DOCUMENT RESUME

ED 155 026 SE 024 281

TITLE Mathematics for Junior High School, Pilot Edition, Chapter 10.
INSTITUTION Boston Univ., Mass.
SPONS AGENCY National Science Foundation, Washington, D.C.
PUB DATE 75
GRANT NSF-SED-74-18105
NOTE 26p.; For related documents, see SE 024 279-283

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS Activity Units; *Curriculum; Instructional Materials; *Junior High Schools; Mathematics Education; *Mathematics Materials; *Probability; Problem Sets; *Secondary School Mathematics; *Textbooks
IDENTIFIERS *Boston University Mathematics Project; Estimation

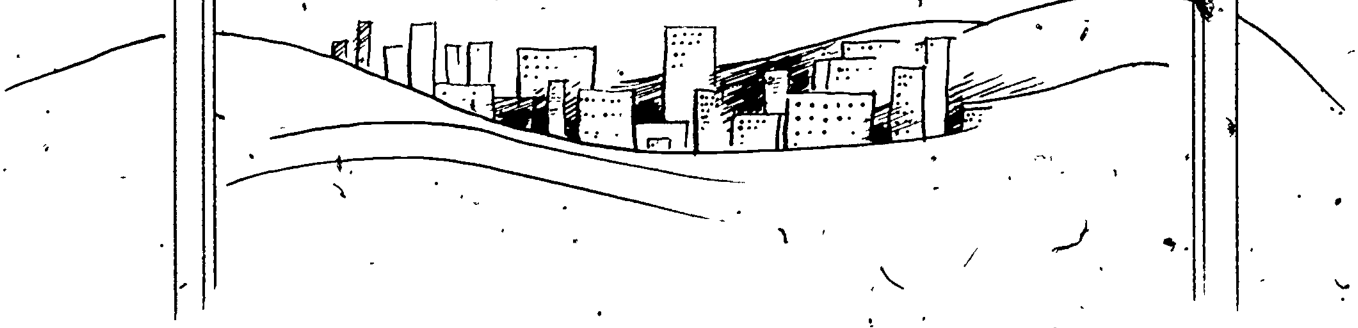
ABSTRACT

This book contains the tenth chapter of a pilot mathematics sequence for the seventh and eighth grades. The content of the sequence is to serve as a vehicle for the development of relevant computational skills, mathematical reasoning, and geometric perception in three dimensions and is to reflect the application of mathematics to the social and natural sciences. The material is divided into five types of sections: (1) activities; (2) short reading sections; (3) questions; (4) sections for the student with a weaker background; and (5) sections for the strongly motivated student. The material in chapter ten includes probable and improbable events. (MN)

MATHEMATICS

FOR JUNIOR HIGH SCHOOL

pilot edition — *chapter 10*



Boston University Mathematics Project

CONTENTS

Printed in the United States of America

10. PROBABLE AND IMPROBABLE EVENTS

SECTION 1 PIE CHARTS

An opinion poll was taken to find out if the President did his job well. At one time 65 percent said "yes" and 35 percent said "no." A year later another poll was taken. This time the answers were 80 percent "yes" and 20 percent "no."

The two pie charts in Figure 1 have the same information as the sentences in the above paragraph. Yet most people say the pie chart says it in a more convincing way.

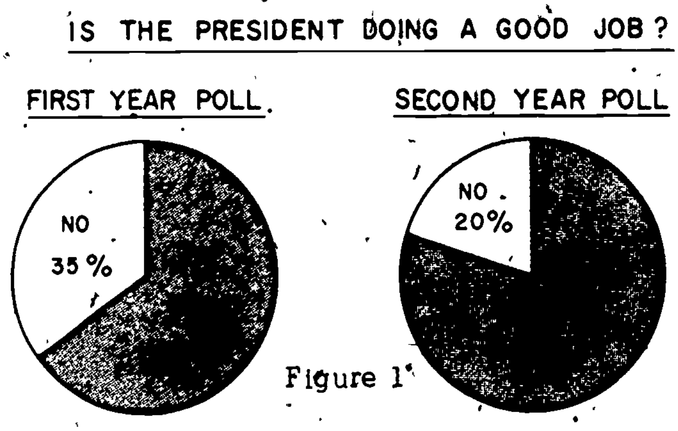


Figure 1

How are pie charts made? How are the angles corresponding to the percentages calculated? The whole circle, consisting of 360°, corresponds to 100%. The angle corresponding to any given percentage is that same percentage of 360°. For example, the angle corresponding to 30% is 30% of 360°. As you have seen before, the word "of" calls for multiplication. Thus

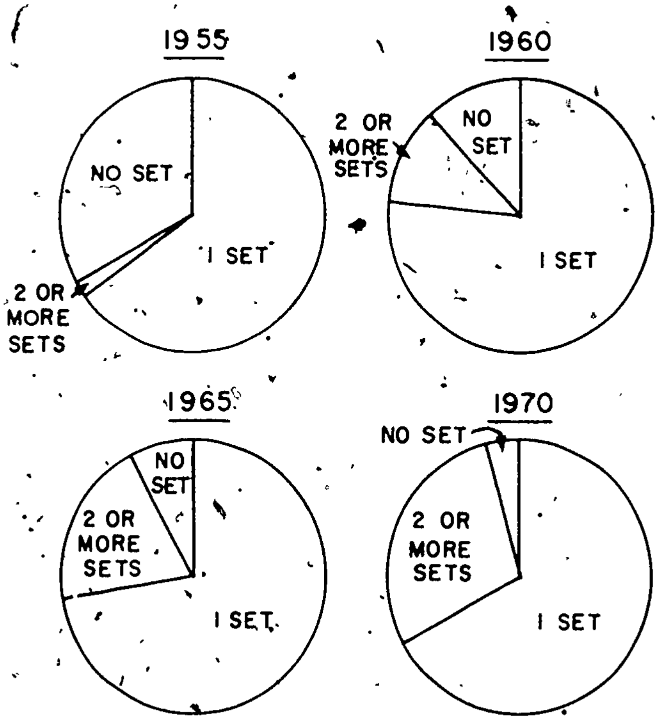
$$\text{angle in pie chart} = \text{percentage} \times 360^\circ$$

1. Draw a pie chart that has angles corresponding to 25%, 15%, and 60%.

2. The pie charts in Figure 2 indicate the percentages of households in the United States with 0, 1, or 2 or more television sets. No numbers for the percentages are given.

Figure 2

PERCENTAGES OF HOUSEHOLDS WITH TELEVISION SETS



(a) Estimate the percentages of households with 1 television set during each of the four years shown.

(b) Estimate the percentages of households having two or more sets during each of the four years.

(c) Do you think that the total number of television sets decreased from 1960 to 1965?

3. (a) How can you calculate the percentages on a pie chart after measuring the angles with a protractor?

(b) Check your estimated answers to Question 2 by actual measurements and calculation.

How accurately can you measure an angle on your protractor? If, for example, you can only read angles to within 1°, there is no reason to calculate angles to a higher accuracy. Decide how accurately you can measure angles with your protractor. Then carry out the calculations in the following questions to only that accuracy.

4. The following table lists the percentages of families of a given size in the United States for the year 1972.

Number of Persons	Percentage
2	35.4
3	21.2
4	19.7
5	11.9
6	6.2
7 or more	5.5
total	99.9

(a) Calculate the corresponding angles and draw the pie chart.

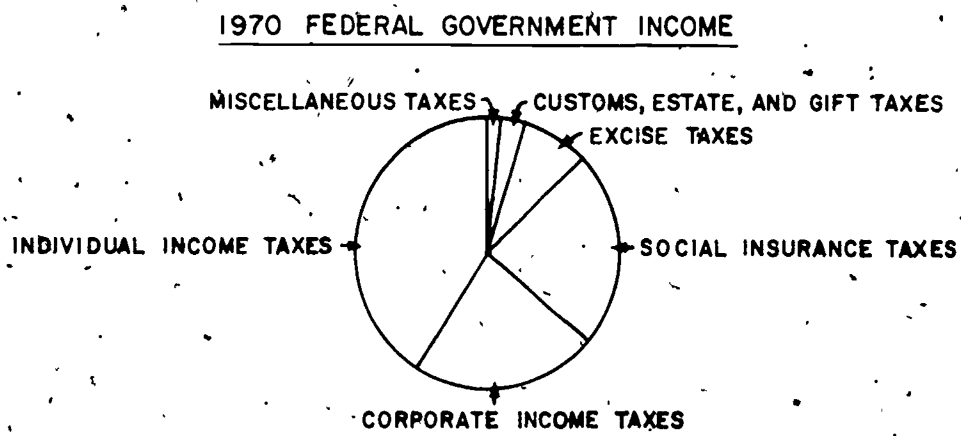
(b) How do you explain the fact that the percentages do not add up to 100%?

(c) Did this fact affect your pie chart?

5. The percentages in the following table stand for the federal government's income for 1970. From this data an artist constructed the pie chart in Figure 3. Find the error he made in constructing this pie chart.

Individual income taxes	46.7%
Corporation income taxes	16.9%
Social insurance taxes	23.4%
Excise taxes	8.1%
Customs, estate, and gift taxes	3.1%
Miscellaneous taxes	1.8%

Figure 3



6. The table below lists the number of cars produced in the United States by each company during 1972. Make a pie chart showing the percentage of cars produced by each company.

American Motors Corp.	279,132
Chrysler Corp.	1,367,354
Ford Motor Co.	2,400,871
General Motors Corp.	4,775,344
Checker Motors Corp.	5,504
	8,828,205

SECTION 2 SODA TASTING

Of course you can tell the difference between a cola, an orange soda, and a lemon soda! But which of your senses enables you to tell the difference? Is it by seeing the different colors? Is it by smelling the different odors? Or is it by tasting the different flavors?

Whenever you are faced with many questions it is best to answer them one by one. In this experiment you will be given a sample of one of these sodas and you will be asked to tell what flavor it is. However, you must close your eyes and hold your nose until after you have made your guess. In this way you will get an idea of how important taste is alone.

A student volunteer will record what flavors each of you will be given and what guess each of you will make. A convenient way to record this information is to write the name of the student, the initials of the soda he was given, and what he guessed. For example, John Lamb was given cola and guessed "orange." This would be recorded as

John Lamb (C, O)

It is important to keep the correct order. Reversing it would change the meaning. The class results will be distributed after the experiment is completed.

7. Make a tally of all the times when students were given cola. How many said it was cola? Orange? Lemon soda?

8. From the tally of guesses when cola was given, what percentage of students guessed cola? What percentage guessed orange? What percentage guessed lemon?

9. Make a pie chart of your answers for Question 8. What percentage guessed correctly? Incorrectly?

10. What would you expect the pie chart to be like if the whole class could recognize cola by taste alone?

11. Assume that nobody in the class could recognize the cola by taste alone. They just said "cola," or "orange," or "lemon"—whatever came into their heads first. What do you think the pie chart would look like?

SECTION 3 EQUALLY PROBABLE EVENTS

If you toss a coin, is it more likely to come out heads or tails? If the coin is bent, it may be more likely to land on one side than on the other. But for a well-made coin we see no reason why one side is more likely to be up than the other. Whenever we see no reason why one event should be more or less likely than another, we say that the two events are <u>equally likely</u> or <u>equally probable</u>. (An "event" here is anything that happens.)

We think of heads or tails as equally likely events when we toss one coin. What is likely to be the result of, say, 1000 tosses? We cannot predict exactly what will happen because each toss can go either heads or tails. But we can feel pretty sure that the result will be close to half being heads and half being tails.

Now let us turn our thoughts to actions that can have three different results. Imagine a bag containing red, blue, and green marbles. If you pick one marble it may be red, blue, or green. Suppose there is an equal number of marbles of each color in the bag. Also assume that all the marbles are the same size and weight and are well mixed. Therefore we have no reason to believe that it is more likely to pick a red marble than a green or a blue one. Again we say that it is equally probable to pick a red, a blue, or a green marble.

If we were to pick a marble repeatedly, we could expect about a third of the total to be of each color.

12. (a) Suppose you throw a perfect die. Are you as likely to throw a one as a six? Why or why not?

(b) You throw the die many times. In what fraction of the throws is each number likely to appear.

(c) Make a pie chart to illustrate your answer to part (b).

13. (a) With a perfect die is it as probable to throw an even number as it is an odd number?

(b) If you throw the die many times what fraction of the throws will turn out even?

(c) Draw a pie chart to illustrate your answer to part (b).

14. Suppose that a friend tells you that she can predict whether your next throw of a die will produce an even or an odd number. You challenge her by asking her to predict the result of 100 throws. She turns out to be right in about half of them. Do you now believe her?

15. A true-false test in French has an equal number of true and false statements. A student who does not know any French

takes the test. What fraction of the answers is he likely to get right?

16. Suppose that with closed eyes and nose it is equally probable to think of the cola as cola, orange, or lemon. Draw a pie chart of the results.

17. Compare your pie chart for Question 16 with the pie chart for Question 9. Can you prove that the class can recognize cola by taste alone?

18. Tally all the times when students were given orange soda. How many said it was orange? Cola? Lemon? What are the percentages? Was your class any better in recognizing orange soda?

19. Repeat the entire analysis of the class data for the case of lemon soda. What do you conclude?

SECTION [illegible] COUNTING EQUALLY PROBABLE EVENTS

You need not rely on feeling to guess that out of a large number of coin tosses about half will be heads and half tails. We can provide a reason for it.

Let us start with a single toss. In this case heads (H) or tails (T) is equally probable. Now we look at two tosses. There are four possible results: two heads, a head followed by a tail, a tail followed by a head, and two tails. In Table 1 these results are conveniently written in shorthand. The left-hand letter of each pair stands for the result of the first toss.

TABLE 1

(H H)	(H T), (T H)	(T T)
1	2	1

For each toss H and T are equally probable. Furthermore, the result of the second toss does not depend on the result of the first toss. Therefore, each pair of results in Table 1 stands for equally probable events.

There is only one way to get two heads, but there are two ways to get one head and one tail. This is indicated by the numbers in Table 1. Therefore, it must be twice as likely to get one head and one tail as it is to get two heads.

Let us go one step further and count the number of equally probable results of three tosses. This is done in Table 2.

TABLE 2

(H H H)	(H H T), (H T H), (T H H)	(H T T), (T H T), (T T H)	(T T T)
1	3	3	1

Again, the letter on the left stands for the result of the first toss. Note that there are three ways to get two heads and one tail, but only one way to get three heads. Thus it is three times as likely to toss two heads and one tail as three heads.

We could go on counting equally probable results for larger and larger numbers of tosses, but this is not necessary. Our results so far suggest a pattern that allows us to find the answer for larger numbers of tosses. Table 3 is a summary of our results so far and the extension to larger numbers.

TABLE 3

Total Number of Tosses	Number of Heads 0	1	2	3	4	5	6
1	1	1					
2	1	2	1				
3	1	3	3	1			
4	1	4	6	4	1		
5	1	5	10	10	5	1	
6	1	6	15	20	15	6	1

"Zero heads" means all tosses turned out tails. Similarly, "one head" means that all the other tosses came out tails, and so on. Table 3 shows a clear trend: As the total number of tosses increases, it becomes much more likely to have about half the tosses being heads than about all being heads.

20. (a) Figure out what should be the next line in Table 3.

(b) How much more likely is it to get 4 heads out of 7 tosses than it is to get 7 heads?

(c) How much more likely is it to get 4 heads out of 7 tosses than it is to get 6 heads?

21. When you throw a perfect die, each number is equally probable to be on top. Suppose you throw a pair of perfect dice.

(a) What are the equally probable combinations of the results?

(b) How many combinations are there whose sum equals 8? How many combinations are there whose sum is 12?

(c) How many times as likely is it to throw an 8 as a 12?

SECTION 5 AVERAGES

The heights of 20 students to the nearest centimeter were measured and the results were

130	167	142	145	161
152	137	143	165	163
135	140	170	157	164
167	185	143	160	164

How can we summarize this information? Is there a single number that can give us a general idea about the heights of all 20 students? One such number is the <u>average</u>. To calculate the average we add all the heights together and divide by the number of students.

$$\text{Average height} = \frac{\text{sum of all heights}}{\text{the number of students}}$$

We find from our calculation that the average height is 154 cm.

Whenever we summarize a set of measures with a single number, such as an average, we lose some information. Knowing that the average height of 20 students is 154 cm does not give us as much information as knowing the height of each student. For example, knowing only the average we could not tell how tall the shortest student in the class is. But in many cases the average provides enough information and is easier to remember.

22. Peter rolls 5, 1, 2, 5, 3, 4, and 6 with a die. What is his average score?

23. Use the following table to answer the following questions.

Farm Statistics

Year	Number of Farms (in thousands)	Farmland (in millions of acres)
1930	6,546	987
1950	5,648	1,202
1970	2,954	1,103

(a) Find the average number of acres per farm for 1930, 1950, and 1970 separately.

(b) From the data given, describe what has been happening to the size of farms.

24. A bowling league of 8 teams meets once a week. Each team has 6 players and each player bowls 3 games.

(a) The top bowler on Team A had scores of 210, 230, and 181 during one week. What was his average score?

(b) Another player on Team A bowled a 173 and a 161 on the first two games. If his average for the day was 155, what must have been his score on the third game?

(c) During that same week the other 4 players on Team A had averages of 135, 160, 143, and 124. What was the average for the whole team?

25. In 10 rolls of a die, Joe averaged 4 points. Using the same rules, Buddy averaged 4.5 points in 20 rolls. Taken together, what was the average number of points for both of them?

26. If Jim got a 96 and an 80 on two tests, and if 90 is an "A," what must he get on the next test to bring his average up to an "A"?

27. Erika wanted to figure out her test average for the year. She had kept a record of her averages for each marking period. Use the following table to find her test average for the year.

Marking Period	Number of Tests Taken	Average
1	2	78
2	3	80
3	5	75
4	2	90

SECTION 6 WHICH GAME RULE IS BEST?

Here is a game for you to play with a friend. You each roll a die and use one of the scoring rules in Table 4 to find out how many points you get. For example, if you are using rule D and you roll a 3, you get 5 points. On the other hand, if you choose rule A and you roll a 3, you get 3 points.

Take a few moments to study the rules. Which do you think is best for you?

You must choose which rule you want to use before you start the game. Both of you may choose the same rule if you wish. The object is to score as many points as possible.

TABLE 4

Showing on Die	Points A	B	C	D
⚀	1	4	0	8
⚁	2	4	0	5
⚂	3	4	0	5
⚃	4	4	18	4
⚄	5	4	0	4
⚅	6	4	0	0

The higher total score at the end of 20 rolls of the die wins the game. Your teacher will record each person's score and the game rule used.

Which do you think is the best rule now that you have played the game? How sure are you?

Look at the class data. Were all the rules used? For the rules that were used, which rule do you think is best? What is the average score of all the students playing rule A? What is the average score of all the students playing rule B? Rule C? Rule D? Use these averages to decide which rule is best.

SECTION 7 BAR GRAPHS

A student took a survey of 138 students in his school to find out what the most popular soft drink is. He put the results of the survey in a table.

	Orange	Root Beer	Cola	Ginger Ale	
Number of Students	47	24	46	21	Total 138

Another way to display this information is on a bar graph, as in Figure 4.

Note that the bar graph has a title so that we know what information is shown. Also note that the label "Number of Students" is used to show what the numbers stand for.

A bar graph can also be drawn sideways if you prefer, as shown in Figure 5.

Figure 4

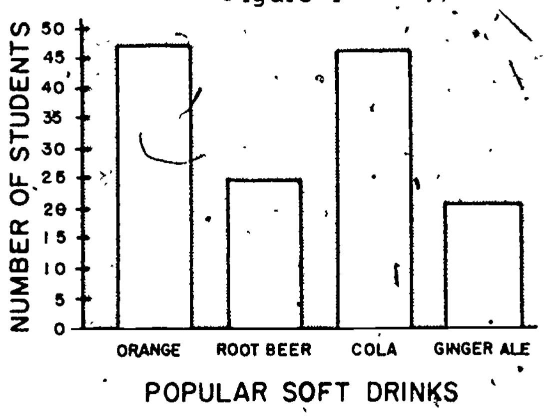
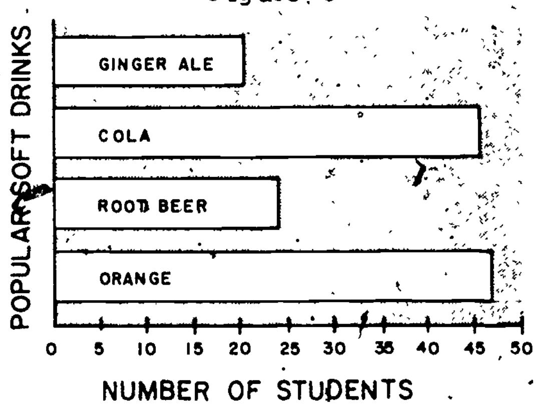


Figure 5



Either way the bar graph displays the same data as the table but in a way that makes the information easier to see at a glance.

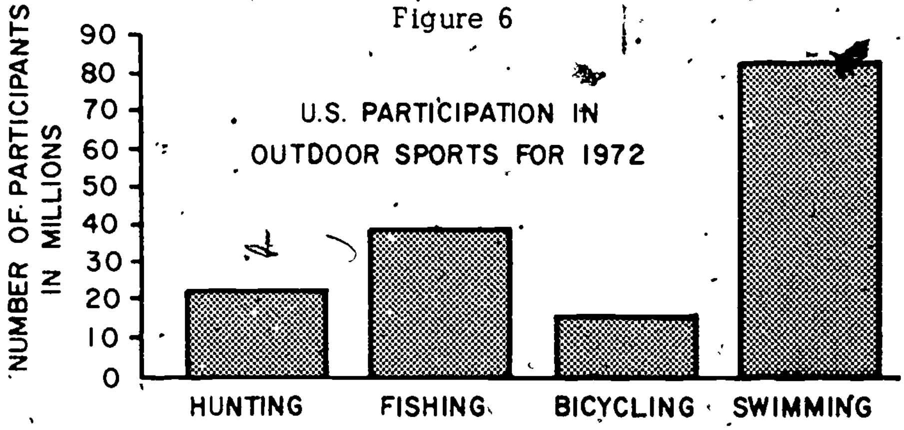
28. The data in the bar graph in Figure 6 are projections based on a survey of 4000 Americans, twelve years old and older. Use these data to answer the following questions.

(a) Approximately how many Americans fished in 1972?

(b) Of the four sports listed, which is the most popular?

(c) About 10 percent of the total population goes bicycling. About what percent goes swimming?

Figure 6



29. From the table below make a bar graph showing the number of people who speak each of the five most commonly spoken languages.

Language	Number of Speakers
Chinese	750 million
English	300 million
Russian	200 million
Spanish	200 million
Hindi	180 million

30. Gwendolyn took a survey of 150 students in her school. She asked, "On the average, how much time do you spend on homework each night?" Her tabulated results are:

Number of Minutes	0	5	10	15	20	25	30	40	45	60	75	90
Number of Students	6	10	13	28	21	13	18	5	15	12	6	3

(a) Make a bar graph of the results.

(b) What amount of time was most frequently given?

(c) What percent of the students spend more than 30 minutes on homework? Less than 15 minutes? 15 minutes through 30 minutes?

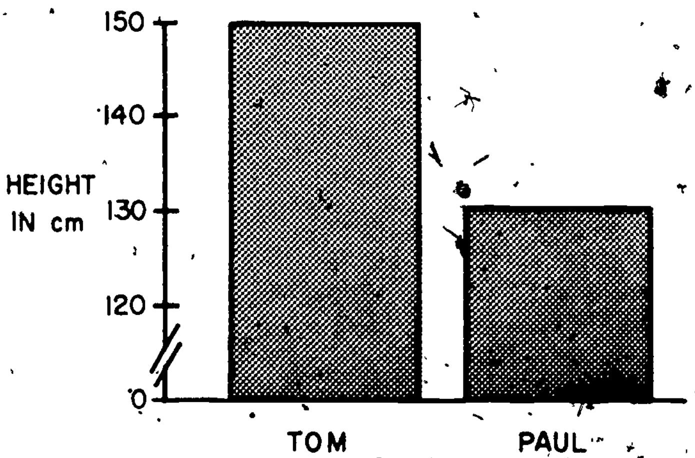
31. Tom and Paul were comparing their heights. Tom insisted that he was much taller than Paul. To prove his point he graphed their heights as follows:

(a) Is Tom actually taller than Paul? How many centimeters taller?

(b) The bar representing Tom's height is how many times as large as the bar representing Paul's height?

(c) Tom's height is how many times as large as Paul's height?

(d) Make another bar graph that more accurately represents the comparison of their heights.



SECTION 8 COMPARING GAME STRATEGIES

In all likelihood some rules for the game in Section 6 were chosen by more students than were other rules. For example, very few students may have chosen rule B. You already know from your work with codes that small samples are not reliable. To be able to judge each rule you need larger samples. To get them, play each rule once. Then collect the results from the whole class.

Work with one of your classmates. Roll a die ten times and record your results in a table like Table 5.

TABLE 5

Roll	Results of Roll	Score A	B	C	D
1	4	4	4	18	4
2	1	1	4	0	8
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
10	3	3	4	0	5

After you have rolled the die ten times, find the total score for each rule. Your teacher will make bar graphs to display the scores of the whole class.

What is the highest and lowest score for each rule? What is the average score for each rule? If you were to win a penny for each point you scored, which rule would you rather play? Why?

Look at the bar graphs. Which rule has the greatest range of scores? Which has the least? For which rule do you think luck is most important? Why?

Is there a rule that always gives a better score than other rules? Is it possible to win by using any of the rules?

SECTION 9 EXPECTATIONS

Is there some way that you could decide which is the best rule without playing any games? One way to do this is to figure out what score you can expect on each game if you were to play the games many times.

Suppose you are using rule C (Table 5). You roll the die many times and write down your score for each roll. If the die is perfect, the numbers 1 through 6 are equally likely to come up. On what fraction of the rolls would you therefore expect to get a score of 18?

You receive a score of 18 when a 4 comes up. A 4 is likely to appear $\frac{1}{6}$ of the time. Therefore, you would expect to get a score of 18 on about $\frac{1}{6}$ of the throws. On the other hand, you would expect a score of 0 on about $\frac{5}{6}$ of the throws. Why?

On a large number of rolls, say 6000, you would expect to get a score of 18 about 1000 times and a score of 0 about 5000 times. For 6000 throws, using rule C, you would probably, therefore, have a total score of about 18,000 points. This is an average of 3 points for each roll. By calculating the expected number of points for each roll for the other rules, we can compare the rules and decide which is the best.

32. (a) Suppose you are using rule A. In what fraction of throws would you expect a score of 1? A score of 2?

(b) For 6000 rolls how many times would you expect a score of 1? A score of 2?

(c) For 6000 rolls what would probably be your total score for rule A?

(d) What is the average number of points per roll for rule A?

33. What is the average number of points per roll for rule B?

34. (a) For rule D, in what fraction of rolls would you expect a score of 8? A score of 5? A score of 4? A score of 0?

(b) For 6000 rolls how many times would you expect to get each of the scores of part (a)?

(c) For 6000 throws what would probably be your total score for rule D?

(d) What is the average number of points for each roll for rule D?

(e) Which rule has the highest expected average for each roll? How does this agree with what you found in Section 5?

35. Which rule has the highest expected average for each roll? How does this agree with what you found in Section 5?

SECTION 10 ESTIMATING FRACTIONS OF A LINE SEGMENT

How well can people mark the midpoint of a line segment? Are they as likely to be off to the left as they are to the right? Is it just as easy to mark the one-third point on a segment? Here is an experiment that will give some answers.

You have sheets of paper with the segments already drawn. On one sheet mark the point that you think divides the segment in half. On the other segment mark what you think is the one-third point from the left without looking at the first sheet.

Exchange papers with a classmate. Using a centimeter ruler, mark the actual one-half or one-third points on the appropriate sheets. For each segment measure to the nearest tenth of a centimeter the distance between the estimated and the actual points. This will tell you the size of the error in the estimate. (If your mark fell within 0.1 centimeter of the actual point, you can consider your mark to be correct.) If you made an error be sure to write down whether the mark was to the right or to the left of the actual point.

(a) How many students in your class marked the one-half point correctly? How many missed to the left? How many missed to the right?

(b) How many students in your class marked the one-third point correctly? How many missed ~~to the~~ left? How many missed to the right?

(c) Of all the students who did not mark the one-half point correctly, what percentage was off to the left? To the right? Show the class results on a pie chart.

(d) Suppose people were as likely to be off to the left as to the right. What would a pie chart look like under this assumption? Is this assumption valid for your class?

(e) Of all the students who did not mark the one-third point correctly, what percentage was off to the left? To the right? Again show the class results on a pie chart. Are people as equally likely to be off to the left as to the right when making the one-third point?

(f) How well did you do? Did you guess the one-half and one-third points as accurately as your classmates? Make bar graphs to display the errors made by the entire class. For the bar graphs consider only the size of error and disregard whether it was to the left or to the right.

(g) How many students in your class had an error greater than yours? What percentage of the class is this?

(h) Find the percentage of the class that had an error less than or equal to yours. This is called the <u>percentile rank</u>. What is your percentile rank?

6. Secondary Outcomes

There is no evidence that any attempts were made to survey teachers, counselors, or parents to determine impacts on attitudes and behaviors in these groups. Institutional change as a result of this program was also a neglected measure. It is not too late, however, to use these subjects as "treatment" groups and compare attitudes with another group of controls. DRI has sent a letter to the counselors involved with the project to ascertain these outcomes, but has not yet received any responses.

An examination of perceived barriers, information needs, and facilitating factors, determined from responses to direct questions, and confirmed by a survey of other pertinent literature, suggested the following major reasons for the relative lack of participation of women in science careers in the twelfth grade women.

1. doubts about combining family life with a science career;

2. lack of knowledge about how to prepare for a career in science;

3. perception of science career preparation as being uniquely long and difficult;

4. inadequate encouragement from adults; and

5. inadequate number of role models.

Although reasons 1 through 3 are major obstacles to career planning of any kind among young women, they are even more important as obstacles to careers in science.

Ninth grade girls perceived different barriers than the twelfth graders. The ninth graders perceived the most important discouraging factor to pursuing a science career to be popular beliefs that girls are not capable of succeeding in science careers (51 percent) and discouragement by friends from entering school science courses (48 percent). By twelfth grade, the barriers were perceived difficulties in combining family responsibilities with the demands of a career (55 percent) and preparation for a career in science seemed to be very hard, long and expensive (47 percent). The forms used to obtain this information were not parallel, so direct comparisons cannot be made. The changes in perceived barriers at different "on-line" times, however, may further elucidate psychological mechanisms leading to occupational segregation. While these differing responses may indicate new awareness of the difficulty of pursuing a science career, they may also represent an adaptation (rationalization) to the social pressures indicated by the freshmen.

7. Materials and Dissemination

The project utilized three major types of materials. The Vocational Interest Profile (VIP) was used as an intervention. The VIP is a guide to vocational exploration, and was designed to minimize sex-related responses by utilizing sex fair items. Consequently a female has about an equal chance as a male of being "sent to" any given occupational family. The booklet Exploring: You and Your Career is part of this package. An update version of this package is now available, entitled VIESA (Vocational Interest, Experience and Skill Assessment). The package is self scored and can be completed in one class period.

The Career Guidance Survey was used as the outcome measure. The survey was taken from the Planning Involvement Unit of the ACT Assessment of Career Development. The self report survey assesses the amount of career exploration, occupational preferences, and certainty of preference. It is very short and easy to complete.

The development and/or validity and reliability of these instruments are reported by ACT. The survey appears to be very complete and adequately validated. Both of these are being distributed by Houghton Mifflin Company, Test Department, Box 1970, Iowa City, Iowa 52240.

The booklet Women in Science and Technology: Careers for Today and Tomorrow is self contained and excellent. It is easy to read, with many pictures, and comprehensible in content, dealing with the reasons for the absence of women in science related careers, the types of careers available, compatibility with family life, and career preparation. This booklet may be ordered from ACT.

8. Costs

The costs to reuse the material are estimated at about $1.00 per participant for the VIESA packet; this includes teacher's guides and so on. The booklet costs about .40 apiece.

We do not know the price of the Assessment of Career Development.

The booklet Women in Science and Technology: Careers for Today and Tomorrow is available for $1.50 per copy.

9. Recommendations and Conclusions

1. This study indicates that mailed material, in the absence of other interventions, is not sufficient to change the career preferences of qualified high school seniors.

The same must be concluded regarding the nonsex restrictive inventory and class discussions. In sum, while such interventions may be good, they are not enough to counter action.

2. Some evaluation of the effect on the counselors and parents should be conducted.

3. Because of the design and analysis, the outcomes of this experiment were conclusive and were reported with standard terminology. Since conclusive outcomes were the exception rather than the rule in this set of NSF experiments, the question is raised regarding the relative efficiency of funding researchers with a background in experimental design rather than persons in other disciplines.

4. Because of the interesting differences in the perceived barriers between the ninth and twelfth grade girls, we recommend a study of the perceived barriers <u>at the time they are perceived</u> rather than in historical retrospect.

5. The Assessment of Career Development appears to be a good vocational interest test and we would recommend its usage in other projects.

6. The booklet <u>Women in Science and Technology: Careers for Today and Tomorrow</u> is a well-prepared document that could be incorporated into a wide variety of other career education programs.

L. "Increasing Women in Science Through Reshaping Role Perception"

Mary Baldwin College, Staunton, Virginia
Project Director: Dr. Donald Thompson
Project Amount: $99,681.98
Educational Level: Post Secondary

1. Proposed Project

The project was intended to test the hypothesis that more college women will choose careers in science if there are women role models for them to emulate; if career options are made available to them through improved counseling; and if they can be assisted in developing self-confidence as women scientists through experiential learning. The specific aims of the project were to: (1) increase the student's awareness of careers in science open to women; (2) influence the student's attitudes in the direction of more favorable perceptions of such roles; (3) enable interested students to obtain direct experience in areas of possible science careers through January term and summer internships; and (4) organize the information obtained about career options into a permanent and ongoing file so that faculty and students at the participating colleges and other interested colleges may readily retrieve this information.

Four women's colleges--Hollins College, Mary Baldwin College, Randolph-Macon Woman's College, and Sweet Briar College--were to participate in an experimental program that included several components.

Seminars featuring successful women scientists were held at Hollins College and Mary Baldwin College; exposure to a videotaped package on science careers was available at Hollins College, Mary Baldwin College, and Randolph-Macon Woman's College; and a variety of internships in scientific careers were offered at all four colleges.

The seminars were to feature four or five participants who will be on one campus for approximately one day and then will go to the other campuses for the same period of time. During each college seminar, discussions were to be open to all students and then the seminarians were to be available as resource people in science classes and as consultants for the students on an individual basis.

The content of the videotape presentations was determined by interviewing successful women scientists who were engaged in careers which are highly related to the fields of psychology, physics, chemistry, biology, and mathematics. The project director was to encourage the science and mathematics faculties at Hollins College, Mary Baldwin College, and Randolph-Macon Woman's College to incorporate the videotaped presentations into their respective science courses.

During the course of the project, the director was to assemble detailed information on careers in science for women. This information was to be disseminated at the close of the project. On all campuses central files were to be established, and these files would be made available to faculty and students for up-to-date information. In addition, increased opportunities were to be made available for student externships during the January term and during the summer months. These externships were to include 160 hours of on-the-job experience at various industries and agencies involved in science-related endeavors for which credit would be given.

Evaluation of the project was to be made by analyzing the results of tests on attitudes toward science and scientific careers given before and after the program at the four colleges and by cross-comparisons among all four colleges.

2. Implemented Project

The project was conducted much as it was planned. Six seminars on science careers in industry, in government, in environmental fields, in the behavioral sciences, and in medicine were held. A more general workshop on the image of the woman scientist was substituted for the workshop on teaching careers in science. All of the workshops were well attended.

Twenty five or 30 videotapes were produced from interviews with successful women scientists.. The content of these interviews centered around educational backgrounds, job procurement, and personal and job satisfaction and dissatisfactions. The seminars were also recorded on tape. A total of 147 students viewed at least one of these tapes, and many students viewed more than one tape.

One hundred nine women participated in the externships, the majority of these women experienced more than one externship. To accommodate this number of women, 41 additional sponsors were recruited.

One element added to the project was the opportunity for senior students at Mary Baldwin who, at the time of pretesting, stated that they were undecided about their future career to attend a weekend workshop on career decisions. Although four such workshops were planned, only one was held. Six women attended. In addition, all of the first year students were given the opportunity to have the vocational interest inventory administered by the project interpreted by counseling personnel, and those who had them interpreted were invited back for further career exploration. One hundred ninety-seven women discussed their vocational tests with a counselor, and 12 returned for further exploration.

Some difficulty in retaining the isolation of control and experimental groups was encountered. Specifically, in addition to some loss of post experimental data, the group designated as control was switched from Sweet Briar College to Randolph-Macon because the faculty at Randolph-Macon refused to show the videotapes. Consequently, some of the planned evaluation analyses could not be conducted.

Recruitment and sampling. The project was aimed at two distinct populations. One was all first year students at the four schools irrespective of their intended major. The other was the junior class science majors in those schools. Presumably, the aim of including first year students was to introduce/influence them toward science-related careers, while the aim of including junior science majors was to reinforce their decision and to provide them with additional information regarding their chosen careers. In addition to these two groups, many of the activities were open to the entire student body, and numerous individuals not in the target group participated in some of the events. Results, however, are only reported for the target group of freshmen and juniors.

Pre-intervention data were collected on 87 percent of the first year women at all four colleges and from 91 percent of the science majors from these schools. About 75 percent of the women pretested were surveyed one year later. Completed data were available on 74 science majors and on 459 sophomores. Participation in the testing, as in all activities, was voluntary and represented a self-selected sample. The size of the sample, however, suggests that the self-selection of the pretest and posttest sample did not dramatically affect the results.

Most of the information regarding project activities was transmitted through posters, the campus newspaper, and by faculty members. Invitations for the seminar were sent to science majors and a randomly selected group of first year students.

3. Obstacles to Implementation

In general, the project ran smoothly. The principal investigator reported some difficulties in coordinating data collection activities between campuses. Specifically, although good cooperation was given by the college liaisons on the executive committee, the faculty members were not given release time to conduct project activities. Consequently, some of the activities could not be conducted as they were planned. This appears to have a greater impact on the experimental nature of the results, rather than program impact.

4. Project Personnel

The project director was Donald Thompson, Ed.D., on staff at the psychology department. Dr. Thompson is an energetic, outgoing individual who appeared to be well liked by the students. He was well qualified to run the program. He was assisted by a research associate, Ms. Hinda Levin, who was primarily responsible for data analysis, and a publicity specialist, Ms. Sandy Harris, who was primarily responsible for logistical arrangements.

An executive committee included one representative from each college. This committee served as the coordinating committee, and each member served as the liaison with her/his campus.

One of the most important aspects of the program was the female role models used in the seminars and the videotapes. The women represented a wide variety of fields, occupations, and life-styles, e.g., there were about 30 women representing the health fields, research jobs, government and industry jobs, the behavioral and environmental sciences. Some were married with children, some married without children and some were single. The role models also represented a range of degree levels and accomplishments. Many, if not most, of the women were Mary Baldwin graduates, and currently resided in the southern United States. The role models were consistently rated very favorably by the seminar attendees.

5. Primary Outcomes

a. Experimental outcomes. Most of the outcome indicators did not show a significant change from pretest to posttest period across the four schools. For example; the percentage of women pretested as first year students who intended to major in science remained constant at about 30 percent. No significant changes in the rankings on the 22 categories on the Educational Interest Inventory were noted, and no significant changes in attitudes toward science were observed, although a slight positive increase was apparent. The percentage of these women on whom measurements were taken that directly participated in the program is not known. Therefore, it must be concluded that no changes in short-term indicators in the general target population was found.

Mary Baldwin College students participated in the experimental activities to a greater extent than students from other schools. Consequently, more favorable results might be expected. Several indices suggest that this is the case. At Mary Baldwin, there has been an overall increase in the number of science majors. The number increased from 18.8 percent in the fall of 1975 to 34.9 percent in the winter of 1976 to 38.0 percent in the spring of 1977. That is, the number of students at Mary Baldwin who changed their proposed major from non-science to science was significantly greater than the number who changed their proposed major from science to nonscience. These were not necessarily the target group of first year students. The science interest scores remained about constant over the period, but the attitude toward science score increased somewhat.

A more stringent way to examine the direct affect of the programs is to investigate the change scores of the actual participants and the effect of extent of participation, e.g., to look at those women who actually participated in the project events. The results of the project showed an interrelationship between participation in various project events that was very strong and significant for science majors, and moderate but significant for first year students. In other words, approximately the same group of people experienced most of the project components. By inference, many of the target group tested experienced few of the project events. Unfortunately, although participation was positively related to overall interest and attitude scores, only the sum of the pretest and posttest measures were used. Specifically, the change in these scores was not correlated with participation, so it is impossible to determine whether the relationships shown was a function of high initial scores.

Since participation in the seminars and externships were voluntary, attendance may also be used as a criterion of success. The final report calculated that a total of 217 individuals from the entering class attended the seminars. These figures, however, dramatically underestimate total seminar attendance, e.g., 40 from the target group of first year students and science majors attended the first seminar at Mary Baldwin College, but the total attendance was 103. The total attendance for all of the seminars was 769, and attendance appeared to decrease only slightly over successive seminars. The extent of the attendance at the seminars would suggest that these met some need of science and nonscience majors alike. The student evaluations of the seminars indicated that the seminars were well received and thought to be valuable.

A total of 85 first year students and 24 junior science majors participated in externships. Many of the students expressed satisfaction by participating in multiple externships.

The videotapes were viewed and evaluated by approximately 119 freshmen and 28 junior science majors. The project data indicated that the majority of the students felt the videotapes could direct undergraduates toward a career in science. Most of the comments about the videotapes concerned their technical quality. No analysis of their affect on the outcome measures was reported.

The seminars were also evaluated by the attendees. The majority of the attendees responding to the questionnaire felt these seminars could direct a student toward science. A very small minority felt they could direct students away from the careers in science. The participants also expressed satisfaction with the externship experiences by rating it as rewarding.

b. Participant impact survey. Because of the late inception of the project, DRI did not conduct an independent participant impact survey.

c. Site visit conclusions. The site visit was conducted early in the life of the project at the time the first seminar was held.

One videotape was already completed and was viewed by one member of the evaluation team. The interview had been videotaped in a quiet setting, and was an "informal chat" with a woman scientist. It was felt that the videotape was sufficiently well done to be usable and informative by many educators.

Two seminars were attended by the evaluator. The seminars were well attended, went smoothly, and generated many questions from the audience. The refreshment period allocated to talk to the role models on a one-to-one basis was also well attended, although the majority of the women attending the seminar did not stay for refreshments. The women had specific questions to ask the role models and it appeared that the conversations could have lasted many hours if possible. During this time, the evaluator visited with 15 or 20 women. They were uniformly pleased with the seminar, and all seemed anxious for career information from the role models. This informal coffee hour appeared to be an important and highly successful aspect of the program that should be included wherever possible.

The role models also enjoyed the experience. The planning and coordination of their activities was well done.

6. Secondary Outcomes

There were several secondary outcomes of this project. The first is the additional information gained from the seminars by the nontarget population. As noted previously, many sophomores and seniors attended. Their attendance may have been responsible either directly or indirectly for the increase in science majors observed at Mary Baldwin College. The project may have directly influenced the nontarget attendees to shift majors, or indirectly influenced a changing attitudinal climate.

Another secondary project impact may have been on the faculty members at the participating institutions. Specifically, the science faculty was invited to all of the seminars, and at least some attended. This may have increased their interest in science-related careers for women, and increased their awareness of science-related career options outside of teaching occupations. The individuals in industry or private practice guiding the young women through their externships may have also become more aware of science areas as appropriate occupations for young women.

A fourth secondary impact may have been on the role models. Many of the role models became friends during the program, and increased their "network." In at least two instances known to the evaluation team, the relationship formed during the seminars has resulted in a productive working relationship between the role models.

In addition, Mary Baldwin College made some alterations in its structure at least in part to continue the project activities. They have formed a women's center that will be responsible for administering certain of the career education and placement activities. They now have a department to administer externships, and have decided to utilize externships as the primary placement activity. Since the vocational interest inventory indicated that many students were interested in the field of communications, plans have been made to initiate a communications department at the school. The principal investigator summed it up by commenting that the NSF program had increased the institutional responsiveness to the needs of the student.

7. Materials and Dissemination

One of the objectives of the project was to organize the information obtained about career options into a permanent and ongoing file so that faculty and students at the participating colleges and other colleges may easily retrieve this information. The project obtained printed materials from 75 government agencies, businesses and professional organizations. These have been distributed to all of the schools. In addition, an annotated bibliography on science careers is being prepared for distribution by the project staff. No information on the extent they are being used is available.

The status and/or distribution plans of the videotapes are unknown to the evaluation team.

Another "product" of the project is the development of 41 externships that may be used by future students.

8. Program Costs

It is extremely difficult to calculate program costs. The total cost of the program was approximately $100,000. The number of individuals reached (if double counts are included) was about 1,000, including total numbers attending the seminars, the videotape viewing and the externships. The direct cost, then, was about $100 per participant. This figure represents considerable underestimation of <u>cost per actual participant</u> because the same individuals frequently participated in several project activities.

Future replication of project activities might be less expensive. The cost of project operation could be reduced by one-third if clear development tasks are deleted and half-time for project director is sufficient ($60 per participant).

However, the primary operation costs of continuing such a project may be quite modest. For example, the travel expenses and publicity of the role models for the seminars was estimated to be $9,000. If the 800 attendance mark could be sustained, the cost would average about $11.25 per attendee. The costs could be further reduced if more students attended each seminar. Likewise, further use of the videotapes, externships and vocational counseling activities would likely be small, and possibly absorbed by the institution.

9. Summary and Conclusions

The project comprised of seminars, career counseling, externships and videotaped career information represented the most comprehensive intervention of the post secondary projects, The project was aimed at first year students and the junior science majors at four women's colleges, although all students from the schools could participate in some of the program activities. These activities represented an increased effort and modified focus of ongoing programs which have now been institutionalized at Mary Baldwin College. There was differential participation in the project: the campus of the project director participated to the greatest extent; junior science majors were more involved than freshmen; but freshmen who anticipated a science major and those who did not were proportionally represented.

During the period of project activities the percentage of declared science majors increased substantially at the campus where the activities were concentrated. Although this may have been due to multiple causes, it seems likely that the project activities or their secondary impacts contributed to this effect. No specific activities can be implicated because the target group of freshmen and juniors declaring science majors remained relatively constant and shifts from science to nonscience majors and from nonscience to science* were not significantly different. The project can also be judged a success if rate of participation and participant satisfaction are used as criteria. In addition, many positive secondary outcomes resulted on the Mary Baldwin campus.

There were several parts of the project that were suggestive and interestingly, but not completely, explored by the project evaluation. These are:

1. The cooperative arrangement between relatively contiguous schools represented a promising cost-effective approach to career information activities. Yet the evidence indicates that the school participated and benefited differentially. It is possible that the logistical barriers encountered may be surmounted once the activities were operational rather than experimental. On the other hand, personal

*This was treated as an equally probable event in the analysis although national data suggest that a shift from science to nonscience is the more probable event.

commitment and responsibility of the institutional members may have more far reaching affects than the activities themselves.

2. The study had the potential for reinforcing existing decisions. While it certainly performed this necessary function, it also provided career information for those women not choosing science-related careers. The overall effect on the campus where activities were concentrated suggests that activities may be beneficial to both groups.

3. The externships represented a unique component of this project, and, in general, served to enhance career commitment among the junior science majors. In addition, such externships provide a close, more realistically based relationship between the community and the colleges that should serve both to increase career awareness on the part of the faculty and to increase the employability of its graduates.

4. The most unfortunate part of the experiment was its failure to indicate the effects of exposure to project activities in order to provide an indication of necessary level of effort needed to reverse the flow of women away from science majors. In this experiment, as with almost all naturalistic experiments, no reasons for the increase in science majors could be postulated from the experimental results, e.g., the differential effects of project activities on attitudes was not determined.

5. Many of the project activities, such as the externships, career material and videotapes are being continued in the absence of NSF funding.

6. The fact that role models were graduates of the local colleges probably enhanced their effect, e.g., the majority of the role models had graduated from Hollins or Mary Baldwin. This likely increased student identification with the role models and their success seemed attainable.

7. The affect of the additional career counseling is not clear; e.g., its influence on freshmen was not analyzed. In addition, the low attendance at the weekend seminar on career counseling and assertiveness is not discussed. The lack of enthusiasm on this topic is interesting in light of the good reception of the seminars and externships.

CHAPTER III
PROGRAM OBSERVATIONS AND COMPARATIVE ANALYSIS

Although aimed at science-related careers, many of the recommendations of this report, especially at the primary and secondary school levels, apply equally to all nontraditional jobs, especially those that are highly technical. Therefore, the authors feel that the same recommendations may apply to many interventions designed to increase the awareness of women regarding employment alternatives and options and to increase their participation in many nontraditional careers.

The projects described in this report were aimed, in general, at motivating and reinforcing decisions to enter professional careers in science, for preparing effectively for those careers, and for removing barriers to the attainment of those aspirations. All of the scientific and engineering positions described in the materials developed by these projects required at least a college degree, and most required advanced degrees including a doctorate. On the whole, those women receiving doctorates in science-related fields are productively and continuously employed, and salary differentials between men and women is less than men and women with less education. That is, it appears that a Ph.D. may be an "equalizer." Since these women may also serve as visible examples of the employment potential of females, they may serve to increase the aspirations of other equally talented women. Therefore, it would seem desirable to increase the proportion of women in this category. Since the recommendations may only apply to a small number of women, they are treated independently in this report. The recommendations incorporate the evaluators' observations, derived from a comparative analysis of the projects, and should be considered as hypotheses to be tested since definitive conclusions could not be made from the present projects.

Although this report has concluded that there is probably a higher success rate to be expected by funding programs for high ability, highly motivated groups, and has recommended concentrating on reinforcement programs for these people, there is no evidence that the <u>need</u> is not greater among low motivation, low self-esteem groups. Assuming these groups are larger, it is possible that the potential output would be greater even though the "success rate" may be lower.

Moreover, the consequences of adequate science and mathematics background and awareness of broad career options may have widespread impact on women in the society. For example, comprehension of mathematic and scientific principles may serve to "demystify" a technological environment and decrease a sense of helplessness and lack of self-confidence. Further, the acceptance of nontraditional career options, even for those not choosing to pursue them, may create a more supportive environment for those who do choose them.

Finally, a number of nontraditional nonprofessional science-related jobs exist which, for many women, would represent both economic and social benefits: electronics-, video-, sound- or flight-technicians, computer operators, highly skilled labor, etc. These are jobs that require science-oriented preparation and contribute to the emerging role of women as productive partners in providing highly specialized support skills in a technological society. Although these positions do not usually require college degrees or the same high degree of academic learning ability, they do require early exposure and commitment, continued encouragement, and special training. They represent improved earnings and more respected skills than many traditionally female jobs. For these reasons it may be just as desirable to increase the number of women participating in these careers. Recommendations concerning career education programs are given separately in this report.

Reentry is a critical area for increasing the participation in science-related occupations, e.g., many more women are qualified for these occupations than are currently employed in them. For example, the Scientific Manpower Commission reports that women earned about 35 percent of the bachelor's degrees in mathematics between 1948 and 1973, 25 percent of the master's degrees and 10 percent of the doctorates. Far fewer at each degree level are employed, and the underemployment appears to increase as the level of degree decreases. Approximately 87 percent of the Ph.D. recipients in math are employed, but only about 28 percent of the master's degree recipients and about 31 percent of the bachelor's recipients are working in math related occupations. Similarly, the pool of women qualified to be employed as chemists is about 20 percent of the total pool, but only about 8 percent of the working chemists are female. The percentage of working Ph.D. recipients may be higher than that of lower degree recipients only because a greater percentage of them are continuously employed.

Clearly, underutilization of females in the economic sector is a widespread problem. In fact, in view of the pool of qualified women, it may be more imperative to address the reasons resulting in their underutilization and to develop remedial interventions than to encourage more women to prepare themselves for these careers. Consequently, reentry programs, designed to meet the specialized educational and emotional needs of all women, professional or not, are discussed in a separate section.

A. Professional Careers--Observations From the Projects

Among the objectives of this contract was the examination of the results occurring across projects in order to isolate observable patterns by the type of intervention, types of materials, age groups and other variables that might have relevance in the implementation of similar projects. This analysis may be called program strategy analysis or comparative analysis.

Unfortunately, none of the projects proved to be effective as judged by rigorous statistical methods, either because of the problems in design, control group implementation, and outcome measures, or because the treatment actually had no effect. Therefore, the evaluation team employed a "preponderance of evidence" criteria for judging the effectiveness of a project. That is, some combination of the statistical results, other nondesign outcomes such as experiences with a roughly comparable group, the opinions of the participants, and our own impressions was used to judge whether a project was effective. Under these conditions, even if "success" was indicated, no causal reason for the success could be determined. Consequently, commonalities between the more successful and less successful projects were explored. Because of the experimental limitations on the conclusions, these observations should be treated as hypotheses to be tested, and not as recommendations.

Even when statistically significant results were obtained by the experiments, these were frequently difficult to interpret and place in perspective. The difficulty was encountered under several circumstances. First, frequently a multitude of items were used in the evaluation instrument, but only a few items were significant. Further, when a variety of outcome measures were used, some of the significant outcomes may have been interesting and/or beneficial, but not directly relevant to encouraging women to choose science-related careers. A third difficulty was when different "control" groups indicated different results, such as with the University of Kansas study. A fourth difficulty was the probable Hawthorne effect, where the novelty of the intervention may have skewed the results. On the other hand, multiple-year projects (University of Oklahoma) were difficult to analyze because the effects may have been cumulative and not directly related to the segment that NSF sponsored.

Therefore, the indicators used to estimate effectiveness, were at best, only global measures, frequently not conceived of as part of the experimental design. Consequently, the reason for the outcome could not be conclusively determined. For example, the special math course at UMKC appeared to be effective in encouraging women to take subsequent math courses. However, the comparison group were those taking math courses the year before, and those taking a different math course the same year. Therefore, the interest in mathematics might be attributed to any of the following: (1) the actual curriculum, (2) the method of instruction, (3) the additional tutorial help, (4) the all-female classes, (5) the influence of the instructors, (6) the "Hawthorne" effect, and (7) the differences in the population that would sign up for the course.

The projects are described in three tables. Table 1 breaks down the 11 projects by the age of the participants, the sex of the participants, the types of treatment, and whether the treatment was available at different intervals (spaced), or given all at one time (massed). Finally, the outcome of the experiment is given. Table 2 lists the products of each of the projects, and their potential applicability, and Table 3 contains a rough estimate of the cost to reuse that particular intervention and a subjective assessment of its effectiveness.

The subjective assessment regarding the effectiveness is reported in three categories: probably effective, no effect, and possibly a negative effect.

The special math course offered by the University of Missouri at Kansas City (UMKC), the workshop offered by the University of Oklahoma and the workshop offered by Michigan Tech for counselors and teachers and the workshops at the University of Kansas appear to represent the most viable strategies. UMKC reported a much greater percentage of women taking subsequent math courses, although no true control group was available for statistical comparison. Similarly, the University of Oklahoma workshop reported a higher percentage of women reporting that they would choose an engineering major than a noncomparable control group. The participants in the University of Kansas workshops reported more science majors than the year before, but about the same as the control group composed of individuals who were invited to the workshop but did not attend. The counselors/teachers workshop, sponsored by Michigan Tech, reported a consistent, but slight, increase in awareness of engineering as a career for women, and reported increased activities regarding these careers on a form that the participants devised. Consequently, the commonalities between these programs that may have been successful are discussed.

The ACT nonsex restrictive vocational inventory, the MIT film, the Michigan Tech program for students, Queensborough's cassettes and slides, and Rosemont's program to update skills reported having little effect when used as the primary intervention. Rosemont was included in this category because at the time of the report, only 25 percent of the seven participants had obtained jobs, and this appeared to be about average for women making some active effort to get them. Goucher and Policy Studies indicated that their project might have had a negative effect on the participants. Commonalities between these projects are discussed.

Some of the commonalities we observed and areas where we recommended further investigation are as follows.

TABLE 1
PROJECT DESCRIPTIONS

	Grade	Sex/ Sample	Intervention	Contact Time	Results
Michigan Tech	8th	F	Presentation by role models of preparation, job content and lifestyle in engineering.	4 hrs.	No significant results.
	8th	F	Demonstration projects.	4 hrs.	No significant results.
	8th	F	Mailed printed matter.	1 hr.	No significant results.
ACT	9th	F	Given non-sex biased career inventory, discussion groups, and printed matter.	2 hrs.	More career exploration, increased congruence between aptitude and aspirations.
Policy Studies	10th, 11th	F	Workshops in school on lifestyle and career clusters.	12 hrs.	No significant results--slight trend toward disinterest in science.
MIT	10th, 11th, 12th	M,F	Film and booklet.	1 hr.	More in experimental group undecided about career plans--same amount definitely wanting engineering.
Goucher	11th	F	College level semester course in science.	15 hrs.	Significant decline in interest in science at end of course, but 58% of respondents planning science career one year later.

TABLE 1 (continued)

	Grade	Sex/ Sample	Intervention	Contact Time	Results
Oklahoma	11th, 12th	F	Workshop of mixed discussions, labs and field trips.	40 hrs.	Probably increased number of women planning engineering careers (not adequately tested).
ACT	12th	F	Mailings of relevant materials & VIP inventory.	2 hrs.	More planning taking courses in science but more control planning to take math
Kansas	12th	F/high ability	Workshop.	8 Hrs.	Significantly more women pursuing science careers than women in prior year control; but same percent as women who were invited to workshop but did not attend.
Queensborough	9-12	M,F	Slides and cassette of six role models.	1 hr.	No significant differences.
Michigan Tech	Parents	M,F	Printed matter mailed.	1 hr.	No significant differences.
Michigan Tech	Teachers	M,F	Printed matter distributed.	1 hr.	No significant differences.
Michigan Tech	Teachers, counselors	M,F	Workshop with role models, labs, discussion.	80 hrs	No significant difference in participants but may have increased activity in school community.
Kansas	Parents	M,F	Workshop on career materials with daughters.	8 hrs	Not measured; daughters reported it as positive.

TABLE 1 (continued)

	Grade	Sex/ Sample	Intervention	Contact Time	Results
Missouri	College	F	Special math course.	1 sem. 80 hrs.	More took further math courses in sequence.
Rosemont	Post-grad	F	Course to update skills and industry internship.	100 hrs.	About 1/4 did get jobs in science-related areas.

TABLE 2
PROJECT MATERIALS

Material	Appropriate Age	Description	Dissemination
1. Choosing a Career--Women's Work: Engineering (MIT) book	All secondary and college engineering students.	Description of three female engineers--student, young professional, middle age professional/all life-styles represented.	May be used for TV and distributed on film by Educational Development Center Inc. Now available from MIT catalogue.
2. Women in Engineering (MIT) film	All secondary and college engineering students.	Shows students and professional women in engineering at work and home.	"
Exploring (ACT)	Secondary.	Updated version called VIESA: book on job clusters and aptitudes, career planning--non-sex restrictive.	Part of Houghton Mifflin "Career Planning Program."
Vocational Interest Profile (VIP) (ACT)	Secondary.	Non-sex restrictive career assessment/intervention.	
Women in Science and Technology: Careers for Today and Tomorrow (ACT).	Secondary.	Booklet describing realities on women in science-related careers.	ACT. Nice booklet that should be widely used.
Workshop format (Kansas)	Secondary, college.	Series of self awareness exercises.	None.
Women in the Professions (Kansas)	Secondary, college.	Home study course designed for three credits.	None.

TABLE 2 (continued)

Material	Appropriate Age	Description	Dissemination
Women in Science (Queensborough)	College, graduate school.	Interviews with six of top female scientists: mixed ethnic background and variety of lifestyles.	American Association of Physics Teachers and NSTA distributing. Should probably be used in conjunction with other material except at graduate level--may be better at college level than secondary.
Workshop Curriculum (Policy Studies)	Secondary	Mixture of job clusters and lifestyle alternatives.	None.

TABLE 3
PROJECT COST PER PARTICIPANT

	Intervention	Hours*	Cost	Effectiveness
University of Kansas	exploration workshop	8.00	10.00	possibly positive
Policy Studies	career education course	12.00	50.00	no effect or negative
Queensborough	slide and tapes	1.0	1.00	no effect
Massachusetts Institute of Technology	film	1.0	2.00	unknown
Univ. Miss. at Kansas City	math course	64.00	350.00	probably positive
Rosemont	chemistry course	100+	800.00	positive for small proportion
University of Oklahoma	workshop	40.00	300.00	possibly positive
American College Testing	literature mailing	.10	1.65	no effect
	nonsex restrictive interest inventory	1.0	1.00	no effect
Goucher	research course	30.00	1,000.00	no effect or negative
Michigan Tech	student literature	1.0	1.55	no effect
	student seminars	4.0	30.00	no effect
	parents literature	1.0	1.55	no effect
Michigan Tech	counselor teacher workshop	112.00	400.00	probably positive

*Estimates minimum contact time; the time may have been greater for some participants.

1. Concentrating on women who are already interested in science. In general, it is thought that projects providing support for women interested in science, and projects to remove barriers to the full participation of these women, are preferable to direct motivational projects to encourage women to change their interests for the following reasons:

- They are more easily justified in terms of providing equal opportunity and avoiding criticisms of reverse discrimination.

- They are less apt to result in unsatisfactory career choices.

- None of the projects observed appeared to be successful in changing attitudes.

- It is difficult to switch from a nonscience to a science area. That is, beyond the junior year in high school, compensating for inadequate math and science backgrounds is difficult.

Since the projects examined did not appear to be successful in changing occupational choices at the senior high level, intensive support and information could be provided to those women having the necessary background, ability and motivation to pursue their existing interests.

While there is not an established theory on the vocational choice patterns of women, there has been a growing number of studies in the area. Most of the literature appears to be in agreement that there are many shifts in both occupational interests and commitment to a career. However, the literature uniformly indicates that from preadolescence on the shift is toward typically feminine careers and away from nontraditional careers (e.g., Angrist, 1970; Harmon, 1971). Consequently, interest should be defined very liberally, and should not be interpreted to mean an expressed career choice.

The kinds of support that may be helpful can come from a wide variety of sources, and the most important source will be different for each age group. These support programs could include parental support, encouragement from teachers, peer support (both same and opposite sex), guidance counselors and from the institution as a whole. The range of possible forms these programs may take is virtually infinite and could include counselor workshops, special housing programs, special workshops for science/math teachers, or sex-segregated classes.

2. Concentrating on women with above average aptitude and motivation. Realistically, professional careers in science-related areas require intellectual ability, an adequate background derived from math and science courses, and more than average motivation. In fact, having completed advanced mathematics and science courses successfully is probably a good indicator of ability and motivation. Although there is a controversy about the measuring of aptitude and ability (Prediger and Hanson, 1976; Schmidt and Hunter, 1974), it seems feasible to determine whether individuals have at least average ability or are highly motivated by utilizing either standardized test scores, grade point averages, or the courses chosen and completed.

Many studies have shown a relationship between career commitment in general and measures of accomplishment and/or aptitude (e.g., Hoyt and Kennedy, 1958 and Tyler, 1964). Further, a higher level of aptitude appears to be related to the choice of nontraditional careers, e.g., those occupations dominated by males (e.g., Astin, 1971). Consequently, it would appear that intensive and/or expensive programs should concentrate on women who have either a high ability or who have taken the necessary requisite course or overtly express an interest in science.

This hypothesis was substantiated by the projects: the more successful strategies/projects utilized a motivated population, while the ones judged less effective did not. For example, the Kansas workshops invited only women that had been selected for admission to KU, Oklahoma University required active motivation to apply, as did Michigan Tech. On the other hand, the two studies categorized as "possibly negative" reported severe problems getting young women of adequate ability; and one report contained reservations about the participants' motivations. The majority of the studies reporting no results had no special requirements regarding either the motivation or aptitude of the participants.

One indicia of motivation may be found in the participant selection procedures: University of Missouri at Kansas City, University of Oklahoma and Michigan Tech all had self-selection procedures; only those individuals who wanted to participate attended. On the other hand, some of the projects had more or less captive participation; the intervention was administered in classrooms, or the entire class participated.

The self-selection, of course, provided a strong experimental bias toward success, and mitigated any conclusions about the intervention itself. However, since the aim of further implementation is to bias the projects toward successful outcomes, voluntary participation may be a judicious procedure.

3. Using workshops as a format for the intervention. Although it is very possible that the selection procedures for the workshops was a greater determinant of outcome than the format, the hypothesis is proposed that concentrated "live-in" workshops may be effective. These workshops may offer a wide variety of activities as in the University of Oklahoma, Michigan Tech and KU projects, may be the more enjoyable and effective format to provide support and information for young women interested in science.

4. Encouraging participant interaction. Social psychology would predict that other persons sharing similar outlooks and attitudes could provide reenforcement for women choosing nontraditional careers and/or lifestyles. The projects provided some evidence for this assumption. The live-in workshop, where participants with similar interests spent concentrated periods of time together, provided a perfect environment to obtain these rewards. In the special math class, informal tutoring at the noon hour was available and provided the same opportunity. On the other hand, the larger class situations and/or media presentations were generally less successful and did not provide an opportunity for participant interaction. The Goucher project entailing basic science research did provide this atmosphere, but participants reported that they did not form any new friendships.

5. Using sustained contact periods. When the treatment did not require intense concentration and work, the longer periods of time for administration of the treatment appeared to be more effective, possibly because of the increased opportunity to make new friends with people sharing similar outlooks. The more successful interventions appeared to require at least eight contact hours. It is possible that short "one-shot" affairs may not be sufficient to counteract existing cultural mores discouraging women from choosing science-related careers. However, since some other projects of greater length did not appear to be successful, careful examination of related variables should be conducted. The length of exposure may be one of the reasons why the media products did not appear to have a demonstrable effect.

6. Using role models in as many situations as possible. Uniformly, role models appeared to be the most effective component of some of the projects and were the primary material for the media products. The original connotation of a role model was a person in a position of influence that one could identify with; most of the projects did incorporate these younger women in mid-level positions. In one of the projects containing a mix of role models, the younger women were judged most effective by the participants. In this respect, then, choosing the role models closer in age and only slightly above the level of aspiration of the participants may be advisable.

The evaluation team, however, feels that there is also real value in depicting the most successful women of our time. Although very few women (or men) may be able to identify with these outstanding people, they demonstrate that a woman can "make it," they are a source of pride for the women, and may serve as an inspiration. Consequently, a mix of age groups and levels of accomplishment (as well as lifestyles, ethnicity and so on) is recommended.

The area of concentration of the role models did not appear to have any impact; the more important factor was that they genuinely enjoyed their work and their lives.

7. Using "hands-on" experiences. In many of the projects, various types of hands-on experiences were used. Very frequently, these were engineering or science projects. These activities were rated highly by the participants. They appeared to be most effective when they were group projects, continuing over a period of time, e.g., when they facilitated the formation of social relationships. Also the active participation in these and other activities appeared to enhance the effectiveness of every kind of intervention.

8. Segregating some activities by sex. Although in theory, as well as in practice, sex-segregated classes might be considered counter productive since women live and work in a world with men, a consistent comment on the part of many of the participants was that they preferred all-female seminars. This comment extended to a preference for female tutors in math. The young women commented that they felt more free to ask (what they considered) "dumb" questions, to appear as "bright" as they are, and to discuss their personal life and ambitions. Consequently, although a sad commentary on socialization and peer pressure, sex-segregated classes appear to be useful in situations where remediation skills or personal questions are involved. These classes, however, could incorporate methods to lead to more open discussions with male peers and parents, once the women have gained self-confidence and support from their same-sex peers.

9. Emphasizing the social contribution of science. One of the myths of science-related careers, not directly dispelled in any of the projects we observed, is the absence of emphasis on social importance and social interaction in science careers, e.g., scientists/engineers were frequently not portrayed as persons with extensive social/environmental concerns and responsibilities who interacted with the community. Since women are reputed to be very interested in social welfare, emphasizing the input of science to the well-being of society, and a deep involvement with people, might enhance the desirability of the profession. Moreover, the greater the number of scientists whose interests supercede "the testtube," the greater the potential impact of scientists on society in areas other than technology.

Consequently, we would recommend, on the basis of the experience gained by these projects, further examination of a format where able and motivated young women, having some interest in science, gather for a workshop having the ingredients of role models, hands-on experiences, and the opportunity for new friendships. This format is quite similar to the existing Student Science Training Program,* which still does not have full participation by females, and has a demonstrated success rate in turning out scientists (Vidulich, Christman, Drake and Kirk, 1976), e.g., about 50 percent of the females participating in these programs expressed career aspirations in science.

Similar experiences could be provided for both college and graduate students. David (1971) concluded that "earning a doctorate is the factor that most equalizes the women to the men in science and engineering," in terms of employment, salary and contribution to their field (p. 222). However, of students entering graduate school, possibly twice as many men as women actually complete the degree. If the doctorate is an equalizing factor in employment, salary and accomplishment, special programs to encourage completion (and to contribute to the supply of role models and female faculty members) should be conducted. These programs might include female colloquium, particular speakers, support groups, internships, workshops and seminars or nationally conducted week-long seminars for female graduate students.

10. <u>Removing institutional barriers to female participation in science careers.</u> Although the NSF projects were not directly concerned with overt discrimination, many observations regarding the obstacles they presented became apparent to the evaluation team.

Not only do women pursuing nontraditional careers encounter social barriers, they frequently encounter institutional barriers. Even those schools professing equal opportunity for financial aid, intern programs, etc., frequently have not adapted them to the special needs of women. This discrimination, and misinformation, starts very early and continues through her educational and job career, and has to be a discouraging factor even to highly motivated women having superior ability. For example, assistantships in science have positive effects on the junior and senior science majors. It not only serves as a financial aid. it is interpreted as a "vote of confidence" and serves to increase interest, exposure and expertise in their areas. Assistantships also provide additional encouragement to go to graduate school, and usually provide a closer relationship with a faculty member. Assistantships to declared science majors may improve the retention rate and result in more women attending graduate school in science. Yet discrimination

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*The Student Science Training Program sponsored by NSF has the basic goal "of providing talented students learning opportunities above and beyond those normally available in most formal science education programs" (NSF, 1975). Typically this involves high school juniors living on a college campus for a period of time during the summer.

in granting fellowships is common. For example, consistently less than 3 percent of NASA fellowships go to women (about twice the rejection rate for females as males), and about 18.7 percent of NSF fellowships went to women in 1972-73 (Nies, 1976).

B. Career Education

There are a virtual plethora of problems associated with current practices in career education. These include sex stereotyping of careers in literature and media, lack of awareness of alternative careers and lifestyles, sex-biased counseling, and so on. However, two appear to be especially relevant for science-related careers.

Increasing the education in science and math has many benefits for all women, whether or not they choose a career in these fields. It allows for greater perceived control of their environment, and provides them with a background adequate for a wide variety of careers. In the area of general career and science education, we recommend:

1. Differentiating between career education and programs to encourage women to choose science as a career. This conclusion is drawn from the recommendations to concentrate on women who have already expressed an interest in science and/or who have taken the necessary courses by the senior high level. However, some general encouragement may be necessary to obtain these prerequisites, e.g., prior to that time, career education courses for all students is important. Utilizing some of the media products and portions of the Kansas and Policy Studies Programs to make young women aware that science is a career option and to encourage them to obtain the necessary background (e.g., math and science) to keep those career options open is important prior to the senior high level. These programs could be done inexpensively, reach a large number of students, do not necessitate "special" programs for women, and become part of the career education classes in the school systems. These programs could incorporate the "lifestyle" considerations of a career.

2. Emphasizing the importance of continuing mathematics preparation. Since mathematics appears to be the "critical filter" to a wide variety of occupations it is imperative that females continue these courses in order to keep their career options open.

A great many methods in assisting women in mathematics are involved. These include developing innovative methods of teaching math adapted to the typical strengths of females, offering special tutorial/remedial courses, math anxiety counseling, and emphasizing an awareness of the effect of discontinuing math education.

C. Job and Educational Reentry Programs

Thirty-seven percent of women with children under six years of age and 50 percent of women with children between the ages of six and 17 were working in 1975. Since a majority of these women choose to remain out of the labor market for the first years after the birth of a child, these figures indicate that many women reenter the labor market after some period of economic inactivity. These women are typically re-employed in jobs that do not utilize their full potential, and jobs that typically are lower paying. This underemployment is more acute for the woman entering the labor market than for women who are continuously employed.

The woman attempting to reenter the labor market faces a multitude of problems and adjustments. First, her technical skills and theoretical understanding of her field may be outdated. This problem may be addressed by an additional educational experience. Second, her confidence in her ability to get or hold a challenging job may be diminished. She may not know how to interview for a job. She may have many logistical problems, such as arranging for child care, transportation and dinner each night. She may not have the support of her family and friends. She may be afraid of failure (or success). She may face very real discrimination on the part of employers. Consequently, the transition to work after a period of unemployment includes a dramatic change in lifestyle for herself and her family, and a change in her perception of her role.

After the childbearing years, many women want or need to reenter the labor market, i.e., they want to transition to work. For many women, this transition may include completing an advanced degree, or acquiring specific job related skills. Considering the underemployment and underutilization of the talents of these groups, the type of assistance given these women is important. Therefore, we recommend:

1. Concentrating on underemployed women. It is suggested that reentry programs for mature women might utilize already working, but underemployed, women. Updating the skills of women already in the labor force might alleviate problems in recruitment and placement. These women would have already adjusted their family arrangements to meet their work schedules, and have shown that they are motivated for employment. They may be currently underemployed, e.g., rather than capitalizing on their scientific skills, they may be working as secretaries, sales personnel or other jobs unrelated to their training. The major obstacle to this approach would be that their families may be accustomed to or dependent on the additional income, and a period out of the labor force to update their skills may impose an economic hardship for them, unless financial assistance is provided.

One successful approach is the current affirmative action program at the Food and Drug Administration. All males and females without opportunities for advancement are eligible for an on-the-job training and work release time for school in order to be qualified as an inspector. Normally a heavy science background is required for this position. The program enables advancement into a science-related career without initial salary penalty.

2. Considering employment prospects in the locale. It would appear logical to fund programs to update skills in areas where the labor demand is not abnormally low. That is, it is not cost-effective to prepare women for jobs that aren't available, and would be a discouraging experience for those women, and can elicit adverse community reaction among unemployed males and their dependents.

3. Funding projects to update job related skills. While these programs are typically expensive, it appears that some assistance to women to update their skills may be necessary. One of the side benefits of these programs may be that it allows for a more gradual adjustment to a working environment.

4. Making special seminars, workshops and counseling available. Since the majority of these women will have to make personal and familial adjustments to accommodate their new schedules, and job demands, special programs to help them overcome the perceived barriers and obstacles associated with employment could help to increase the success rate of these reentry programs. That is, a woman's ability to get and hold a job, even though she has adequate skills, may be dependent on her attitudes and motivation for work, i.e., her job readiness. It is recommended that assistance in developing an appropriate job readiness profile be a component of all reentry programs.

D. Administrative Recommendations

1. Improving the quality of the experimental research. There are several ways to attempt to improve the quality of the research. These include (a) more selective funding, (b) providing technical assistance, and (c) use standardized measures and long-term follow-up.

a. *More selectivity in funding.* Overall, the quality of the projects, as experiments, could have been improved. One factor was the circulation of the announcement of the availability of support for these projects. Most of the project directors reported learning about the program from the flier received at a dean's office. Consequently, only a very few proposals were received and very few requests for funding were rejected. A better mechanism of disseminating information to prospective applicants should be developed.

A concomitant observation is the difference in results obtained by experienced researchers and those with less experience in experimental design. That is, all of the project directors appeared to be committed to increasing career options for women, and to have strong backgrounds in science. Most, however, did not have an extensive background in experimental design and evaluation, adequate knowledge of control group procedures and statistical analysis. The results of only two projects, although not confirming the hypothesis, allowed some degree of confidence in the outcome. However, there are many benefits to providing a wide spectrum of individuals. These include increased capability by personnel to conduct such projects, increased commitment to women's projects, and possible beneficial effects to the participants. Therefore, a conscious strategy should be developed regarding the importance of reliable experimental results. Should it be decided that confidence in the experimental results is important, some percentage of the project directors should have a demonstrated capability in project management, experimentation, and evaluation.

b. Providing technical assistance to the project directors. NSF has traditionally adopted a "hands-off" policy to grantees. While this policy has many advantages, providing technical assistance in evaluation procedures and instruments to those project directors requesting it might mitigate against the technical problems encountered in many of the projects.

If the current "hands-off" policy toward grantees is maintained, a brief project directors handbook, containing a description of commonly occurring barriers to the implementation of both the project and the experimentation/evaluation is recommended. The case studies do not serve this purpose well because (1) the case studies are too long, (2) are not necessarily perceived as relevant to project needs, and (3) may not be fair to the individual project reviewed, since they were written for other purposes.

This booklet could contain, for example, an overview of problems encountered when dealing with recruiting, working in the public school systems, or in developing evaluation instruments.

c. Using standardized evaluation tools and long-term tracking. If experimental projects are to be continued to encourage women to choose science-related careers and the independent measure is a questionnaire of any kind, the evaluation team recommends that reliable and validated instruments be provided for use by the project directors. Each of the projects has designed at least one such instrument, and the best items could be chosen and validated from this pool or one of the better validated ones, such as that used by ACT, could be used. It is felt that a standard unit of measurement could be developed for all similar projects. Even if a project wanted to have additional dependent measures, at least a comparison, either of the project outcome or its evaluation methodology, would then be possible. It is recognized that a single instrument may not be appropriate for all types of experimental designs and that the use of a validated instrument will insure neither superior experimental nor evaluation procedures.

2. Coordinating intergovernmental activities and delineating activities. There are several federal agencies currently working in the area of career education with some emphasis on women. These include the Women's Educational Equity Act (OE/HEW), Education and Work Group (NIE), Office of Career Education (HEW), and the American Association for the Advancement of Science, Office of Opportunities in Science. Ideally, full sharing of resources should occur. In addition, some agreement about areas of concentration might be possible. For example, NSF might focus on high ability women interested in science, and only assist Office of Career Education in making younger women aware of nontraditional career opportunities. Further, OE/HEW is already planning dissemination activities for similar programs and NSF could add their material to this clearinghouse.

3. Continuing experimental activities by NSF and disseminating knowledge about its programs. In addition to the increase in knowledge gained by the experimental projects, the team has observed some psychological benefits just from the existence of the program. Even the participants commented that they were impressed that "somebody" was interested in their careers. Further, in the current climate of the women's movement and the possible defeat of the ERA, the existence of federal interest and support is imperative for the morale of the people committed to career/life options for women. However, the evaluation team feels that a great many benefits in formulating effective policy would be derived by continuing in the experimental mode, both to NSF, as well as to other agencies. That is, building on the present experience could enhance knowledge about effective methods of implementation.

4. Including specific programs for minority women. In neither the women's projects, which typically contained no minority women, nor in the minorities projects, where women subjects were not identified, were the special problems of minority women addressed. It is recommended that minority women should be given special attention and special programs should be initiated if they continue to "fall between the cracks" of existing programs (cf. Malcom, 1976).

5. Attending to continuity/institutionalization of funded efforts. Ideally, there should be no need for women's offices and programs as separate entities, e.g., these efforts should be incorporated and integrated into every level of the existing structures. Further, one specific aim of research/demonstration projects is their continuation by the institution in the absence of special funding. In order to facilitate both continuity and institutionalization

we recommend special attention to utilizing existing and ongoing structures as a basis for these activities, such as sororities of black women, professional associations, PTAs, etc. Where these are not available, the program should be cognizant of continuation problems prior to initiation, and should plan to "institutionalize" the program. One way of doing this is to make the program concretely benefit the parent institution (e.g., increased enrollment, increased visibility, legal compliance, etc.).

6. Disseminating the developed materials. Some of the projects have engaged in fruitful activities to disseminate their "products." These appear to be successful. However, since these have occurred through different outlets, a compilation of these activities might be produced by NSF. Several projects overlapped in the materials developed (e.g., Policy Studies and Kansas) and other project products (e.g., the film and media packets) could be used co-jointly in the context of other programs. A compilation of all projects designed to encourage women to choose science as a career could be an aid to science teachers and career educators to choose the material most appropriate for their classes. These materials could be made available to a variety of clearinghouses, public libraries and school libraries.

7. Investigating additional intervention strategies. We also recommend experimental investigation of several areas not covered by these projects. These are the study of the effects of aggregation, males in science establishment, and the effect of "significant others," including peer and social group pressure.

a. *Systematic examination of the effects of aggregating women students.* A recent article in Science (Tidball and Kistiakowsky, 1976) reported that the undergraduate institutions from which women have gone on to receive doctorates are different from the institutions preparing men for doctorates. The authors concluded that "women who subsequently received doctorates were more likely to have graduated from institutions that enroll large numbers of women students, had a long and continuous history of women graduates who attained doctorates and offered strong academic preparation in several areas of study." Since many schools enrolling women offer strong preparation in several areas, the distinguishing characteristic of these institutions preparing women for nontraditional roles appears to be their long and continuous history of female representation.

To describe the effects of grouping a certain proportion of these women, a construct might be developed involving "critical mass" or "critical proportion." The construct implies that once this number or proportion is reached, the recruitment and retention of the group becomes a self-sustaining and self-perpetuating system.

Once a critical number or given proportion of women participate in a nontraditional activity, an examination of the need for special recruiting/retention programs should be performed. In fact, it may result in an ever increasing rate of participation.

Conversely, another investigation should determine whether the absence of the critical number or percentage may produce a situation where efforts must be continuously expended to recruit and retain these groups, since the history of unsuccessful participation acts as a discouraging factor, e.g., as the retention rate drops because of a feeling of isolation, fewer will be attracted.

b. Systematic examination of attitudes of males. There is undeniably still a great deal of overt and covert discrimination against women pursuing science. The guardians of the profession are predominantly male. We recommend examination not only of the attitudes of the male science establishment toward females in these professions, but the circumstances that could occur to influence their attitudes toward the participation of women. Dr. Janet Brown, head of the Office of Opportunities in Science at AAAS, has strongly suggested that such research be conducted by an eminent male scientist.

c. Examination of the effect of significant others on women. Since the problems involved in occupational segregation are similar to normative deviance, we recommend examining the influence of:

- parents
- school personnel
- male peers
- female peers

Admittedly, a multitude of studies have attempted to examine the most important influences on female scientists. Unfortunately, most of them have been retrospective; e.g., asking women to recall what was important to them 20 years ago. This type of research has several disadvantages: perspectives change over years, especially regarding events that were not consciously considered at the time. Examination of these factors in real time would be more advantagous, and might, as in the ACT study, indicate important changes in perceptions over years. Further, several of the present experiments included these groups, but none was successful in gauging their impact on the female students. If these are successful, the long range benefits of these programs would likely be more cost-effective.

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APPENDICES

APPENDIX A

ALTERNATIVE INTERVENTIONS

ALTERNATIVE INTERVENTIONS

There are many barriers to account for the lack of participation by women in nontraditional science careers. These psychological, sociological and institutional barriers have been systematically laid out by Dr. Smith at the University of Kansas (1976). His delineation of the barriers is given in Table 1.

There are a wide variety of interventions or treatments which may serve to overcome these barriers and to encourage women to choose science-related careers. These vary by age group, comprehensiveness and area of focus. Generally speaking, programs for young women may be considered career education and are less specific to science. Further, programs offered in earlier years may be considered as recruitment, while programs for college age may concentrate on support and retention.

Many of the potential programs listed below are not within the charter constraints of the National Science Foundation. Because it is felt that a sustained effort, reaching each female as continuously as possible throughout her formative years, may be necessary to counteract society's socialization processes, many programs are listed.

The list of programs is divided by educational level. The assumption underlying these programs is given first. The list is not complete, and is intended to act as a "working draft," and is laid out in Table 2.

TABLE 1

Barriers Proposed as Affecting Career Choice of Women

Role Conflict (Career Person versus Parent)

1. Women feel a long-term commitment to a career interferes with raising preschool children.
2. Women feel a long-term commitment to a career interferes with raising a family.
3. Women feel that their basic responsibility is raising the children in our society.

Role Conflict (Career Person versus Spouse)

4. Women feel that a husband's success is more important than a wife's success.
5. Women feel they should adjust their career goals in order not to interfere with their husband's success.
6. Women are not free to move to new locations as career opportunities open in their field.
7. Women feel a strong career commitment interferes with a happy marriage.

Family's and/or Friends' Opposition to a Career

8. People who are important in a woman's life (that is, family and friends) believe a woman's place is in the home.
9. People who are important in a woman's life (that is, family and friends) do not think it is appropriate for a woman to pursue a professional career.

Lack of Opportunity (in Jobs)

10. Women who are trained in science fields do not have as many job opportunities as men.
11. Women have not been informed of job openings in traditionally male science careers.
12. Women are not as aware as men of the variety of available science careers.

Lack of Opportunity (in Education)

13. Women with math and science ability do not have the same educational opportunities as men. For example, women have more difficulty getting into medical school than men.
14. Senior high women are discouraged from pursuing the science and math courses which would prepare them to pursue science majors in college.

TABLE 1 (Continued)

Fear of Success

15. Women fear the consequences of being highly successful in their careers.
16. Women do not want jobs that involve professional responsibility and commitment.

Lack of Professional Support

17. Women scientists are out of the mainstream of important professional contacts.
18. Women who are scientists are not supported and not kept informed by fellow professionals. For example, women do not receive up-to-date information about research possibilities.

Perceived Lack of Ability

19. Women do not feel competent enough in math and science areas.
20. Women believe the stereotype that they do not have a natural bent for solving problems and therefore do not have a natural ability to be scientists.

ALTERNATIVE INTERVENTIONS
TABLE 2

Assumption	Elementary School Programs	High School	College	Graduate	Reentry	Post Employment
Knowledge that science-related careers are open to women is a prerequisite for pursuing those careers	1. Use of nonsex stereotyped depicting of occupations in printed material 2. Programs to reach elementary school teachers and administrators 3. Efforts to eliminate current sex role specialization in school systems	1. Use of nonsex stereotyped depictions of occupations in printed matter and "career day" programs 2. Programs to reach high school teachers, administrators, and especially counselors 3. Efforts to eliminate current sex role specialization in the school systems	1. Workshops and seminars portraying professional women in science careers 2. Increase in number of female science professors			
Many women capable of pursuing science-related careers lower their aspirations because of peer and parent pressures and concern for popularity and future familial relationships		1. Making males and females aware of career alternatives 2. Making males and females aware of satisfying nontraditional family relationships 3. Encouraging young women to discuss career options with their parents				

A5

TABLE 2
(Continued)

Assumption	Elementary School Programs	High School	College	Graduate	Reentry	Post Employment
Many women fail to pursue science-related careers because they fail to successfully complete prerequisite mathematics preparation		1. Programs emphasizing long-range planning including continuation of mathematics 2. Innovative methods of teaching math adapted to the strengths of females 3. Special tutorial programs	1. Remedial math courses 2. Innovative teaching methods 3. Special tutorial programs			
Career committed females may benefit from special counseling support group activities		1. Identification of career committed females	1. Special counseling and support groups 2. Special housing			

A6

TABLE 2
(Continued)

Assumption	Elementary School Programs	High School	College	Graduate	Reentry	Post Employment
Tangible and intangible institutional barriers discourage women from pursuing science-related careers			1. Increasing number of undergraduate assistantships 2. Increase women in coop and intern programs 3. Rewriting "fellow"ship brochures 4. Increase female faculty	1. Provide more financial aid 2. Adapt financial aid provisions to meet the needs of women 3. Increase in number and status of female faculty 4. Special programs to encourage Ph.D. completion		1. Repeal of anti-nepotism rules 2. Tenure and fringe benefits for part-time employment 3. Split positions and flexible hours 4. Equalization of pay scales
Women reentering labor market have special needs					1. Programs to update previously learned skills 2. Special counseling programs 3. Assistance in job placement	

TABLE 2
(Continued)

Assumption	Elementary School Programs	High School	College	Graduate	Reentry	Post Employment
Women beginning or continuing formal education in their mature years have special needs					1. Special vocational guidance programs 2. Use of CLEP and related programs 3. Increase in assistantships 4. Increase in coop and intern programs	
Increasing the awareness of the status of women by the working community will (1) increase job satisifaction, (2) increase the number of females in the labor force, and (3) may alter the stereotypes that employees convey to their children						1. Workshop/seminars of employees on the status of women 2. Soliciting industrial support for women's programs

APPENDIX B

SITE VISIT OUTLINE

Institution:

Project Number:

Principal Investigator:

Original Design of Experimental Project

A. Rationale of project designed:

B. Stated objectives (hypotheses):

C. Independent variables (treatments):

D. Dependent measures:

E. Sample:

	Experimental	Control
1. age		
2. number		
3. ability in science		
4. interest in science		
5. sex		
6. other variables (ethnic, suburban, etc.)		
7. recruitment procedures		

Project Implementation

A. Changes in rationale (if any):

B. Changes in goal (if any):

C. Any other procedural deviations (schedules, etc.):

D. Actual sample

	Experimental	Control
number contacted		
number participating		
number (%) completing (retention)		
factors influencing participation and/or attrition		

Participants

A. Describe any distinguishing characteristics not covered by "sample":

B. Other comments:

Project Personnel

Total number of personnel interacting with participants

A. Scientific background:

B. Commitment to open career options:

C. Perceived attractiveness by participants:

D. Perceived credibility by participants:

E. Motivation for instituting project:

F. How heard about program:

G. Sex of personnel:

H. Other comments:

Type of Communication

1. Modalities (print, etc.):

2. Format (sequence of presentations, etc.):

3. Actual content (realism, etc.):

4. Relevance of content to background of participants:

5. Number of disciplines discussed:

6. If more than one type of communication was used, which type was most effective?

7. Which (content area) of each type of communication had most impact:

8. Comments:

Institution

1. Type of school (liberal arts, etc.):

2. Geographic location:

3. Degree and type of institutional support and commitment at program inception:

4. Adequacy of facilities for conducting the project:

5. Possibility for program continuation in absence of NSF funding:

6. Institutional ratio of males/females:

7. Comments or distinguishing characteristics:

8. Attitude changes with institution members because of the program:

9. Behavioral changes in institutional members because of program:

Cost Variables

1. Total cost per participant $\left(\frac{\text{number participants}}{\text{total budget}}\right)$

2. Cost and time to prepare course materials:

3. Cost to administrate $\left(\frac{\text{program cost-cost to prepare}}{\text{number of participants}}\right)$

4. Cost to use if number of participants were increased:

5. Cost to reuse with same number of participants:

6. Time commitment by participants:

7. Cost in comparison to alternative, similar programs:

Overall Evaluation

A. Program Conception

1. Appropriateness:

2. Validity and utility in meeting needs:

3. Quality:

4. Priority in face of competing needs:

5. Adequacy of experimental design:

B. Need for Program

1. Number of people applicable to:

2. Intensity of need of appropriate participants:

3. Projected demand for program at other institutions:

4. Projected support for program (source):

Global Effectiveness of Program

1. Short term changes:

2. Anticipated long term changes:

3. Goal attainment

4. Obstacles in conducting program:

5. Suggested changes if program repeated:

6. Most effective program component:

7. Least effective program component:

8. Most effective combination of components:

9. Generalizability and replicability of program:

10. Dissemination of materials:

11. Comments:

APPENDIX C

PARTICIPANT IMPACT SURVEY AND
SAMPLE COVER LETTER

COLORADO SEMINARY
UNIVERSITY OF DENVER
DENVER RESEARCH INSTITUTE
UNIVERSITY PARK • DENVER, COLORADO 80210

Industrial Economics Division

June 9, 1976

XXXXX
XXXXX
XXXXX

Dear Ms. :

In the summer of 1974 you participated in Summer Engineering for Women at the University of Oklahoma. That project was funded as part of an experimental program. The Denver Research Institute is conducting a study to examine the impact of these projects, and to recommend the kinds of projects that best serve to encourage women to choose math, science or engineering as a career.

We would appreciate it if you could take a minute to fill out the enclosed postcard to help us in our efforts to recommend the most effective projects for women.

Sincerely,

Alma Lantz, Ph.D.
Research Psychologist
Industrial Economics Division

Enclosure

PROJECT NAME

		YES	NO
1.	I am now taking a math or science class . . .	[ ]	[ ]
	I most likely would have without program. . .	[ ]	[ ]
2.	I am now planning on a career in math/science	[ ]	[ ]
	I most likely would have without program. . .	[ ]	[ ]
3.	I am now planning on a different career as a result of the program	[ ]	[ ]

4. The most positive aspects of the program were:

5. The less influential aspects of the program were:

COLORADO SEMINARY
UNIVERSITY OF DENVER
DENVER RESEARCH INSTITUTE
UNIVERSITY PARK • DENVER, COLORADO 80210

Industrial Economics Division

Dear "project director":

We are enclosing a copy of the "independent impact survey form" that we have sent to the list of participants that you gave and a copy of the cover letter accompanying the form. We do not feel that the questions on the postcard will be objectionable to you.

We also have one final favor to ask. We have enclosed a copy of the summary sheet we are using for each project. We would appreciate it if you could also complete it and return it to us as soon as possible. Your response may add fresh insights into our observations and will correct any errors we might have made. If you have any questions, please call us collect at either 303/753-3376 or 753-3301.

We really appreciate your time in this last request.

Sincerely,

Alma Lantz
Industrial Economics Division

AL:tk
Enclosure

cc: Dr. Anita West
Ms. Joan Callanan

APPENDIX D

SELECTED EXISTING ALTERNATIVE CAREER PROGRAMS FOR WOMEN

SELECTED EXISTING ALTERNATIVE CAREER PROGRAMS FOR WOMEN

Special Programs for Women

The Women's Center
Barnard College
606 W. 120th Street
New York, NY 10027
Contact: Jane Gould
212/280-2067

The Women's Center at Barnard College devotes itself to reaffirming the dignity, autonomy, and equality of women. The Women's Center hopes to contribute to the dialog about the problems, the place, and the potential of women in contemporary life; to help develop new bonds between a college and women away from college; and to give fresh insight for undergraduates about what it means to be a woman in modern times. They maintain resource materials for the students on options and the various careers available to them.

Wider Opportunities for Women Center
1649 K Street, 4th Floor
Washington, D.C. 20006
Contact: Nancy Rigby, Betsy Cooley
202/638-4868

Formerly called the Washington Opportunities for Women Center, this women's center has been in existence for ten years as an information and career counseling center. They have recently begun publication of Women's Work, with which they are expanding their services to provide sources for practical news and ideas about job realities for women. The main thrust of the Center is toward job counseling and training aimed at integrating women into the workforce more equitably. The Center provides job counseling for professional women and has extensive programs enabling women to obtain vocational job training and placement in both traditional and non-traditional fields. In these programs, they not only help obtain training and placement, but also help to sensitize supervisors, management, fellow workers and the women themselves to what they can expect especially with women in non-traditional careers. The Center is presently trying to organize a coalition of similar programs across the country to share and exchange information and resources.

Business and Professional Women's Foundation (BPW)
2012 Massachusetts Ave., N.W.
Washington, D.C. 20036

BPW Foundation will start a revolving loan fund for women engineering students to assist women in obtaining graduate engineering degrees. This program was announced recently by the Business and Professional Women's Foundation. The Exxon Education Foundation made a $100,000 grant to the Foundation to assist in starting the program. "Only one percent of the professional engineers in this country are women," said Maxine R. Hays, President of the BPW Foundation Trustees. "Women are only five percent of the enrollment in engineering degree programs. The BPW Foundation is encouraging more women to become engineers and one important way that this can be accomplished is to make financial assistance available." Loans amounting to $70,000 annually will be made to women accepted for masters' level study at universities accredited by the Engineers Council for Professional Development. Working with the Society of Women Engineers, the BPW Foundation will distribute information about the loan program to engineering schools and women who are presently employed in engineering fields or who are undergraduate engineering students. A selection committee to review applicants for engineering study loans will include representation from the Foundation, the Society of Women Engineers and the general public. Loans up to $2,000 for one year will be granted.

Women's International Information and Communication Service (ISIS)
Via della Pelliccia 31
00153 Rome, Italy
Contact: Judy Sidden
ISIS
1915 Glenwood Ave.
Raleigh, NC 27608

A new Women's International Information and Communication Service has been organized to serve the world-wide feminist community. The four primary goals of ISIS are information dissemination and documentation, information organization, continued dialogue about women's issues on an international basis and coordination and cooperation among women on projects of an international concern. The work tasks are viewed in two main categories--information organization and dissemination and the development of communication networks among women. Among the proposal planners and endorsers of ISIS are Brigalia Bam, head of the Women's Desk, Unit III, World Council of Churches; Sylvia Talbot, Episcopal Supervisor, African Methodist Episcopal Church; Jessie Bernard, sociologist, National Institute of Education; Robert Cramer, Director of Resources for Communication and Elise Boulding, sociologist, Institute of Behavioral Science, University of Colorado.

Women Doing Research
American Psychological Association (APA)
Workshop conducted by Committee on Women in Research
Susan Sacks, Barnard College
Reesa Vaughter, Fordham University

This APA workshop was designed to communicate and utilize each participant's resources, and attempted to share expertise, ideas and strategies. Participants in the workshop articulated barriers to research achievement and strategies for overcoming those barriers. The purposes of the workshop were to (1) identify internal (psychological) and external (institutional and social) barriers to the productivity, achievement, personal satisfaction, and professional development of women researchers; (2) to exchange information concerning developed strategies which are effective against these barriers; (3) to initiate a network of communication among women researchers; and (4) to communicate participant recommendations and suggestions for action.

Introduction to Engineering Program for High School Girls
College of Engineering
University of Wisconsin
Madison, Wisconsin 53706
CONTACT: Lois B. Greenfield
608/262-2473

The Introduction to Engineering Program for High School Girls is a summer program "designed to introduce qualified high school women to facets of the engineering profession and to encourage them to consider engineering as a career." Eligibility for the program requires three years of high school, two years of high school math, one year of science beyond general science, and academic standing in the upper 20 percent of the student's class. Applicants who had a great deal of knowledge about engineering through participation in similar programs were not generally accepted into the program.

The program involves a one-week in-residence introduction to the specific fields of engineering offered by the college. This introduction took the form of lectures and tours of facilities by members of the college facilty, and literature pertinent to the specific fields. Extensive use was made of realistic role models and hands-on experiences. (The women were able to program a computer, make castings in the foundry, etc.)

Extensive background information was taken on each woman and questionnaires were filled out by the students both before and after the course. An attempt was made to determine the significant factors in creating an awareness of or an interest in science fields, not only within the program but also in the student's home or school environment.

Suggestions from participants for improving the program included having more tours and demonstrations; having more "doing" experiences, as opposed to passive listening; involving engineering students more actively in the presentations; and encouraging speakers to communicate more at the level of the participants so they may be more easily understood.

The program's evaluation "tends to indicate that for these select young women, a program such as this is influential in helping young women choose an engineering career."

Operating funds for the program are supplied by the University ($25 per student) and each participant contributes $25 toward dormitory housing and meals for the week.

Math for Girls
Lawrence Hall of Science
University of California
Berkeley, California 94720
CONTACT: Nancy Kreinberg
415/642-4193

Math for Girls is a program involving eight-week tuition courses with the purpose of introducing girls to hands-on experiences in logical thinking and problem solving to stimulate their curiosity and interest in mathematics. Puzzles, games and computer activities show a side of mathematics that can be fun as well as challenging.

Stimulus for the program came from the low enrollment of female students in the Hall's classes in physical and life science, computer science and mathematics. The courses are taught by female students at the University who are enrolled in mathematics and computer science. They are selected and trained on the basis of their interest and ability in mathematics, and their desire to act as role models of women in mathematics for their students.

Throughout the course, time is set aside for discussion of girls' competency and interest in science and mathematics, and the stereotypic attitudes that can result in limited career expectations for women. The importance of electing science and mathematics courses in high school is stressed, since avoidance of such courses severely restricts an individual's choice of college major.

The program is still experimental and does not as yet have an evaluation process built in. Presently, they have no funding outside the University, but are seeking such funding to enable them to not only evaluate effectiveness but also bring Math for Girls to the larger Bay Area community by providing after-school workshops in selected areas.

Simmons College
Boston, Massachusetts
CONTACT: Ann Bryant
617/238-0410

Simmons College has a program funded by a large grant from the Carnegie Foundation for women employed in the banking industry. This program is directed toward women who do not have B.A. degrees and is designed to teach management principles and give them skills needed to succeed in the banking industry. The course consists of weekend seminars leading to a B.A. degree.

Project Equality--Expanding the Occupational Perceptions of Girls
Highline School District #401
15675 Ambaum Boulevard Southwest
Seattle, Washington 98166
CONTACT: LaRae Glennon
206/433-2365

The goal of this program, which deals with both secondary and primary students, is to expand the occupational perceptions of girls. Their objectives in attaining this goal include developing occupational simulations for the primary grades (to demonstrate both sex's abilities to perform these occupations); career exploration experiences, including speakers and simulation experiences, for girls in the secondary grades; developing packets of activities which suggest practical techniques of countering sex-stereotyping (role playing, role reversal); and developing a bibliography of nonsex biased and female role model books.

The program has evaluation instruments designed to assess perceptions of occupational opportunities available (with regard to sex) and indications of sex-role stereotyping. Five different instruments were used to evaluate the programs of five grade levels.

Evaluation of the primary and secondary level programs showed that significant gains were made in expanding student's perceptions of occupational opportunities available to females and a reduction in instances of sex-role stereotyping. Additionally, initial evaluation results of secondary level programs suggest an increased knowledge of the participation of females in society.

The project's first year was funded for over $70,000 by the State of Washington under Title III of the Elementary and Secondary Education Act of 1965.

Department of Mathematics and
Computer Science
Mills College
Oakland, California 94613
Contact: Lenore Blum
415/632-2700

This program, which is funded in part by the San Francisco Foundation, was begun in order to increase mathematical and technical expertise of women in many fields. A key feature is to provide easy access into the mathematics program at Mills College. Their methods include stimulating interest by weekly seminar series featuring invited speakers (predominantly women); redesigning math courses so that those with only limited high school background would not be deterred; designing a network of workshops to deal with additional student needs and to provide a variety of entrance points to the program; providing early career experiences; and increasing awareness of career options.

Evaluation of long-term effects is anticipated but not yet started.

Women and Careers in Traditionally Male Fields
Institute of Technology
University of Minnesota
Minneapolis, Minnesota 55455
Contact: Sandra Davis
612/373-2851

This two-year-old program offers a credit course to meet the needs of women entering traditionally male career fields, including engineering, medicine, dentistry, veterinary medicine, architecture, mathematics, computer science and law. The program makes extensive use of role models allowing participants the opportunity to listen to professional women's experiences and asking them questions of what life, pay, and work is like in professional careers. In choosing role models, the program looks for diversity of life styles and occupations as well as age.

The program as yet does not have a formal evaluation, but in terms of numbers of women students enrolling in the Institute, the program appears to have had an impact as the number has almost doubled.

Catalyst
14 East 60th Street
New York, New York 10022
CONTACT: Miriam Krohn
212/759-9700

Catalyst is a national nonprofit organization which develops and expands career options primarily for college-education women, with some programs for undergraduate women and women re-entering the work force. The group provides career information and self-guidance material; helps the employed woman respond effectively to opportunities for upward mobility; assists employers with the recruitment, assimilation and upward mobility of women; interprets the needs of the marketplace and offers services to equip women to meet those needs; and maintains information for referral to a national network of resource centers for women. They also publish the National Roster monthly. This roster is a computerized listing of professional women seeking employment and is distributed to employers nationwide.

Options for Women, Inc.
8419 Germantown Avenue
Philadelphia, Pennsylvania 19118
CONTACT: Marcia Kleiman
215/242-4955

Options for Women is a nonprofit corporation consultation service for women seeking to expand their career options. Modest fees are charged to cover their operating expenses and vary according to the service.

Their purpose is to aid women in defining and clarifying their career goals and explore the options available to them; they also help the community consider alternative career patterns, recognize the varied abilities of women, and create more varied opportunities for women.

The program includes individual and group consultations, vocational interest and aptitude tests, a resource library, a placement service, and a consulting service to aid employers and institutions in issues dealing with issues regarding the hiring and promotion of women.

Maple Heights Equity Career Education Program
Maple Heights City Schools
5500 Clement Drive
Maple Heights, Ohio 44137
CONTACT: Marilyn Hormann
216/587-3200, Ext. 200

The objectives of this program are to give learners in grades K through 10 an increased knowledge of careers so that they may make more informed decisions, and make students (especially female) more aware of equity and the fact that existing sex bias and sex stereotyping limit career choices and career goals, so they will be challenged to consider alternative roles and career models.

The program utilizes classroom activities, as well as activities with parents, the community, and business and labor leaders.

An evaluation (by consultants) will be completed by May 1976 and will determine the change in student's attitudes toward career choices and goals. The program has been funded by a $131,000 grant.

Sandia Laboratories
Albuquerque, New Mexico 87115
Contact: Charles E. Cockelreas
505/264-1130

Sandia Laboratories, a prime contractor to the U.S. Energy Research and Development Administration, has produced three films on science and engineering. The first two films dealt with Chicano and Indian Ph.D.'s in science and engineering. The third film is the first in a series of 6-8 films about women in science and engineering. The first of this series is . . . keep the door open. This film and the rest of the series have the goal of encouraging young women to consider careers in science and engineering and are directed toward junior high school girls. The thrust of all the films will be to provide role models that counteract existing stereotypes. Interviews were conducted throughout the country to find articulate women of varying physical and intellectual types. Although the films obstensibly deal with the professional side of science and engineering careers, there is also considerable discussion about the kinds of problems the women faced as girls growing up in a traditionally conservative culture.

Building Effective Minority Programs in Engineering Education
Committee on Minorities in Engineering
Assembly of Engineering
National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

This report is the first of a series on minority programs in engineering education. The committee's work is aimed at increasing the representation of American Indians, Black Americans, Mexican Americans, and Puerto Ricans in the engineering professions. They hope to accomplish this by providing effective national leadership and coordinating the various activities best calculated to advance minority group participation in historically underrepresented engineering professions. The Committee is made up of representatives from engineering schools and societies, racial and ethnic organizations, industry and government.

Women in Science and Technology: Careers for Today and Tomorrow
The American College Testing Program
P.O. Box 168
Iowa City, Iowa 52240
Contact: Dale Prediger
319/356-3711

This publication is intended to provide information for women on careers in science and technology. Comments from numerous women already established in their fields provide some insight to what it's like to be a scientist or engineer as well as problems encountered in being a woman in traditionally male fields. The booklet examines the many varied fields of science and technology including suggestions on steps young women can take to plan a successful career.

Math Learning Center
Oregon Mathematics Education Council
325 13th St., N.E., Room 301
Salem, Oregon 97301
Contact: Barry Mitzman
503/378-3175

The Math Learning Center is an experimental program to improve math education in Oregon with support from the National Science Foundation. The program is designed to allow teachers to approach mathematics instruction through nontraditional methods. Another program in the system offers in-service workshops for teachers, and has established math resource centers. The Council publishes two periodicals: The Oregon Mathematics Teacher and the Math Learning Center Report.

The Spokeswoman
53 West Jackson, Suite 525
Chicago, Illinois 60604
Contact: Karen Wellisch
Editor and Publisher

This monthly newsletter reports news about women not usually covered by the established mass media. They include news about education, employment, politics, legislation, legal action, welfare, etc. Their objective is to inform women about what other women and women's organizations are doing all over the country to win equal rights and open new opportunities.

Federation of Organizations for Professional Women

Executive and Research Office
828 Washington Street
Wellesley, Mass. 02181
617/235-8624

Governmental Information Office
1346 Connecticut Avenue, Room 1122
Washington, D.C. 20036
202/833-1998

The affiliates of the Federation coordinate their energies and activities to increase women's intellectual and economic independence and to advance women in the professions. The organization is working to attain equal status in professions and occupations for all women; equal access to training, funding for research, and policy appointments; equality in hiring, pay, benefits, and promotions, as well as entrance into professions at all levels; and the sharing of expertise to promote effective national policy on the status of women.

APPENDIX E

FILM BIBLIOGRAPHY

FILM BIBLIOGRAPHY

Title: And Who Are You?
30 minutes, 16mm, B/W
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Hubert S. Coffey and Marya Mannes discuss discovery of one's inner self and the possible conflicts in maintaining one's individuality. One of the series, Choice: Challenge for Modern Woman.

Title: Choice Chance Woman Dance
44 minutes, color, 1972
Filmmaker: Ed Emshwiller
Description: Purports to "tackle the dilemmas, paradoxes, and choices available to the middle class woman today . . ."

Title: Girls and Women
A series of 10 programs of 30 minutes each
Filmmakers: Selma Odom and Margo Shackson
Producer: The University Television Center
Description: A series which focuses on the physical and sociological differences between the sexes, the psychology of women, variations of life styles, women's place in history, stereotypes of women and women's rights.

Title: Is Personal Growth Selfish?
30 minutes, 16mm, B/W
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Sister Mary Corita, and Anne Steinmann discuss women's growth throughout life, their dependency upon male and societal attitudes, and opportunities with "the system." One of the series, Choice: Challenge for Modern Woman.

Title: Margaret Mead
30 minutes, B/W, 1960, #6930
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Celebrated anthropologist brings the experience and understanding gained from her study of primitive cultures to a lively discussion of contemporary world problems--marriage and morality, the place of women in modern life, the education of young people, etc.

Title: Woman's Place?
30 minutes, 16mm, B/W
Source: American Association of University Women/2401 Virginia Avenue, N.W./Washington, DC 20036/phone 202-338-4300
Description: AAUW panel discussion by six women on the status of women.

Title: A Woman's Place
A weekly program series on WTTW Ch. 11. Production started in February 1972, and broadcasting began shortly thereafter.
Description: Focuses on the changing role of women in today's world. The program is designed as an open forum for the exploration and discussion of the full spectrum of viewpoints concerning women's issues.

Title: 51%
30 minutes, 16mm, color, 1971
Directed by Dick Feldman, produced by Rob't Drucker & Co.
Source: Sheldon Satin Films/1175 York Avenue/New York City, NY 10021
Description: Three case studies of women employees in a corporation spotlight stereotypes about and discrimination against women. Provides good role model examples for women dealing with difficult situations.

*Title: Help Wanted - Women Need Apply
61 slides with script
Source: Jim Patron/Dallas Regional Office/Civil Service Commission/ Dallas, TX
Description: Designed to be shown to high school and college classes and women's clubs, the film describes and shows women in a variety of jobs--flood control engineer, attorney, chemist, accountant, radio equipment installer and repairer, photographer, and others.

Title: Job Interview - Three Young Women
17 minutes, B/W 1968
Source: Business Education Films/5113 16th Avenue/Brooklyn, NY 11204
Description: Three young women are interviewed for a job. The discussion centers on mistakes they make during the interview for a job, and how to correct them.

Title: Never Underestimate the Power of a Woman
20 minutes
Source: Norma Briggs/Department of Apprenticeship Training/ 310 Price Place/Department of Labor, Industry and Human Relations/ Madison, WI
Description: A film showing women performing well in so-called male occupations.

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*Films dealing specifically with women in science.

Title: Modern Women: The Uneasy Life
55 minutes, 16mm, B/W, 1965
Source: University of Indiana
Description: Faces with candor--the feelings of both women and men regarding the traditional role of women. The new freedom involves multiple choices which create anxieties. Participants include young married women, college women, career women.

Title: What Is A Woman?
30 minutes, 16mm, B/W
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Keith Berwick and Margaret Mead discuss what is feminine and masculine, as prescribed by society and confused by changing patterns. One of the series, Choice: Challenge for Modern Woman.

Title: What Is The Shape Of Tomorrow?
30 minutes, B/W
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Jeanne Noble and Rabbi Alfred Gottschalk discuss variation in personal standards, beliefs, and values; spiritual, moral and interpersonal sources of strength; and women's power in shaping the world of tomorrow. One of the series, Choice: Challenge for Modern Woman.

Title: Who Wants Freedom?
30 minutes, 16mm, B/W
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Elisabeth Mann Borgese and Richard Lichtman discuss the meaning and consequence of "freedom" . . . how much self-determination and in what areas of life? One of the series, Choice: Challenge for Modern Woman.

Title: Woman Is
27 minutes, color, 1969
Producer and Source: American Standard Association/10 E. 40th Street/ New York City, NY 10016
Description: Examines the personal philosophy of the woman in today's world and shows her in some of her many roles, as an enigma, a philosopher and a romantic.

*Title: . . . keep the door open
19 minutes, 16mm, color.
Filmmaker: Charles E. Cockelreas
Source: Motion Picture Production Division-3153/Sandia Laboratories/ Box 5800/Albuquerque, NM 87115
Description: Film designed to encourage young women to "keep the door open" on career options and to consider non-traditional careers, especially math and science. Discussions of life and work with numerous professional women involved in non-traditional careers.

Title: New Careers for Women
17 minutes, color
Source: American Educational Films/331 North Maple Drive/ Beverly Hills, CA 90210
Description: Restructuring of the roles between the sexes will be illustrated in a discussion of the new family and the role which the creative working woman will have in the world of the future.

Title: Wages of Work
30 minutes, 16mm, B/W
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Mary Keyserling and a panel of employment experts discuss why, how, when, and where women work, and effects on family, job, and community. One of the series, Choice: Challenge for Modern Woman.

Title: What's The Matter With Alice?
30 minutes, 16mm, color, 1972
Source: Newsfilms, USA/21 West 46th Street/New York City, NY
Description: Prepared for the Civil Service Commission, the film communicates an understanding of "upward mobility."

Title: The X-Factor: Women As People
30 minutes each (one inch video-tape)
Source: Cornell University/Director ETV Center/Van Rensselaer Hall/ Ithaca, NY 14850
Description: Two half-hour programs on the status and image of women, developed for a course at Cornell.

Title: Childcare: People's Liberation
20 minutes, 16mm
Source: San Francisco Newsreel/Department W/1232 Market Street/ Room 101/San Francisco, CA 94102
Description: This film reviews how mothers and children in this society tie each other down. It shows, through examples, how community-run childcare centers are a step toward liberation.

Title: Who is Sylvia?
27 minutes, B/W, 1957, #4793
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Study of the dreams, fears and hopes of a 14 year old girl, "half child, half woman" and of her relationships with her family, school and friends.

Title: Teach Your Children Well
30 minutes, 16mm, color
Producer: Marta Ashley; Assoc. producer: Nina Janowsky; Assistant: Marty Coe
Source: Femedia/2286 Great Highway/San Francisco, CA 94116
Description: Documentary about three women: a Black, a Chicana, and a white woman in a comparison of how their parents educated them and how the consequences of this affects them today.

Title: Choice: Challenge for Modern Women
series of 12 films each 30 minutes, B/W, 16mm, 1967
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Twelve discussion programs designed to help women arrive at reasoned choices as they make decisions affecting themselves, their families, and society.

Title: Anything You Want To Be
8 minutes, 16mm, B/W
Filmmaker: Liane Brandon
Source: New Day Films/267 West 25th Street/New York City, NY 10001
Description: The conflicts and absurdities that beset a high school girl. She mimics female stereotypes: the wordly sophisticate, the wholesome homemaker, the sexy "chick," the sweet young thing. The film raises questions and provokes thought rather than prescribing answers.

Title: Evolving Toward Woman
60 minutes
Source: Contact Deidre Walsh, c/o The Feminist Voice for more information
Producer: Deidre Walsh
Description: The struggle of women to redefine themselves in the midst of the changes that are happening in our culture. It presents an introduction to the issues, rather than narrowing in on one specific issue. It includes rap sessions, interviews, and scenes of everyday occurrences.

Title: Growing Up Female: As Six Become One
60 minutes, 16mm, B/W
Filmmakers: Julia Reichert & James Klein
Source: New Day Films/267 West 25th Street/New York City, NY 10001; or from San Francisco Newsreel/Department W/1232 Market Street/Room 101/San Francisco, CA 94102.
Description: A documentary on the socialization of women in America. The film traces this process through the lives of six females; the youngest is 4, the oldest is 35. In between, the women are students and workers, white and black. A powerful film.

Title: Woman, Wife Or What
29 minutes, 16mm, B/W
Producer and Source: KUON-TV Univ. Ed. TV Station/1600 R Street/ Lincoln, NE 68508
Description: Explains that in a modern world, many modern women have feelings of being trapped, their role confused. Describes the battle for intellectual recognition and need for creative achievement.

*Title: To Be A Woman
13 minutes, 16mm, color
Source: Billy Budd Films/235 East 57th Street/New York City, NY 10022
Description: Designed as a tool to trigger re-thinking and start discussion. Girls and young women were interviewed and 18 hours of feminine voices speaking of themselves, their self-image, their attitudes, their conviction, and themselves were collected. The best statements were put into 6 sections: girlhood, personhood, feminity, anti-stereotypes, sexuality and idealism.

*Title: Women's Work: Engineering
26 minutes
Source: Massachusetts Institute of Technology/Center for Advanced Engineering Study/Cambridge, Massachusetts
Description: Designed for use by secondary school students in science, math, social studies, and career education classes. The film is intended to provide in-depth portraits of women students and professionals, giving their personal views about the opportunities, problems, and rewards of an engineering career.

*Title: Women in Science
Source: Queensborough Community College/Bayside, New York 11364
Description: This is a multimedia package containing cassette interviews, slides and articles plus references, showing the work and lifestyles of six successful contemporary female scientists. Designed for use by young women making educational and career choices.

Title: A World for Women in Engineering
Filmmaker: Bell Telephone
Source: Bell Telephone Companies/Available Fall 1976
Description: A film designed to encourage young women to consider engineering as a career. Six women engineers from Bell Labs talk about their experiences in engineering.

We understand that a number of promotional films dealing with women in science are being produced privately by various companies, including General Electric and Kodak; however, we have been unsuccessful in our attempts to locate these films, or their titles.

*Title: . . .How Many Eves
14 minutes
Filmmaker: Zelda Zeldin
Source: Women's Media Workshop
Description: A film about a woman's long, but successful, struggle to secure a promotion to the next job up the ladder, for which she is clearly the most qualified. The film illustrates the problems she encounters with a manager who thinks women should be kept in their place, her co-workers (both men and women), and her husband. The film is intended for corporations, educational institutions, and counseling and management consulting organizations. The film was produced in cooperation with the U.S. Civil Service Commission.

APPENDIX F

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