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ABSTRACT

Presented is a paper related to a Career Exploration Project, supported, in part, by the National Science Foundation. Studied was the effect of an instructional treatment designed to encourage highly qualified females to pursue male-dominated science careers such as medicine and engineering. The study also attempted to ascertain what kinds of barriers women thought had affected their career choices. The latter was purported to be their perceptions of a conflict among the roles of parent, spouse, and professional science career persons. A self-awareness treatment aimed at increasing the proportion of highly talented women choosing specific science careers was designed and evaluated. Lists of the careers chosen are listed in tabulated form. The research methodology incorporated for the study is presented and references are cited. (EB)

Science Education in the Affective Domain: The Effect of a Self-Awareness Treatment on Career Choice of Talented High School Women

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Concern has been expressed that some highly talented people (particularly women and minorities) have been limited in career choice, leading to an under-utilization of talent for society and problems of dissatisfaction among the talented individuals. The present study, limited to women, was undertaken to ascertain what barriers had affected the career choices of highly talented high school women. Then, in light of our initial findings regarding the effect of barriers on career choice, we designed and evaluated a self-awareness treatment aimed at increasing the proportion of highly talented high school women choosing to pursue those science careers which previously had been male dominated (i.e., traditionally male science careers).

Traditionally male science careers were those science related careers in which at least 80% of the practitioners were male. Examples of traditionally male science careers included physician, engineer, dentist, research scientists, and veterinarian. Those other science related careers in which less than 80% of the practitioners were male were labeled as "not traditionally male science careers." (Since some of these careers were not necessarily female dominated, the category was not labeled "traditionally female.") All other careers were labeled nonscience. The careers which were chosen by at least one subject are listed by category in Table 1.

Table 1

Comparison of Traditionally Male Science Careers,

Not Traditionally Male Science Careers,

and Nonscience Careers

Traditionally Male Science Career	Not Traditionally Male Science Career	Nonscience Career
Bio. Scientist (PhD)	Nurse	Architect
Physician	Medical Technician	Business Person
Dentist	Dental Hygienist	Journalist
Computer Scientist (PhD)	Pharmacist	Educator
	Physical Therapist	Lawyer
Mathematician	Dietician	Fine Arts (e.g., painter)
Engineer	Psychologist	Historian
Physicist	Optometrist	Foreign Language (e.g. translator)
Chemist	Occupational Therapist	Humanities (e.g., teacher)
Geologist	Speech Pathologist	Foreign Service Agent
Economist		Librarian
Sociologist		Recreation Leader

We were interested in whether highly talented high school women believed certain barriers to career choice existed for women and whether these barriers had affected their own career choice. The barriers had previously been proposed as affecting the career choice of women, usually having the effect of impeding their choice of traditionally male careers (Epstein, 1971; Knudsin, 1974; Mattfield and Van Akin, 1965; Theodore, 1971; White, 1970). Barriers involved role conflict (between career person and spouse and/or parent), family's and/or friends' opposition to a woman's pursuing a career, lack of opportunity to enter appropriate training programs or to gain employment, fear of success or not wanting the responsibility of a career, lack of natural ability, and lack of professional support necessary to pursue a career. Table 2 exemplifies the barriers.

Table 2

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.

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.

Lack of Natural Ability

19. Women do not feel competent enough in math and science areas.
20. Women do not have a natural bend for solving problems and therefore do not have a natural ability to be scientists.

Method

Subjects. High school women from the state of Kansas or the Kansas City, Missouri, area were included in the highly talented group, if their ACT mathematics and natural science scores, as reported to the University of Kansas, placed them in the top 15% of applicants in both areas (ACT Score of 27 or higher in each area) and if they had completed at least two years of science and three years of mathematics by their senior year of high school. It was judged that these women possessed the necessary ability to pursue successfully those college courses of study which would lead to traditionally male science careers.

Subjects were included in one of three groups. The first group, control group one (N = 139), was made up of highly talented women who graduated from high school in 1974 and entered the University of Kansas that fall. They were not offered the self-awareness treatment.

All highly talented women of the high school class of 1975 (N = 254) were invited to take part in the self-awareness treatment (called the "Career Exploration Workshop") in the spring of their high school senior year. Those

women who did not attend, but subsequently enrolled in the University of Kansas, were included in control group two (N = 59). Those women who did attend the Career Education Workshop and who subsequently enrolled in the University of Kansas were included in the treatment group (N = 32).

Control and Treatment Groups. Control group one was studied in order to ascertain what barriers had affected their career choices and also to provide a comparison group, which unlike control group two, had not turned down the opportunity to attend the Career Exploration Workshop. The fact that control group one included women who were high school seniors one year prior to the treatment group women must be taken into account in considering the study's findings.

The second control group and the treatment group were high school seniors at the same time, but the two groups were different in their choosing to attend or not to attend the Career Exploration Workshop (the treatment). Highly talented women from the class of 1975 were not randomly assigned to treatment or control groups for two reasons. First, even if a subject had been assigned to the control group two, she might have vicariously received the treatment from a friend who had been in the treatment group. Second, it was not considered in the best interests of the University for the University to identify some women as "highly talented" (by a letter of invitation to the workshop) but not to identify similarly classmates who had similar talents.

Data Collection. Data were initially collected from ACT results sent to the University of Kansas. For each subject, data were collected regarding career choice, certainty of career choice, and highest expected level of education.

Similar data were collected at the end of the subjects' first semester in college (December 1974 for control group one and December 1975 for the treatment group and control group two). In addition, subjects were asked in December whether they agreed, disagreed, or had no information about whether any of the twenty barriers (see Table 2) prevented women from pursuing a traditionally male

science career. Further, subjects were asked whether they themselves possessed any of the barriers and whether any of the barriers had affected their choice of career. For example, subjects responded to "I feel I will not have the same educational opportunities as a man." Finally, subjects were presented a hypothetical problem involving role conflict between a woman's desiring to pursue a career and (possibly) having conflicting responsibilities as a spouse and parent. Subjects were asked to predict the outcome of the role conflict situation and to suggest methods to prevent the role conflict.

Treatment. Subjects graduating from high school in 1975 were invited to participate in one of six one day career exploration workshops throughout the state of Kansas in April 1975. Five workshops with 12-19 participants each were held in Topeka, Johnson County (a heavily populated suburban area adjacent to Kansas City), Lawrence, Hutchinson, and Wichita. A sixth workshop in Kansas City was cancelled due to insufficient response. Parents were invited to take part in a concurrent, but somewhat separate and shorter, workshop. (Some of the student participants were not included in the treatment group, since they did not attend the University of Kansas in Fall 1975.)

During the six-hour workshop subjects examined their own interests and capabilities, related their findings to career options, explored various factors (including barriers) affecting their decision making, discussed their capabilities and career aspirations with their parents and/or each other, re-examined their ideas about a woman's pursuing a traditionally male science career, and talked with women in traditionally male science careers about pursuing such a career. Workshop leaders helped the group explore barriers (especially role conflict) during the discussion with role models.

Results

Data Collection. In order to be included in the sample, each subject's ACT data had to be available, so all ACT data were available for each subject. Of the 139 subjects in control group one, 112 (80.6%) returned usable questionnaire data in December 1974 (the end of their first college semester). Usable questionnaire data in December 1975 (the end of their first college semester) was returned by 37 (62.7%) of the 59 members of control group two and by 24 (75.0%) of the 32 members of the treatment group. These return rates were judged acceptable for the purposes of this study.

Reliability Data Interpretation. Since most of the data collected was in the form of numerical answers to questions, no measurement of reliability was made for those data. For those items which required rater interpretation, a 10% random sample of questionnaires was reinterpreted and analyzed for intrarater reliability. To the question asking subjects to list the barriers which they believed impeded women's choice of high level science career, 44 barriers statements were made on the sample of questionnaires. Of the 44 statements, 39 (88.6%) were categorized identically on both ratings. To the question asking subjects to predict the outcome of the hypothetical role conflict situation, 22 predictions were made, and 20 (90.9%) of these statements were categorized the same on both ratings. To the question asking subjects to make suggestions about what could have been done to avert the role conflict situation, 42 suggestions were made and 40 (95.2%) of these suggestions were categorized the same on each rating. It was judged that the rater had reliably interpreted the questionnaire data.

Barriers Perceived to Affect Women's Career Choices. Initially we were interested in what barriers highly talented women believed affected career choices of women, in general. Further, we were interested in what barriers these women believed had affected their own career choice.

Subjects were asked in December of their college freshman year to list barriers which they believed were obstacles to women's choosing careers such as engineering,

veterinary medicine, and dentistry. This question was asked prior to our presenting them a list of specific questions about the barriers listed in Table 2. Since there was no significant difference among groups, data for all subjects are reported here. Role conflict (among career person, parent and/or spouse) was listed by 47.1% of subjects as being an obstacle to women's choosing a traditionally male career. Lack of opportunity in education or in employment was listed by 33.3% of subjects. A lack of ability was listed by 21.8% of subjects. The opposition of family or friends to a woman pursuing a traditionally male career was listed as a barrier by 18.6% of the subjects. A fear of success or not wanting the responsibility of a career was listed by 10.8% of the subjects as a barrier.

When subjects were presented a list of 20 barriers, they were asked whether they agreed or disagreed that each barrier existed and impeded women from pursuing a traditionally male science career. Again, the conflict of the roles of career person, parent and spouse was perceived as having the greatest effect on impeding women from choosing traditionally male science careers. Since there were no significant differences among groups, data are summarized in Table 3 for all groups.

Barriers Affecting Subjects' Career Choices. Although a subject might recognize a barrier as affecting other women, it could not be logically concluded that the same barriers had affected the women making the original barrier statements. Therefore, each barrier listed in Table 2 was changed into a form so that we could ask whether the subjects possessed the feeling (which represented the barrier) and whether the barrier had affected their career choices. Again role conflict was perceived as the category of barriers having the greatest effect on the subjects' career choices. The role conflict of career person versus parent had affected approximately one fifth of the subjects' career choices. Since there were no significant differences among groups, data are summarized for all groups in Table 4. In many cases even though few subjects reported they had not been

Table 3

Perception of Barriers by All Subjects

Rank	% Agree or Strongly Agree	Type of Barrier	Barrier Statement
1	81.1	RC-P[a]	Women feel a long-term commitment to a career interferes with raising preschool children.
2.5	66.0	RC-P	Women feel a long-term commitment to a career interferes with raising a family.
2.5	66.0	RC-S	Women feel they should adjust their career goals in order not to interfere with their husband's success.
4	62.6	RC-S	Women feel that a husband's success is more important than a wife's success.
5.	55.9	RC-S	Women are not free to move to new locations as career opportunities open up in their field.
6	53.3	RC-S	Women feel a strong career commitment interferes with a happy marriage.
7	48.8	F	People who are important in a woman's life (that is, family and friends) believe a woman's place is in the home.
8	46.1	RC-P	Women feel that their basic responsibility is raising the children in our society.
9	40.2	LO-J	Women have not been informed of job openings in traditionally male science careers.
10	39.8	LO-J	Women are not as aware as men of the variety of available science careers.
11	34.8	F	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.
12	33.1	LO-E	Women with math and science ability do not have the same educational opportunities as a man. For example, women have more difficulty getting into medical school than men.
13	31.7	FS	Women fear the consequences of being highly successful in their careers.

14	31.1	LO-J	Women who are trained in science fields do not have as many job opportunities as men. For example, a male chemistry graduate will be offered a job over a woman college graduate.
15	21.7	LO-E	Senior high women are discouraged from pursuing the science and math courses which would prepare them to pursue science majors in college.
16	20.2	LA	Women do not feel competent enough in math and science areas.
17	13.5	LPS	Women scientists are out of the mainstream of important professional contacts.
18	9.5	FS	Women do not want jobs that involve professional responsibility and commitment.
19	6.1	LA	Women do not have a natural bend for solving problems and therefore do not have a natural ability to be scientists.
20	4.9	LPS	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.

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[a] RC-P Conflict between parental and professional career roles.
RC-S Conflict between spouse and professional career roles.
F Family and friends have expectations which conflict with a woman's pursuing a career.
LO-J Women lack opportunity to gain appropriate jobs.
LO-E Women lack opportunity to pursue appropriate education.
FS Women fear success or shun the responsibility of a professional career.
LA Women lack ability to pursue a career.
LPS Women lack professional support necessary to pursue a successful career.

affected in their career choice by the feeling (i.e., barrier), rather high percentages of the subject reported they had the feeling.

(Some interesting differences were revealed when the answers of the control group one were analyzed by type of career chosen (Smith, Stroup, and Coffman, 1975).

Those women in control group one choosing a nonscience career significantly more often reported that their career choices had been affected by a feeling that a career would conflict with their raising pre-school children, that their basic responsibility was in raising children, and that they should remain flexible in their career goals so that they would not conflict with their future husband's success.)

Resolution of Role Conflict. We were interested in how the subjects would predict a hypothetical role conflict situation would be resolved. In the problem the wife's and husband's career plans were in conflict and there was a young child at home. Nearly half (48.8%) of all subjects predicted that the women only would compromise her career plans, either because of her perceived parental duties or out of defference to her husband's career plans. Approximately one fifth (21.5%) of the subjects predicted that the husband and wife would both adjust their career plans out of respect for each other's wishes. A prediction that the husband only would adjust his career plans was made by 14.5% of subjects; and the same percentage predicted no resolution to the conflict (i.e., there would be a divorce). The remain 0.6% predicted that neither adult would adjust their career plans. There were no signficant differences among the groups in these predictions.

When asked what the wife and husband could have done to prevent the role conflict situation, approximately half of the subjects suggested they could have delayed having a child (49.6%), delayed their marriage (49.5%), or the wife should have begun her career preparation earlier (47.7%). Slightly less than one-third (31.6%) suggested that the husband should have made better career plans. (Total percentages are greater than 100%, since subjects could make more than one suggestion.)

Table 4

Effect of Barriers on Subjects' Career Choice

Rank[a]	% Possess Feeling and Affected Career Choice	% Possess Feeling But Did Not Affect Career Choice	Possess Feeling	Rank by Possess Feeling	Type of Item	Barrier Statement (I feel that . . .)
1	20.0	51.2	71.2	1	RC-P	my long term commitment to a career will conflict with my raising preschool children.
2	19.3	37.4	56.7	3	RC-P	my long term commitment to a career will interfere with my raising a family.
3	12.7	25.3	62.0	2	RC-P	my basic responsibility is raising the children.
4.	12.1	28.5	40.6	7	LO-J	I am not as aware as men of the variety of available science careers.
5	11.4	32.5	43.9	5	RC-S	I should remain flexible in my career goals so that I will not interfere with my future husband's success.
6	10.1	33.3	43.4	6	LO-J	I will not have as many job opportunities as a man.
7	9.5	37.9	47.4	4	RC-S	my husband's success in a career will be more important than my success.
8.5	8.8	27.6	36.4	8	RC-S	I will not be free to change locations as new career opportunities open up.
8.5	8.8	18.2	27.0	11	RC-S	my strong career commitment will interfere with a happy marriage.
10	8.3	5.3	13.6	14	LA	I do not have an inborn problem-solving ability that is necessary for success in the math and science areas.
11	6.1	2.4	8.5	18	LA	I am not competent in the math and science areas.
12.5	4.8	11.3	16.1	13	F	my family and friends believe my place is in the home.

12.5	4.8	7.8	12.6	15	LO-E	as a high school woman I was discouraged from pursuing the science and math courses which would have prepared me for a science major in college.
14.5	3.6	26.0	29.6	10	LO-J	I will not be as informed as a man of job openings.
14.5	3.6	21.3	24.9	12	LPS	if I would enter a professional career, I will not be able to make as many professional contacts as a man.
17	3.0	32.1	35.1	9	LPS	if I were to enter a professional career, then I would not receive the same support and encouragement from my colleagues as a man receives.
17	3.0	8.7	11.7	16	LO-E	I will not have the same educational opportunities as a man.
17	3.0	7.7	10.7	17	FS	I do not want a job that involves professional responsibility and commitment.
19	2.4	4.2	6.6	19	FS	I fear the consequences of being successful in a career.
20	0.0	4.2	4.2	20	F	my family and friends think it is not appropriate for me to pursue a career.

Career Choice. There was no significant difference among the three groups in their choice of careers in high school ($x^2 = 2.65$, $df = 4$, $p < .70$). See Table 5. However, there was a significant difference among groups in the career choice indicated at the end of the first semester of college ($x^2 = 9.88$, $df = 4$, $p < .05$).

When groups were compared pairwise, there was no significant difference between the career choices of control group two and the treatment group ($x^2 = 0.12$, $df = 2$, $p = .93$, using SPSS Crosstabs). That is, within the high school class of 1975 there was no significant difference in career choice in high school or at the end of the first college semester between the control and treatment groups.

At the end of the first college semester both the treatment group and control group two significantly more often chose traditionally male science careers, as compared to control group one. (Treatment group versus control group one, $x^2 = 5.99$, df = 2, p = .05, using SPSS Crosstabs. Control group two versus control group one, $x^2 = 6.35$, df = 2, p = .04, using SPSS Crosstabs.)

Table 5

Career Choice in Fall of High School Senior Year and End of First College Semester

Group	First Career Choice					
	TMS[a]		NTMS		NS	
	N	%	N	%	N	%
Control Group One						
High School	43	32.6	30	22.7	59	44.7
College	30	26.5	34	30.1	49	43.4
Control Group Two						
High School m	25	43.1	10	17.2	23	39.7
College	18	48.6	7	18.9	12	32.4
Treatment						
High School	12	40.0	6	20.0	12	40.0
College	12	50.0	3	12.5	9	37.5

[a]TMS = Traditionally Male Science Career
NTMS = Not Traditionally Male Science Career
NS = Nonscience Career

Discussion

Barriers. We have no doubt but that the major impediment which affected the proportion of highly talented women who chose traditionally male science careers was the role conflict category of barriers. Within this category, the perceived conflict between career person and parent had the greater effect in career choice.

Recently Goldman and Hewitt (1976, p. 54) asserted that ". . . higher mathematical ability in males is largely, but not entirely, responsible for greater male representation in science major fields. Insofar as female under-representation in science may be a barrier to the sexual equality of job opportunity, our results indicate a way to remedy the situation -- increase the mathematical ability of women." We are only now in the process of collecting data for males similar in ability to our subjects, so we cannot dispute the assertion that women, as a group, exhibit less mathematical ability than men, as a group. This fact is corroborated by results from the National Assessment of Educational Progress (Males Dominate in Educational Success, 1975). However, among those women possessing high mathematic and science ability, the perceived conflict of roles, and not a perceived lack of ability (or any other category of barriers), was the major impediment (among those barriers we tested) to choosing a traditionally male science career. Therefore, we suggest that for highly talented women, a self awareness treatment (including consideration of a person's roles) will be more successful than mathematical remediation in increasing the preparation of these women pursuing a traditionally male science career.

In another recent publication (Silver, Akey, LaRue, Johnson, & Nicholson, 1975) dealing with career education in the academic classroom, a chapter was included on career education in science. The primary thrust of that chapter was to suggest exciting science projects which might interest students in the broad range of careers in which science was directly or marginally involved. Although we do not believe this "career awareness approach" should be the primary approach to encouraging highly talented women into traditionally male science careers, we believe that career awareness may be useful toward that end, for 40% of our subjects indicated that they felt they were less aware than men of available science careers. However, the career awareness approach should not take the place of a self awareness treatment.

Career Choice. There was an apparent trend from the class of 1974 to the class of 1975 for an increasing proportion of highly talented women to choose traditionally male science careers. This trend was consistent with the trend during the 1970's noted by Parris (1974) toward increasing proportions of women in many professional careers, including those careers which we labeled traditionally male science careers. It was of interest to us that 42.6% of the class of 1975 subjects at the end of their first semester of college stated that they expected they would complete a Ph.D., M.D., or other similar terminal professional degree. We will collect data at the end of the subjects' first year of college to ascertain whether the trends will continue.

We suspect that the significant increase between 1974 and 1975 in the proportion of highly talented women selecting traditionally male science career was due in large measure to the trend documented by Parrish and not due to the self awareness treatment we provided. However, we must note that, in contrast to control group one, control group two was not without treatment. First, control group two received the same Career Exploration Workshop letter of invitation and accompanying information received by the treatment group. This letter on University of Kansas letterhead congratulated the recipient on her high science ability and clearly stated that she had the ability and high school course preparation necessary to pursue a traditionally male science career. This letter may have served to give "official sanction" to a career choice the recipient had considered but not indicated on the ACT. Second, in many cases subjects in control group two were classmates of the subjects in the treatment group. Thus, some of our treatment may have been vicariously delivered by treatment group subjects to subjects in control group two.

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