MALE/FEMALE ASPIRATIONS TO SCIENCE ORIENTED CAREERS IN GRADES 2 - 6 IN RURAL EAST CENTRAL ILLINOIS

PAYNE

Male/Female Aspirations to Science Oriented Careers

in Grades 2 - 6 in Rural East Central Illinois
(TITLE)

BY

Anneliese Payne

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

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IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

1990
YEAR

I HEREBY RECOMMEND THIS THESIS BE ACCEPTED AS FULFILLING
THIS PART OF THE GRADUATE DEGREE CITED ABOVE

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Department of Elementary and Junior High Education

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Eastern Illinois University

Charleston, Illinois

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ABSTRACT

MALE/FEMALE ASPIRATIONS TO SCIENCE ORIENTED CAREERS IN GRADES 2 - 6 IN RURAL EAST CENTRAL ILLINOIS

by

Anneliese Payne, M.S., Education

Eastern Illinois University, 1990

President Bush recently outlined six national goals for education to be accomplished by the year 2000. One of these goals is that American students must rank first in the world in achievement in science and mathematics. How are these goals to be realized? What are the attitudes of students toward science and mathematics? Is there a critical time for intervention? The attitudes of male and female elementary school children in grades 2 through 6 in rural East Central Illinois toward science oriented occupations were examined in this study involving students (N=364) from 4 East Central Illinois communities. Data has been collected through a writing prompt which was distributed to the students and analyzed by three independent adult readers. The results indicate that the students'

interest in science is relatively high at the elementary school level, but females do not envision themselves in science oriented occupations twenty years from now in the same number as males. Since parents and teachers appear to greatly influence vocational choices of young children, it is equally important to educate both groups, so that children are not shortchanged in terms of their future aspirations.

DEDICATION

This work is dedicated to my loving family, my husband Fred, daughter Monica and son Christopher.

ACKNOWLEDGEMENTS

This paper has not only been a very challenging learning experience, but also a very exciting one. I would like to express my sincere appreciation to the many individuals who patiently contributed their time and efforts to this endeavor.

First of all, I would like to thank Dr. Henry Taitt, my thesis advisor and friend, for his guidance and confidence in my ability to complete this task. I would also like to thank Dr. Carol Helwig, who has been my advisor since I began my college career four years ago.

I am also appreciative of the work of the members of my committee, Dr. Susan Brown-Sandberg, who took time out of her busy schedule for revisions and suggestions. Dr. Gene Dolson also gave me his time and valued opinion.

Three people who spent an enormous amount of time reading the student responses were Amy Tharp, Teresa Metzger and Chris Muenning. I will always be grateful.

I would also like to add a word of thanks to the teachers and administrators who were willing to have their students respond to the writing prompt. Without them, there would not have been a study.

Lastly, I want to express my gratitude and love to my family. My husband Fred, who has given me strength and encouragement throughout the years, Monica, who has been my proofreader and emotional support, and Christopher, who has generously shared his computer expertise.

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CHAPTER I

IMPORTANCE OF THE STUDY

In his recent State of the Union address, President Bush outlined six national goals for education to be accomplished by the year 2000. One of these goals is that American students must rank first in the world in achievement in science and mathematics (Tifft, 1990). Statistics show that out of 3.8 million high school graduates, 25 percent cannot read their diploma. In a recent test of the best high school seniors in 13 countries including Singapore, the U.S. students ranked last in biology, 11th in chemistry and 9th in physics (Canevaro, 1989). How can this problem be resolved? How can science and mathematics education for American students be improved? Is there a critical age for such instruction? Cindy Canevaro, Corporate Affairs Officer of Electronic Data Systems (EDS) recently remarked that students decide in the 5th or 6th grade to drop out of school. Is there also a critical time for students' interest in science and mathematics? There is a need to study the attitudes of children in grades 2 through 6 to assess if they see themselves as future scientists. Today's 2nd through 6th graders will graduate from college and search for jobs in a highly technological world. Will they be prepared?

Another important question is: are students developing tastes and curiosity in science or are they losing interest in science in the elementary classroom? It is essential to assess elementary aged students, so that corporate and government funding can be targeted at the age level most likely to produce results. Which careers they envision for themselves in the future is one way to gauge students' interest in science; therefore, investigated in this study is the distribution of science and non-science careers as perceived by students in grades 2 through 6 in rural East Central Illinois.

STATEMENT OF THE PROBLEM

Do females aspire to science oriented occupations in the same percentages as males in grades 2 through 6 in rural East Central Illinois?

HYPOTHESIS

Females aspire to science oriented occupations in the same percentages as males in grades 2 through 6 in rural East Central Illinois.

ASSUMPTIONS

The following assumptions underlie the study:

1. The sample population will be representative of 2 through 6 grade students from rural communities in East Central Illinois.
2. The responses made by the students represent their own thinking.

LIMITATIONS

The limitations of this study include:

1. Students (N=364) at Crestwood School, Paris, Illinois; Casey Elementary School, Casey, Illinois; Windsor Elementary School, Windsor, Illinois; Kansas Elementary School, Kansas, Illinois.
2. The use of specific classes in grade levels 2 through 6.
3. Data obtained from responses to a writing prompt specifically designed for this study which required a written response.

CHAPTER II

REVIEW OF THE LITERATURE

In this chapter, literature related to students' attitudes towards science and science-related careers will be presented. The review of the literature is divided into two sections. The first section will consist of literature which focuses on students' attitudes toward science and science related careers. The second section contains a review of the literature that relates gender differences and its influence on students' attitudes toward science.

Students' Attitude Toward Science

The literature contains studies that were completed in the 1970's and '80's which demonstrated that very little progress was made in improving students' attitude toward science. Fourth graders through high school age students were included in various studies. All of the reviewed studies indicate a consistent decline in attitude toward science.

For example, in 1975, Ayers and Price conducted a study which measured the attitudes of a group of upper elementary grade children toward science. The specific purposes were to develop an instrument to assess children's attitudes toward science, to field test the

instrument with a group of children in the Southern Appalachian Region, to determine how children's attitudes toward science varied, e.g., from grade level to grade level and among the sexes, and to provide information that might be of aid in the redesign of the science curriculum and in-service teacher training programs for a school system. The subjects for this study consisted of fourth, fifth, sixth, seventh, and eighth grade students (N=455) enrolled in the Spring of 1973 in the five elementary schools of the Clay County, Tennessee School System. The results indicated a change in the attitude toward science of children as one moved from the fourth to the eighth grade. Fourth grade students were more positive in their attitude towards science than fifth grade students. Sixth grade students were the most negative. Seventh grade students had a more positive attitude toward science than sixth grade students, but were not as positive as students in the fourth or fifth grades. Eighth grade students were neither extremely positive nor negative in their responses. There were no major differences in the science attitudes of males and females.

Johnson (1981) reflected on a study by the National Assessment of Educational Progress (NAEP) which assessed the science achievement of 9-, 13-, and 17-year-old

students in 1969-70, in 1972-73, and the latest in 1976-77. Besides determining achievement, the 1976-77 assessment measured students' attitudes toward science. In the sampling procedure, NAEP generalized to a national population of students (N=72,000). It was reported that the data from the nine-year old students seemed to indicate positive feelings about science. Sixty percent of them felt that being a scientist would be fun. Thirteen year olds' attitudes toward science were less positive. Less than half of them claimed to have any interest in a science-related career. Further comparison between ages 9 and 13, and 13 and 17 showed a steady decline in interest in science.

A follow-up study by Yager and Bonnstetter (1982) of the 1977 NAEP was completed using the same survey items and age groups used by the NAEP in 1977. A comparison of data showed that there was virtually no difference between the perception of persons from the age group from the 1977 NAEP sample and the 1982 Iowa sample. This tends to validate the results while suggesting few changes in effect of school science upon student perception of teachers, classes, and course content over a five year period.

Yager and Yager (1985) found that the results obtained in four studies on students' attitudes toward science were similar. Younger students were more

excited about science than their older counterparts and teachers were looked on as information providers. Students did not feel more successful or curious as they worked through science programs and the schools failed to provide sound information on science careers nor did they encourage their students to follow these careers.

Solomon and Wroblewski (1989) conducted a study of elementary science-magnet school student attitudes toward science as measured by selected national assessment of educational progress (NAEP) items. The study group included fourth-, fifth-, and sixth-graders (N=358), 177 in the elementary science-magnet school and 181 in a neighboring school which served a similar student population. The measuring instrument was derived from the National Assessment of Educational Progress. It was reported that students enrolled in an elementary science-magnet school were more likely to identify science as their favorite or second favorite subject than their counterparts enrolled in the comparison school.

A study designed to assess the effect of an elementary science curriculum implementation on students' attitudes towards science was conducted by Kyle (1989). The posttest only control group design was used for this study. The following instrument was

administered in May 1988: Preferences and Understandings - Student Version. The validity of the instrument is face validity as reported by NAEP (1978). The questionnaire was administered to all students in ScienceQuest pilot classrooms in grades 2 through 6 (N=260) and a random sample of two control classrooms per grade level from non-pilot schools in the district (N=258). Results showed, while there is a differential impact upon students' attitude depending upon the grade level, frequency data analysis reveals that ScienceQuest students across all grade levels consistently showed more positive attitudes toward science when compared to students in control classes.

The Influence of Gender Differences

The second section of the literature review contains studies that relate gender differences and its influence on students' attitudes toward science.

A study which compared sex differences of sixth grade students' science attitude and science achievement was conducted by Shrigley (1972). The instruments used to measure the independent variables were the Science Attitude Scale and the Science Achievement Test. The sample consisted of four groups of sixth graders (N=120, 64 boys and 56 girls). The three-week teaching period immediately prior to the administration of the

instruments assured the investigator that the sampling of students had experienced a recent learning experience in science. The results of the attitude scale indicated a sex difference in the attitude of sixth graders toward science with males rating significantly higher. The results of the science achievement test indicated no significant sex difference in science achievement among sixth grade students.

Steinkamp and Maehr (1984) conducted a comprehensive review of the literature containing comparisons between boys and girls on some measure of motivation in science and/or some measure of achievement in science. Data was collected from research on school-age children reported in the English language between the years of 1965 and 1981. The information was drawn from articles and reports, large-scale national and international studies, and standardized testing procedures. The researchers found that sex differences in both motivation and achievement are smaller than is generally assumed, but they do occur, and, with few exceptions, they tend to favor males. When data from the United States were examined seperately, it was discovered that girls' orientations became more negative in relation to boys' in the past 6 years. In spite of

that decline, both boys' and girls' motivational orientations in the U.S. were improving across time.

Becker (1989) reexamined the meta-analysis conducted by Steinkamp and Maehr in 1984. Data from 30 studies of the magnitude of gender differences in science achievement previously examined in two separate reviews were synthesized using modern methods for meta-analysis. The results suggested that physical and biological sciences and general science show the greatest discrepancies in achievement-test performance according to gender. For biology and life sciences, the largest effects were found for samples of third and fourth graders, while the smallest were for twelfth graders. Becker concludes that perhaps only able girls persisted through twelfth-grade biology; thus the gender difference appeared smaller when in fact the population had changed. The re-analysis of results from Steinkamp and Maehr's earlier reviews indicate that subject matter indeed relates to the magnitude of science-achievement gender differences.

In their study, Piburn and Baker (1989) examined the variables that might influence females' success in science by experimenting with the outcomes of measures of formal reasoning ability under a number of conditions. The rationale for this approach was the strong similarity between these tasks and the demands

placed upon students in academic science classes. The design of the study necessitated the use of nineteen instruments to be administered to a relatively small sample (N=66). The interviewers obtained better performance on clinical measures from males than from females, tending to confirm the intrinsic bias against females found in those tasks. Piburn and Baker interpret these results as that larger sex differences occur in the case of problems that require additional background knowledge and access to specialized experimental and computational routines of the kind that arise from practice and experience. This would be consistent with the results of National Assessment of Educational Progress, in which females report having significantly fewer experiences using scientific equipment and having experimented less with materials. Science teachers usually provide boys with instructions for completing a project, but show girls how to do it or do it for them.

CHAPTER III

RESEARCH DESIGN AND PROCEDURE

Procedures involved in the study are reviewed in this chapter, which is organized in three sections. They are overall design, population and instrumentation.

OVERALL DESIGN

This study consisted of two major phases. The first stage focused on instrument development, while the second examined the results of the instrument.

The subjects of this study were from four schools in rural communities in East Central Illinois. Students (N=364) in grades 2 through 6 were asked to respond to a writing prompt which was developed to determine if students at the elementary school level see themselves in a science oriented occupation twenty years from now.

Each writing prompt was read by three independent adult readers who determined whether the students' responses indicated an interest in a science oriented career or a non-science oriented career.

POPULATION

Populations under investigation in this study were students (N=364) in the 2nd through 6th grade at Crestwood School, Paris, Illinois, Casey Elementary and Junior High, Casey, Illinois, Windsor School, Windsor, Illinois, and Kansas Elementary School, Kansas, Illinois. The students were enrolled in the 2nd through 6th grade during the Spring 1990 semester.

INSTRUMENTATION

Data was obtained from an instrument (Appendix A) specifically designed for this study. The instrument, a writing prompt, put the students into a science oriented environment by asking the students how old they would be in the year 2010, and what job they would like on a new Solar Space Station. This encouraged the students to place themselves in a highly technological environment. They were then asked what their duties would be to further explain and clarify their chosen occupation. If a student said they wanted to be a teacher, it was not considered science oriented unless they specified a kind of teacher that teaches science, math or a science related subject.

Each student response was read by three independent adult readers who were graduate students in the Elementary and Junior High Department at Eastern Illinois University. The readers were not given any list of science or non-science oriented occupations since the possibilities were unlimited. The readers relied on their own judgement, and the author checked these results for consistency.

CHAPTER IV

RESULTS

This chapter has three sections and focuses on the results of the study. The first section presents the context of the study, the second section the findings, and the third section test of the stated hypothesis.

CONTEXT OF THE STUDY

Four schools in rural communities in East Central Illinois were selected for this study. Students (N=364) in grades 2 through 6 were asked to answer three questions. "The International Space Society is looking for people to live and work in its new Solar Space Station. The pay is great and the view is super! How old are you, and what sort of job would you like to have? What will your duties be?" (Appendix A) By design, the writing prompt put the student into a future science oriented environment. Students were asked to reply in writing and describe specific duties associated with the job. The student responses were then returned to the author and analyzed. Results of the findings are found in the Tables below.

Table 1

Total Number of Males and Females per School

	Males	Females
School A	50	55
School B	18	17
School C	65	78
School D	35	46
Total	168	196

Indicated in Table 1 are the total number of males and females for each school that participated in the study. School A had a female advantage of 5, School C (13) and School D (11). School B was the only school with fewer female responses than male responses (-1).

The sample was then analyzed for the number of males and females per grade as shown in Table 2.

Table 2

Total Number of Males and Females per Grade
(combining the four schools)

	Males	Females
2nd Grade	35	33
3rd Grade	44	56
4th Grade	49	63
5th Grade	23	27
6th Grade	17	17
Total	168 (46.2%)	196 (53.8%)

Table 2 shows that females outnumbered males in three grades, were equal in one grade and, were outnumbered by males in one grade.

To summarize, as shown in Tables 1 and 2, student responses were from a slightly larger female than male population: 53.8% females and 46.2% males.

FINDINGS

Table 3 illustrates the data obtained per school, as well as the total number of science and non-science oriented choices in the Sample.

Table 3

Science and Non-Science Oriented Careers per School

	Science	Non-Science
School A	49	56
School B	26	9
School C	88	55
School D	35	46
Total	198	166

Data obtained from the written response of the 2nd through 6th graders show that more students indicated a science oriented occupation than a non-science oriented occupation. Notice that two schools had more science than non-science careers and two had more non-science than science. However, the total number of students indicating science oriented careers outnumbered the students indicating non-science oriented careers.

Table 4

Science and Non-Science Oriented Careers per Grade Level

	Science	Non-Science
2nd Grade	38	30
3rd Grade	50	50
4th Grade	57	55
5th Grade	34	16
6th Grade	19	15
Total	198	166

When the student responses were examined by grade (Table 4), no grade had more non-science than science oriented careers. Tables 3 and 4 show science oriented responses outnumbered non-science oriented responses.

The data was then analyzed for the number of male and female responses in the science and non-science oriented categories.

Table 5 shows the results of males and females in science oriented careers per grade, and Table 6 shows the results of males and females in non-science oriented careers per grade. The sum of the two tables equal the total number of students in each class.

Table 5

Males and Females in Science Oriented Careers per Grade

	Males	Females
2nd Grade	23	15
3rd Grade	28	22
4th Grade	29	28
5th Grade	19	15
6th Grade	12	7
Total	111	87

Males outnumber females in the science oriented careers.

Table 6

Males and Females in Non-Science Oriented Careers

	Males	Females
2nd Grade	12	18
3rd Grade	16	34
4th Grade	20	35
5th Grade	4	12
6th Grade	5	10
Total	57	109

Females outnumber males in non-science oriented careers.

Males and Females
in the Total Sample

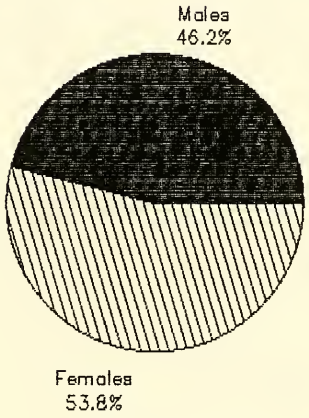

Figure 1

Science/Non-Science Careers in the Total Sample

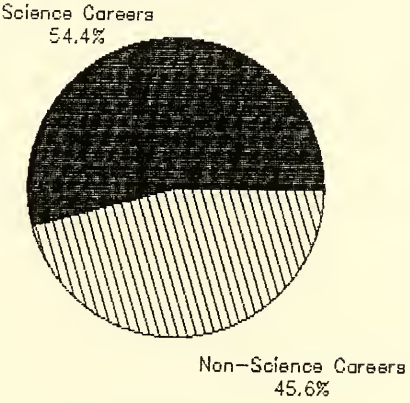

Figure 2

Males and Females
Selecting Science Careers

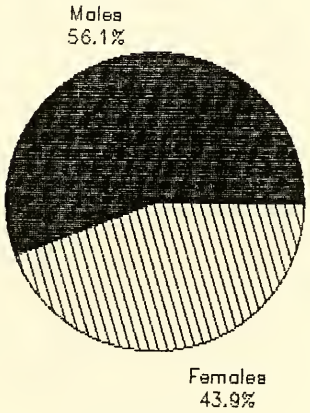

Figure 3

Males and Females
Selecting Non-Science Careers

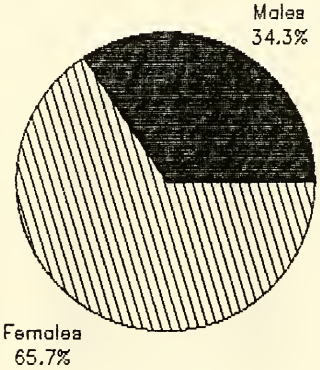

Figure 4

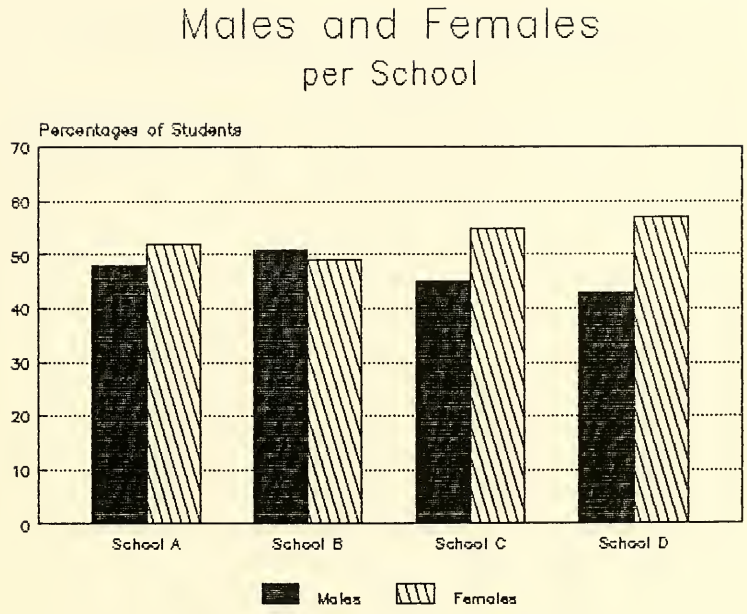
Males and Females
per School
Percentages of Students
70
60
50
40
30
20
10
0
School A
School B
School C
School D
Males
Females

Figure 5

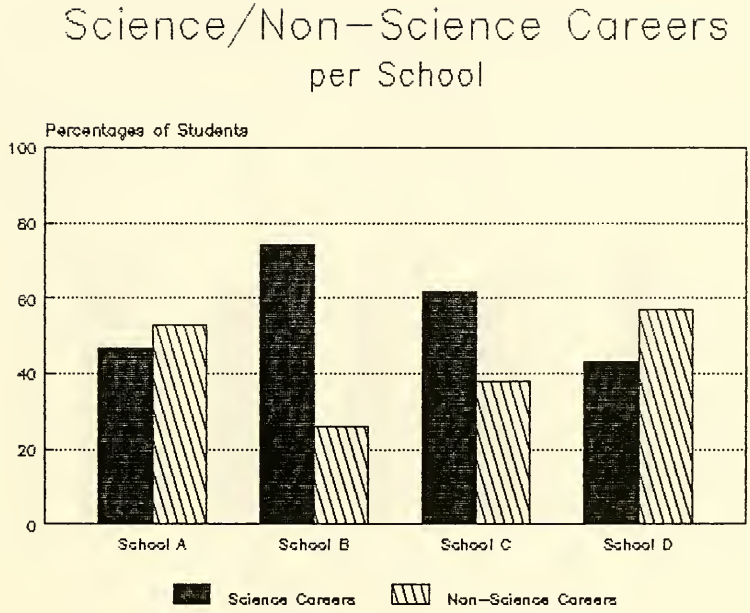
Science/Non-Science Careers
per School
Percentages of Students
100
80
60
40
20
0
School A
School B
School C
School D
Science Careers
Non-Science Careers

Figure 6

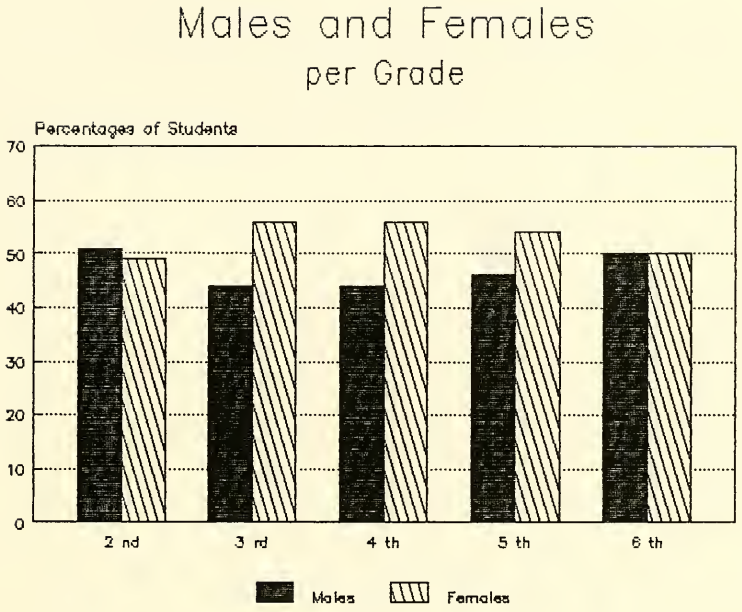
Males and Females
per Grade
Percentages of Students
70
60
50
40
30
20
10
0
2 nd
3 rd
4 th
5 th
6 th
Males
Females

Figure 7

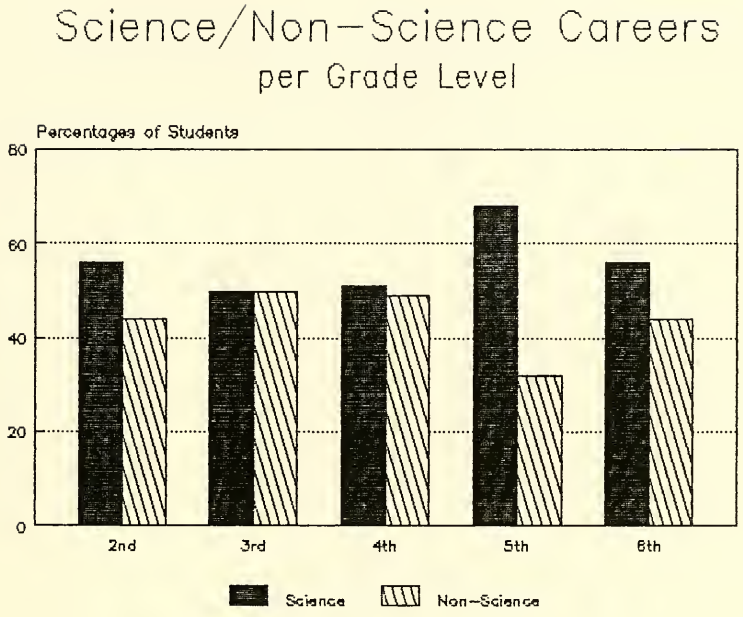
Science/Non-Science Careers
per Grade Level
Percentages of Students
80
60
40
20
0
2nd
3rd
4th
5th
6th
Science
Non-Science

Figure 8

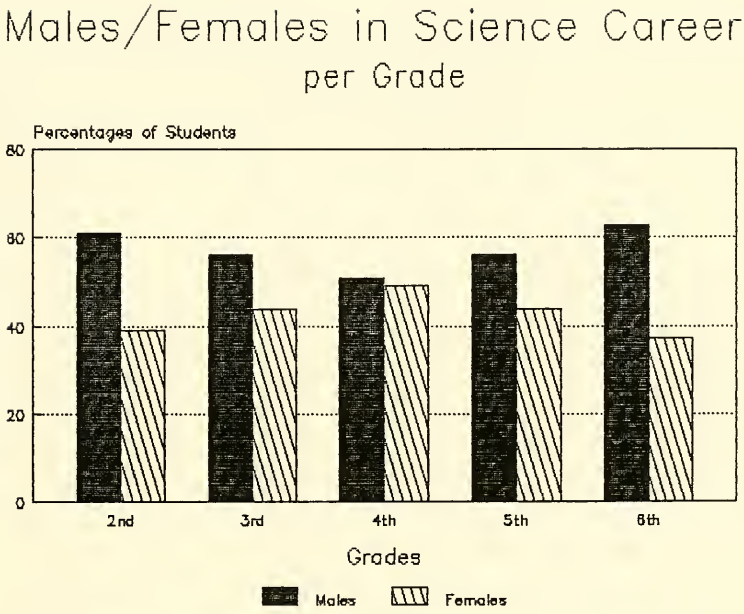
Males/Females in Science Careers
per Grade
Percentages of Students
80
60
40
20
0
2nd
3rd
4th
5th
6th
Grades
Males
Females

Figure 9

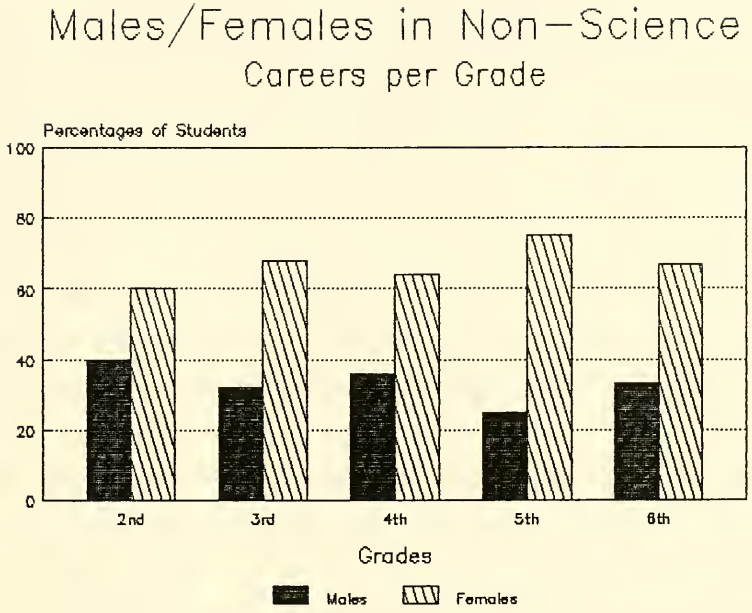
Males/Females in Non-Science
Careers per Grade
Percentages of Students
100
80
60
40
20
0
2nd
3rd
4th
5th
6th
Grades
Males
Females

Figure 10

A summary of the graphic findings are:

1. There are more females (53.8%) than males (46.2%).
2. There are more science oriented careers (54.4%) than non-science careers (45.6%).
3. There are more males than females in science oriented careers (56.1%).
4. There were more females than males in non-science oriented careers (65.7%).
5. Two schools had more science than non-science careers and two schools had more non-science than science careers.
6. Grades 3, 4 and 5 had more females than males, grade had an equal number, and grade 2 had more males than females.
7. No grade had more non-science careers than science careers.
8. All grades had more males selecting careers in science than females.
9. All grades had more females selecting non-science careers than males.

The student's reply to the writing prompt was either classified as a science or non-science oriented career by the readers. Table 7 is a list of occupations taken from the responses that were considered to be science oriented. Also included are those whose duties implied that a science background would be necessary. (Example, teacher was not considered a science oriented career unless the student mentioned teaching a science or mathematics related subject. Table 8 is the same list sorted by the occupations most preferred by females. Table 9 is sorted by the occupations most preferred by males.

Table 10 is a list of occupations taken from the responses that were considered to be non-science oriented. Table 11 and 12 are sorted according to female and male preferences respectively.

Table 7

Science Oriented Occupations

As Identified by the Students
(In Alphabetical Order)

	Females	Males
Architect	0	3
Astronaut	10	7
Astronomer	1	5
Botanist	0	3
Captain of Spaceship	1	1
Chemist	0	1
Collector	0	1
Computer Specialist	3	5
Dental Hygenist	1	0
Dentist	0	1
Doctor	1	4
Electrician	0	1
Explorer	10	10
Flight Engineer	0	3
Geologist	3	2
Hyperdrive Scientist	0	1
Inspector	1	0
Inventor	1	4
Lab Technician	1	0
Mathematician	0	1
Metallurgist	0	2
Nurse	19	0
Paleontologist	0	1
Photographer	1	1
Physical Therapist	0	1
Pilot	2	24
Plant Keeper	3	1
Plant Scientist	2	0
Programmer	0	1
Rescuer	0	1
Satellite Specialist	1	0
Scientist	13	12
Shuttle Engineer	0	4
Space Kisser	0	1
Space Technician	1	0
Spaceship Designer	0	1
Spaceship builder	1	2
Systems Analyst	0	1
Teacher	3	1
Technician	2	0
Veterinarian	4	2
Weapons Engineer	0	1
Zoo Keeper	2	1

Table 8

Science Oriented Occupations

As Identified by the Students
(Ranked According to Female Preferences)

	Females	Males
Nurse	19	0
Scientist	13	12
Explorer	10	10
Astronaut	10	7
Veterinarian	4	2
Teacher	3	1
Computer Specialist	3	5
Plant Keeper	3	1
Geologist	3	2
Pilot	2	24
Plant Scientist	2	0
Zoo Keeper	2	1
Technician	2	0
Spaceship builder	1	2
Photographer	1	1
Satellite Specialist	1	0
Lab Technician	1	0
Inventor	1	4
Doctor	1	4
Inspector	1	0
Space Technician	1	0
Astronomer	1	5
Captain of Spaceship	1	1
Dental Hygenist	1	0
Systems Analyst	0	1
Weapons Engineer	0	1
Dentist	0	1
Electrician	0	1
Programmer	0	1
Mathematician	0	1
Shuttle Engineer	0	4
Architect	0	3
Collector	0	1
Spaceship Designer	0	1
Botanist	0	3
Rescuer	0	1
Metallurgist	0	2
Hyperdrive Scientist	0	1
Chemist	0	1
Space Kisser	0	1
Flight Engineer	0	3
Paleontologist	0	1
Physical Therapist	0	1

Table 9

Science Oriented Occupations

As Identified by the Students
(Ranked According to Male Preferences)

	Females	Males
Pilot	2	24
Scientist	13	12
Explorer	10	10
Astronaut	10	7
Astronomer	1	5
Computer Specialist	3	5
Doctor	1	4
Shuttle Engineer	0	4
Inventor	1	4
Architect	0	3
Botanist	0	3
Flight Engineer	0	3
Spaceship builder	1	2
Veterinarian	4	2
Geologist	3	2
Metallurgist	0	2
Mathematician	0	1
Dentist	0	1
Spaceship Designer	0	1
Plant Keeper	3	1
Zoo Keeper	2	1
Photographer	1	1
Teacher	3	1
Electrician	0	1
Programmer	0	1
Weapons Engineer	0	1
Collector	0	1
Captain of Spaceship	1	1
Rescuer	0	1
Systems Analyst	0	1
Hyperdrive Scientist	0	1
Chemist	0	1
Space Kisser	0	1
Paleontologist	0	1
Physical Therapist	0	1
Plant Scientist	2	0
Lab Technician	1	0
Inspector	1	0
Space Technician	1	0
Nurse	19	0
Dental Hygenist	1	0
Technician	2	0
Satellite Specialist	1	0

Table 10

Non-Science Oriented Occupations

As Identified by the Students
(In Alphabetical Order)

	Females	Males
Artist	1	2
Babysitter	3	0
Baseball Player	0	1
Basketball Coach	0	1
Basketball Player	0	5
Boss	3	0
Business Manager	1	0
Car Sales Person	1	0
Caretaker of Aged	1	0
Cartoonist	0	1
Checker	1	0
Child Care Center Owner	1	0
Cleaner	10	2
Cook	4	1
Dancer	3	0
Decorator	1	0
Dishwasher	1	0
Entertainer	1	0
Farmer	0	3
Fashion Designer	1	0
Florist	1	0
Food Personnel	3	0
Foreman	0	1
Grocery Store Owner	1	0
Guard	0	3
Guide	1	0
Hair Designer	2	0
Helper	0	1
Historian	0	1
Horse Trader	0	1
Hostess	1	0
Janitor	1	3
Lawyer	0	1
Librarian	1	0
Maid	5	0
Mailman	0	1
Masseuse	1	0
McDonalds Manager	0	1
Mechanic	0	5
Messenger	1	0
Model	2	0
Office Manager	2	0
Peace Officer	0	1
People Checker	1	0
Personnel	1	0

Photographer	2	1
Plumber	0	1
Policeman	0	9
Priest	2	0
Printer	1	0
Rancher	0	1
Repairman	0	1
Retailer	1	0
Runner	0	1
Salesperson	1	0
Secretary	2	0
Singer	1	0
Store Owner	0	1
Supervisor	1	0
Swimmer	1	0
T.V. Star	2	0
Teach Manners	1	0
Teacher	27	2
Tour Guide	1	0
Transportation Director	1	0
Trash Collector	1	0
Trucker	0	2
VP of Shopping Mall	0	1
Waitress	4	0
Watchman	0	1
Worker	0	1

Table 11

Non-Science Oriented Occupations

As Identified by the Students
(Ranked According to Female Preferences)

	Females	Males
Teacher	27	2
Cleaner	10	2
Maid	5	0
Waitress	4	0
Cook	4	1
Dancer	3	0
Food Personnel	3	0
Boss	3	0
Babysitter	3	0
Photographer	2	1
Hair Designer	2	0
T.V. Star	2	0
Priest	2	0
Office Manager	2	0
Secretary	2	0
Model	2	0
Dishwasher	1	0
Artist	1	2
Decorator	1	0
Librarian	1	0
Fashion Designer	1	0
Masseuse	1	0
Caretaker of Aged	1	0
Checker	1	0
Janitor	1	3
Retailer	1	0
Tour Guide	1	0
Grocery Store Owner	1	0
Singer	1	0
Child Care Center Owner	1	0
Supervisor	1	0
Car Sales Person	1	0
Transportation Director	1	0
Teach Manners	1	0
Business Manager	1	0
Messenger	1	0
Printer	1	0
Entertainer	1	0
Florist	1	0
Swimmer	1	0
Trash Collector	1	0
Hostess	1	0
Salesperson	1	0
Guide	1	0
Personnel	1	0

People Checker	1	0
Guard	0	3
McDonalds Manager	0	1
Rancher	0	1
Policeman	0	9
Runner	0	1
VP of Shopping Mall	0	1
Trucker	0	2
Repairman	0	1
Baseball Player	0	1
Basketball Coach	0	1
Plumber	0	1
Mailman	0	1
Horse Trader	0	1
Basketball Player	0	5
Worker	0	1
Farmer	0	3
Watchman	0	1
Lawyer	0	1
Peace Officer	0	1
Historian	0	1
Mechanic	0	5
Helper	0	1
Cartoonist	0	1
Store Owner	0	1
Foreman	0	1

Table 12

Non-Science Oriented Occupations

As Identified by the Students
(Ranked According to Male Preferences)

	Females	Males
Policeman	0	9
Mechanic	0	5
Basketball Player	0	5
Janitor	1	3
Guard	0	3
Farmer	0	3
Cleaner	10	2
Trucker	0	2
Artist	1	2
Teacher	27	2
Baseball Player	0	1
Cook	4	1
VP of Shopping Mall	0	1
Horse Trader	0	1
Historian	0	1
Lawyer	0	1
Store Owner	0	1
Rancher	0	1
Photographer	2	1
Worker	0	1
Basketball Coach	0	1
Foreman	0	1
McDonalds Manager	0	1
Runner	0	1
Repairman	0	1
Plumber	0	1
Mailman	0	1
Watchman	0	1
Peace Officer	0	1
Helper	0	1
Cartoonist	0	1
Tour Guide	1	0
Librarian	1	0
Fashion Designer	1	0
Masseuse	1	0
Office Manager	2	0
Food Personnel	3	0
Car Sales Person	1	0
Retailer	1	0
Supervisor	1	0
Dishwasher	1	0
Hair Designer	2	0
Grocery Store Owner	1	0
Singer	1	0
Child Care Center Owner	1	0

Babysitter	3	0
T.V. Star	2	0
Entertainer	1	0
Priest	2	0
Transportation Director	1	0
Florist	1	0
Teach Manners	1	0
Business Manager	1	0
Checker	1	0
Messenger	1	0
Printer	1	0
Swimmer	1	0
Dancer	3	0
Waitress	4	0
Maid	5	0
Model	2	0
Trash Collector	1	0
Caretaker of Aged	1	0
Hostess	1	0
Secretary	2	0
Salesperson	1	0
Guide	1	0
Boss	3	0
Decorator	1	0
Personnel	1	0
People Checker	1	0

TEST OF THE STATED HYPOTHESIS

Hypothesis: Females aspire to science oriented occupations in the same percentages as males in grades 2 through 6 in rural East Central Illinois.

Data was collected by means of an instrument which required a written response from the students. The findings showed that the percentage of females who aspire to science oriented careers is lower at 43.0% than for males at 56.1%. Also, the percentage of females 65.7% who aspire to non-science oriented careers is higher than for males 34.3%. Based on these findings, the hypothesis was rejected.

CHAPTER V

OVERVIEW OF THE STUDY

The purpose of this study was to examine if females aspire to science oriented careers in the same percentages as males in grades 2 through 6. Such information will be useful in determining:

1. Students' current interest in science.
2. Where corporate and government funding should be targeted to improve the number and quality of scientists.
3. At what age level intervention programs are needed.
4. The need for altering teacher and pre-teacher training.

The subjects of this study were from four schools in rural communities in East Central Illinois. Students (N=364) in grades 2 through 6 were asked to respond to an instrument (a writing prompt) which was developed to determine if students at the elementary school level see themselves in a science oriented occupation twenty years from now.

Each student response was read by three independent adult readers who determined whether the students' reply indicated an interest in a science oriented or non-science oriented career.

DISCUSSION OF THE FINDINGS

As presented in Chapter IV, the number and distribution of the subjects, graphic representation of the percentages of students, and lists of the science and non-science oriented occupations chosen by the subjects lead to the following conclusions:

1. At the elementary level, over half (54.4%) of the rural students envision themselves in science related careers.
2. Females are not aspiring to science oriented careers in the same percentages as males.
3. Many science related careers selected by males were completely ignored by females.
4. The most popular science related career selected by females was Nurse (23%). If this career had not been considered to be science related, the female percentages would have been much lower.

In spite of the fact that students were placed in a science oriented environment by the writing prompt, only 54.4% of them chose a science career. In the author's opinion, this could be caused by three things. First, students are not knowledgable about science careers that are available to them. Second, science is not being treated as an important subject in the elementary

schools (Johnson, 1981). Third, teachers and parents are unaware of the numerous science related opportunities.

Females are not aspiring to science careers because we still deprive our female students of the experiences of hands-on manipulatives in science related activities (Piburn & Baker, 1989). It is no wonder that so many science oriented careers selected by males were completely ignored by females. They are not encouraged or supported in the early years to do science related activities. This, however, could be changed. Systems analyst, dentist, programmer, mathematician, shuttle engineer, architect, botanist, metallurgist, chemist, paleontologist, and physical therapist are all occupations that seek female applicants. With the proper early training and encouragement there is no reason why females could not aspire to careers as weapons engineer, electrician, spaceship designer, hyperdrive scientist, or flight engineer.

Based on the findings of this study, it is the author's opinion that there is a dire need for young females to become aware of and to be encouraged to aspire toward science oriented careers. This awareness and inspiration must come from parents and teachers during the elementary school years.

CONCLUSIONS

This study was undertaken out of a need to answer some important questions. Today's 2nd grader will graduate from high school in the 21st century. Will he/she be prepared? What are children's attitudes toward science and do they see themselves as future scientists?

One of the conclusions that can be drawn from this study is that there are a larger percentage of boys who see themselves as future scientists than girls. What changes can be made to encourage females to choose a scientifically oriented occupation? When do these changes need to be made? Included in the review of the literature were several studies which indicated that students' interest in science was at the highest level in the early elementary grades (Ayers & Price, 1975; Johnson, 1981; Yager & Yager, 1985). In order to change the attitudes of children toward science in the junior high and in turn at the high school level, there is a need to find answers to these questions.

It cannot systematically be assumed from the data that the interest difference in science verses non-science occupations is based on age, grade, or location.

This is very encouraging. If some teachers are able to inspire students to envision future fulfillment in science related occupations, other teachers can likewise be trained. Although it currently seems based on both the search of the literature and this study, that many girls and some boys are being short-changed in terms of future aspirations (Piburn & Ayers, 1989), this author feels this could be significantly altered. Offering more science will probably not solve the problem, offering better science probably will. "Teachers may be the appropriate target for an intervention program. Effective changes have been shown to occur due to collaborative relationships between teachers and researchers through which both increase their understanding of the complexities of gender differences in the classroom and the ability to develop effective change strategies" (Mason and Kahle, 1989). However, since both parents and teachers appear to greatly influence vocational choices of young children (grades 2 through 6), educating both parents and teachers is equally important.

Perhaps the most disappointing aspect of this study is that so many females see themselves twenty years from now as cleaners, maids, waitresses, cooks, dishwashers, and janitors (24%). Surely, with a little directed

effort, teachers and parents can do a better job of inspiring their female children to have higher aspirations. Garner et. al. (1989) reported, "Encouraging young women to participate in science studies and careers is important not only to promote educational equity and equal career opportunities, but it will also be a major determinant in our nation's future economic and research competitiveness."

It may be that a national effort to publicize the image and life style of successful women currently working in science-related areas, could produce badly needed increases in interest among young females. Out of 196 females, not one sees themselves in the future as a chemist, botanist, architect, mathematician, programmer, dentist, metallurgist, flight engineer, or computer systems analyst. All of these fields are currently actively recruiting female candidates.

RECOMMENDATIONS FOR IMPLEMENTATION

It is suggested that:

1. Parents be trained to participate with their children as co-investigators in science activities to be performed at home. This is especially needed for females.
2. Teachers make a concerted effort to involve both sexes equally in the hands-on portion of the science classroom.
3. Teacher training be implemented to encourage a positive attitude toward science among teachers being trained at the University level.
4. Universities engaged in the training of teachers ensure that all elementary teachers learn their science through hands-on, concrete experiences, in an effort to provide women teachers an opportunity to make up for the lack of such experience in their own upbringing.
5. School districts provide in-service training for the purpose of improving hands-on science instruction at the elementary level.
6. All of the above groups should be constantly trying to keep students aware of changes in technololgy, opportunities for new careers and identify role models that students may emulate.

RECOMMENDATIONS FOR FURTHER RESEARCH

Based on the findings and on the insights derived from this study, an examination of students' attitude toward science in the elementary classroom should include and/or extend to:

1. Replication studies involving other age groups of students.
2. Replication studies involving a larger population.
3. Investigations of the effect of teacher characteristics on students' attitude.
4. Investigations of the effect of parents' involvement on students' attitudes toward science.
5. Inter city & suburban
6. Pre-service for teachers

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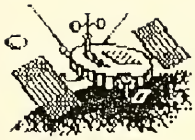
APPENDIX A



The year is 2010.

The International Space Society is looking for people to live and work in its new Solar Space Station. The pay is great and the view is super! How old are you, and what sort of job would you like to have? What will your duties be?

SCIENCE QUESTIONNAIRE EVALUATION

School_____ Grade_____

	Science oriented	Non-science oriented	Undecided
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
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22.			
23.			
24.			
25.			
26.			
27.			
28.			
TOTALS			

Evaluator_____

Comments_____

_____

THANK YOU! Please return form to Anneliese Payne