to have the greatest impact on the neglect of science in today's elementary classroom.

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APPENDIX

Teacher Professional Survey
Teacher Background Survey
Teacher Questionnaire

I understand that the return of this completed questionnaire constitutes my informed consent to act as a research subject in this study.

Teacher Professional Survey

Please Choose the appropriate response: SA = Strongly Agree; A = Agree; UN = Undecided; D = Disagree; SD = Strongly Disagree.

- | | |
|--------------|--|
| SA A UN D SD | 1. I enjoy teaching science. |
| SA A UN D SD | 2. My college undergraduate science courses provided me with a good conceptual understanding in science. |
| SA A UN D SD | 3. My college undergraduate education courses prepared me to teach science in the elementary school. |
| SA A UN D SD | 4. My district provides sufficient professional development in the science content area. |
| SA A UN D SD | 5. My district provides me with opportunities to meet with my peers and discuss strategies and concepts that have been used in the classroom following professional development in the science content area. |
| SA A UN D SD | 6. My district provides professional development in science supplying me with many science activities. |
| SA A UN D SD | 7. My district sends interested teachers to science conventions and conferences such as CAST. |
| SA A UN D SD | 8. My district sends interested administrators to science conventions and conferences such as CAST. |
| SA A UN D SD | 9. My principal is very interested and supportive of a strong science curriculum |

- SA A UN D SD 10. My district is very interested and supportive of a strong science curriculum.
- SA A UN D SD 11. I feel that I have a good knowledge base in all the science disciplines.
- SA A UN D SD 12. I feel that I am qualified to teach science in the elementary school.

Teacher Background Survey

1. How many years of teaching experience do you have?_____
2. How many years of teaching experience has been self-contained?_____ departmentalized?_____
3. How many years of experience do you have teaching science?_____
4. How many high school science courses did you take?
 0 1 2 3 4 More
5. How many undergraduate science courses did you take?
 0 1 2 3 4 More
6. How many graduate science courses have you taken?
 0 1 2 3 4 More
7. How many hours of science staff development have you taken during your career?
 0 - 3 4 - 6 7 - 9 10 - 12 More
8. How many science workshops have you attended?
 0 1 2 3 4 More
9. How many science conventions/conferences have you attended?
 0 1 2 3 4 More
10. Which of the following disciplines do you feel are your strongest?
 Physics_____ Chemistry_____ Geology_____
 Biology_____ Ecology_____ Oceanography_____
 Astronomy_____ Meteorology_____
11. Which of the following disciplines do you feel are your weakest?
 Physics_____ Chemistry_____ Geology_____
 Biology_____ Ecology_____ Oceanography_____
 Astronomy_____ Meteorology_____

12. Which of the following subjects would you choose to teach if you could only pick one?

Social Studies

Math

Science

Urban District _____ Rural District _____

1. About how many minutes do you spend teaching science per day? _____
2. About how many minutes do you spend teaching science per week? _____
3. What would be the main factor(s) that would cause you to exclude the teaching of science from your normal routine? Please explain.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.