DOCUMENT RESUME

ED 404 132 SE 054 971

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TITLE	Gender Differences in Attitude toward Science.
INSTITUTION	Education and Training Corp., Staunton, VA.
SPONS AGENCY	Office of Educational Research and Improvement (ED), Washington, DC.
PUB DATE	Apr 94
CONTRACT	R206R00001
NOTE	24p.; Paper presented at the Annual Meeting of the American Educational Research Association (New Orleans, LA, April 5-8, 1994).
PUB TYPE	Reports - Research/Technical (143) -- Tests/Evaluation Instruments (160) -- Speeches/Conference Papers (150)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Academic Achievement; Attitude Measures; Classroom Research; *High Schools; *Science Education; *Sex Differences; *Test Reliability
IDENTIFIERS	*Attitudes Toward Science; *Test of Science Related Attitudes

ABSTRACT

Since the mid 1980's increasing research has been conducted on the relationship that exists between student attitude toward science and science achievement. While many are focusing on investigating this relationship, this study focused on assuring that measurement of attitude changes of diverse groups in America is done with valid and reliable instruments. This focus was realized by seeking to answer two questions: (1) How well is the construct "attitudes toward science" measured by the Test of Science-Related Attitudes (TOSRA); and (2) Are there differences in attitudes toward science between male and female high school students? Regarding reliability, the results obtained were comparable to similar studies. However, seven distinctive dimensions among the 70 items were not found. It was concluded that the TOSRA is a valid and reliable instrument for use with American students. In addition it was added that although females generally are reported as having poorer attitudes toward science, the females in this study only had less positive attitudes in the areas of career/leisure interest in science and in science classes. In terms of performing experiments and the social importance of science, there were no significant differences between the attitudes of males and females. The text is appended. (ZWH)

Gender Differences in Attitude Toward Science[1]

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This research was funded in part by the National Research Center on the Gifted and Talented (NRC/GT) under the Javits Act Program (Grant # R206R00001) administered by the Office of Educational Research and Improvement, U. S. Department of Education.

[1]Paper presented at the annual meeting of NCME, New Orleans, April, 1994.

Introduction

Fewer and fewer students are perusing science as a career. The National Science Foundation (NSF) has estimated that by the year 2010 the United States could suffer a shortfall of a half a million science and engineering professionals (Rawls, 1991). Women and minorities have a long history of underrepresention in the sciences (Cooper, 1983; Hill, Pettus & Hedin, 1990; Levine, 1985; Thomas, 1986). In 1990, President Bush and the nation's governors drew up a set of national educational goals for the year 2000 (Krieger, 1992). One of these goals was to broaden the participation of women and minorities in science.

Attitude toward science has been shown to correlate with achievement (Napier & Riley, 1985), to influence the selection of science courses, and to affect the choice of science as a career (Germann, 1988; Hill, Pettus & Heiden, 1990; Yager & Bonsetter, 1984). Because attitudes are modifiable, it is important to convince students -- especially women and minorities -- that science is useful and important. If this is to occur, it is important to assure that measurement of attitude change is done with valid and reliable instruments.

The *Test of Science-Related Attitudes (TOSRA)*, developed by Fraser (1981), is a multidimensional instrument with a strong theoretical foundation. Although *TOSRA* has been used extensively in Australia, it has had limited use in the United States (Khalili, 1987; Stuessy & Rowland, 1990). The purpose of this study was two fold: first, to re-examine the psychometric properties of *TOSRA*, with a population of diverse American high school students; second, to use *TOSRA* to compare male and female attitudes toward science. Specific research questions addressed were:

1. How well is the construct "attitudes toward science" measured by *TOSRA*?
2. Are their differences in attitudes toward science between male and female high school students?

Background

Attitude toward science has been shown to correlate with science achievement (Germann, 1988; Napier & Riley, 1985). Napier and Riley (1985) used the data from the

1976-1977 National Assessment of Education Progress (NAEP) survey to investigate the relationship between science achievement and the affective items relating to attitudes toward science. They found significant correlations between achievement and attitudes toward science/science teaching. Germann (1988) using his, *Attitude toward Science in School Assessment (ATSSA)*, found that the size of the correlations depended upon how "achievement" was measured. The National Education Goals Report (1993) indicated that students in higher grades were less likely to have positive attitudes toward science and mathematics than students in lower grades, with the gap between males and females increasing substantially: in grade 4, 81% of males and 78% of females "liked science"; by grade 12, the percentage of males "liking science" had dropped to 74% and the percentage for females had dropped to 57%.

Schibeci & Riley (1986) examined the relationship between students' background, perceptions, attitudes and achievement. They found that gender influenced attitudes and achievement, with females scoring lower on both. Hill et al (1990) found a lack of interest in science careers and lack of participation in science-related activities, outside of school, on the part of middle and high school girls. Ware & Lee (1988), examining a nationally representative sample of high ability college students, found that women perceived a career in science as incompatible with their future.

Most studies of attitude toward science have been haphazard and have used instruments of poor psychometric quality (Haladyna & Shaughnessay, 1982; Munby, 1983a). Of the 204 attitude instruments collected by Munby (1983a), 56 purported to measure attitude toward science. However, nearly half of them reported no reliabilities, and only seven verified these reliabilities through a second study. The most well known and widely used instrument has been the Scientific Attitude Inventory (SAI) developed by Moore and Sutman (1970). Despite its widespread use, a review of thirty studies adopting the SAI concluded that its validity is questionable (Munby, 1983b).

Haladyna and Shaughnessy (1982) examined 49 studies conducted in the United States between 1960 and 1980. They found very little methodological consistency with regard to measurement, which is not surprising, because there is no general agreement on what constitutes an attitude. Researchers have used different operational definitions in the measurement of attitudes toward science, owing largely to two major and competing theories regarding the structural nature of attitudes: the unidimensional theory proposed by Thurstone (1946) and the component theory proposed by Triandis (1971).

In their review, Haladyna and Shaughnessy (1982) did judge one instrument, the *Test of Science-Related Attitudes (TOSRA)*, to be outstanding because of its impressive empirical validation. Fraser (1977) developed *TOSRA* based on Klopfer's (1971) table of specifications of affective behaviors for scientific education. The original version had five subscales created by adapting other existing instruments: modifying a version of an instrument created by Ormerod (1971) to measure attitudes toward the social implications of science; building a scale based on a subscale in Meyer's A Test of Interests (1969); revising a version of Tests of Perception of Scientists and Self, developed by White and Mackay (1976) to measure pupils' adoption of attitudes; and adapting scales originally created for the Science Opinion Poll developed by Laughton and Wilkinson (1968) to measure enjoyment of science. After extensive field testing and revision in Australia, Fraser's (1978) final version of *TOSRA* included 70 items organized into 7 subscales: 1. Social Implications of Science, 2. Normality of Scientists, 3. Attitude to Inquiry, 4. Adoption of Scientific Attitudes, 5. Enjoyment of Science Lessons, 6. Leisure Interest in Science, 7. Career Interest in Science. He reported reliabilities ranging from 0.67 to 0.93 (mean = 0.80) for these subscales. The mean test/retest (2-week interval) reliability was reported to be 0.78.

Khalili (1987) investigated *TOSRA* for the purpose of crosscultural validation. The reliabilities that he obtained were similar to Fraser's (1978,1981)--0.69 to 0.93 with a median of 0.87--but he was not able to confirm the distinctiveness of the 7 subscales.

There are currently several instruments available for measuring attitudes towards science (e.g. Educational Testing Service, 1991; Goldman & Mitchell, 1990; Kramer & Conoley, 1992), but only one, the *Women in Science Scale (WiSS)*, was developed more recently than *TOSRA*. The *WiSS*, developed by Erb & Smith (1984) for an early adolescent population, has a decidedly female focus. The items were written to represent three dimensions: women possessing characteristics for success in science careers, science careers compatibility with wife and mother roles, and equal opportunity for women to pursue science careers (Beece, 1990).

We chose not to use *WiSS* in this study because of its focus on early adolescent girls. We felt that it was not appropriate for older high school girls, and we are also interested in examining differences among ethnic groups in a future study. We chose *TOSRA* for our study because it was shown to be valid and reliable with Australian students. No studies have looked at gender differences using this instrument.

Methods

Subjects

TOSRA was administered to 572 high school students nationwide during the 1992-1993 academic year as a part of a larger study investigating high ability students. The subjects were drawn from the Collaborative School Districts that are part of the National Research Center on the Gifted and Talented (NRC/GT). The sample encompassed all levels of SES, various geographical regions, and community types (urban, suburban, rural). Because one of the purposes of this larger study is to examine ethnic differences among high ability students, school districts with high minority populations that offered Advanced Placement science courses were targeted. Table 1 shows a summary of sample characteristics. The majority of the students were white (63.8%), female (54.5%), juniors and seniors with a mean age of 16.4, and had taken biology and chemistry courses in high school.

Analyses

Using the statistical package BMDP, program AM, the data were first screened for multivariate outliers. To examine the first research question, 472 subjects with complete data were then analyzed by means of exploratory common factor analysis (program BMDP4M), using both orthogonal and oblique rotations. An eigenvalue ≥ 1 was used as the criterion for retaining a factor, and a loading criterion of 0.30 was used to interpret the factors. The oblique (direct quartimin) rotation gave the most satisfactory structure. It produced six interpretable factors explaining 81.3% of the item covariation. The internal consistencies of the six subscales ranged from 0.72 to 0.94 (mean = 0.85). Tables 2 - 7 show the factor loadings and alpha reliabilities for each of the extracted factors. Table 8 shows the factor intercorrelations.

A stepwise discriminant function analysis was used to examine gender differences (second research question). Because there are 6 dependent variables (i.e. the *TOSRA* subscales) which are moderately correlated (factor intercorrelations ranged from 0.13 to 0.46, see Table 8), using separate *t* tests for each dependent variable would inflate Type I error (Tabachnick & Fidell, 1989), and it would ignore the correlation among the scores.

Results

In a preliminary analysis, data were examined for multivariate outliers, defined as any case whose Mahalanobis D^2 value was notably distant from the centroid of all data (i.e. $p < .0001$). Five cases were thus located and removed from further analyses.

The first research question asked if the construct "attitudes toward science" was well measured by *TOSRA*. The reliabilities we obtained were similar to Fraser's (1978) and Khalili (1987). However, we did not find 7 distinctive dimensions among the 70 items.

Our factor subscales Social Importance of Science (TOSRA 3) and Normality of Scientists (TOSRA 4), each contain 9 of the 10 items from Fraser's (1978) Social Implications of Science and Normality of Scientists subscales respectively. Our Preference for Experimentation (TOSRA 2) subscale contains 11 items: all 10 items from Fraser's (1978) Attitude toward Scientific Inquiry subscale plus item #46, "In science experiments, I like to use new methods which I have not used before" which Fraser grouped under his "Adoption of Scientific Attitudes" subscale. Our Attitude toward Science Classes (TOSRA 5) subscale contains 5 of the 10 items from Fraser's Enjoyment of Science Lessons subscale and the Openness to New Ideas (TOSRA 6) subscale contains 4 of the 10 items from Fraser's Adoption of Scientific Attitudes.

Additionally there were seven items that loaded with values below our criterion (0.30). These items (#2,8,11,18,25,53,60) were not included in any of our factor subscales. Five of these items (#11,18,25,53,60) were originally part of Fraser's Adoption of Scientific

Attitudes. Thus there are some close correspondences and some sizeable differences between our data and Fraser's hypothesized structure.

Similar to Kahlili's (1987) finding, we also did not find a distinction between items dealing with leisure and career interest in science. Our subscale Attitude toward Science/Career & Leisure (TOSRA 1) contained 22 items, combining the items from Fraser's Leisure Interest and Career Interest subscales.

The second research question concerned gender differences in attitudes toward science. The results of the discriminant analyses are displayed in Table 9. Three *TOSRA* subcales were significant and entered the discriminant equation ($F[3,551] = 13.75$, $p < .001$). The multivariate effect size (canonical correlation squared) was .07, which is in the small range, according to Cohen (1988). Corresponding to the small effect size is the classification of students into known gender groups: The three significant *TOSRA* scales gave a overall 63% jackknifed classification. Interestingly, females were more correctly classified (73%) than were males (51%).

Inspecting the means of the three significant *TOSRA* scales, we see that males expressed a more positive attitude toward science careers/leisure enjoyment of science (TOSRA 1), but females had a more positive attitude toward the normality of scientists (TOSRA 4) and were more open minded toward the adoption of new ideas (TOSRA 6). The three subscales that showed no significant difference with respect to gender were the preference for doing experiments (TOSRA 2), social importance of science (TOSRA 3) and attitude toward science classes (TOSRA 5).

Conclusions

We believe that *TOSRA* is a valid and reliable instrument for use with American students. Our subjects did not distinguish between attitudes involving leisure interest and career aspirations, which reinforces the results obtained previously (Kahlili, 1987).

Although it is generally reported that females have poorer attitudes toward science, especially by the 12th grade (National Education Goals Panel, 1993), the females that we studied only had less positive attitudes in the areas of career/leisure interest in science and in science classes. In terms of performing experiments and of the social importance of science, there were no significant differences between the attitudes of males and females. Females had more positive attitudes than males with respect to seeing scientists as normal people and in being open to new ideas.

The strength of *TOSRA* is that it is multideminsional, that we can look at specific areas under the broad heading "attitudes toward science." When we do this, we can gain information about where females' attitudes are less positive. This information is crucial in developing interventions to enhance females attitudes. If the goal is to increase participation of women in science, but women "don't like science," how do we get them to "like it," if we don't know what it is they don't like? With *TOSRA* we know, for the females in our sample, that they are less positive than their male peers about considering careers in science. We also know that they are more open to embracing new ideas, which is an important characteristic of a scientist.

TOSRA can be used to define where the students' attitudes are less positive. Interventions could then be designed to target those areas. *TOSRA* could then be reaministered to determine the effectiveness of the intervention.

For our sample of high school students, the gender differences in their attitudes toward science were minor with females having more positive attitudes than males half the time. This finding opposes the general trends reported nationally (National Education Goals Panel, 1993). The multidimensionality of *TOSRA* gives more detailed information than merely asking students to rate how well they "like science." The high ability females in this sample had positive attitudes toward science in general. They only need to develop a more positive attitude toward the possibility of perusing science careers. Role modeling or mentoring could be very effective here.

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Table 1

Sample Description N=572

AGE		Mean = 16.4
	13 & 14	4.3% (18)
	15	11.5% (64)
	16	32.0% (178)
	17	39.4% (219)
	18	11.2% (62)
	19 & 20	1.7% (9)
GRADE		
	Grade 9	4.0% (23)
	Grade 10	23.7% (132)
	Grade 11	31.9% (178)
	Grade 12	40.3% (225)
GENDER:		
	Males	45.5% (255)
	Females	54.5% (306)
ETHNICITY:		
	Asian	10.1% (56)
	Black	13.6% (75)
	Hispanic	7.2% (40)
	White	63.8% (352)
HIGH SCHOOL SCIENCE EXPERIENCE:		
	Biology	96.8% (544)
	Chemistry	75.9% (428)
	Physics	38.1% (214)
	Other Courses	54.5% (306)
ADVANCED PLACEMENT COURSES:		
	Biology	17.8% (100)
	Chemistry	12.8% (72)
	Physics	13.1% (74)
	Calculus	14.2% (82)
	English	22.2% (125)

Table 2

TOSRA Factor 1

Attitude Toward Science/Career & Leisure (α=.94) (n=470)

Item #	Item	Loading
70.	I would like to be scientist when I leave school.	0.776
48.	I would enjoy having a job in a science laboratory during my school vacations.	0.734
14.	When I leave school, I would like to work with people who make discoveries in science.	0.684
21.	I would dislike a job in a science laboratory after I leave school.	0.617
34.	I would like to do science experiments at home.	0.599
20.	I would like to be given a science book or a piece of science equipment as a present.	0.596
49.	A job as a scientist would be boring.	0.586
6.	I would like to belong to a science club.	0.582
28.	Working in a science laboratory would be an interesting way to earn a living.	0.582
56.	A job as scientist would be interesting.	0.575
27.	I dislike reading books about science during my vacations.	0.561
42.	I would like to teach science when I leave school.	0.560
35.	A career in science would be dull and boring.	0.546
7.	I would dislike being a scientist after I leave school.	0.545
19.	School should have more science classes each week.	0.516
33.	Science is one of the most interesting school subjects.	0.512
41.	Talking to friends about science after school would be boring.	0.493
62.	I would enjoy visiting a science museum on the weekend.	0.474
13.	I get bored when watching science programs on TV at home.	0.461
55.	Listening to talk about science on the radio would be boring.	0.414
69.	I dislike reading newspaper articles about science.	0.413
63.	I would dislike becoming a scientist because it needs too much education.	0.326

Table 3

TOSRA Factor 2

Perference for experimentation (α=.86) (n=470)

Item #	Item	Loading
31.	I would prefer to do my own experiments than to find out information from a teacher.	0.691
3.	I would prefer to find out why something happens by doing an experiment than by being told.	0.666
17.	I would prefer to do experiments than to read about them.	0.664
45.	I would rather solve a problem by doing an experiment than be told the answer.	0.657
66.	It is better to be told scientific facts than to find them out from experiments.	0.605
59.	I would prefer to do an experiment on a topic than to read about it in science magazines.	0.602
38.	I would rather find out about things by asking an expert than by doing an experiment.	0.552
52.	It is better to ask the teacher the answer than to find out be doing experiments.	0.561
10.	Doing experiments is not as good as finding out information from teachers.	0.509
24.	I would rather agree with other people than do an experiment to find out for myself.	0.437
46.	In science experiments, I like to use new methods which I have not used before.	0.396

Table 4

<u>TOSRA Factor 3</u>

<u>Social Importance of Science</u> (α=.83) (n=470)

Item #	Item	Loading
50.	This country is spending too much money on science.	0.680
64.	Money used on scientific projects is wasted.	0.679
29.	The government should spend more money on scientific research.	0.608
36.	Too many laboratories are being built at the expense of the rest of education.	0.598
57.	Science can help to make the world a better place in the future.	0.516
22.	Scientific discoveries are doing more harm than good.	0.512
43.	Science helps to make life better.	0.509
1.	Money spent on science is well worth spending.	0.454
15.	Public money spent on science in the last few years has been spent wisely.	0.376

Table 5

TOSRA Factor 4

Normality of Scientists (α=.81) (n=470)

Item #	Item	Loading
51.	Scientists are just as interested in art and music as other people are.	0.734
30.	Scientists are less friendly than other people.	0.674
23.	Scientists like sports as much as other people do.	0.630
37.	Scientists can have a normal family life.	0.557
58.	Few scientists are happily married.	0.554
65.	If you met a scientist, he/she would probably look like anyone else you might meet.	0.494
44.	Scientists do not care about their working conditions.	0.361
16.	Scientists do not have enough time to spend with their families.	0.350
9.	Scientists are about as fit and healthy as other people.	0.348

Table 6

TOSRA Factor 5

Attitude Toward Science Classes (α=.92) (n=470)

Item #	Item	Loading
26.	Science classes bore me.	0.640
12.	I dislike science classes.	0.634
5.	Science classes are fun.	0.580
47.	I really enjoy going to science classes.	0.568
61.	I look forward to science classes.	0.515

Table 7

TOSRA Factor 6

Openness to new ideas (α=.72) (n=470)

Item #	Item	Loading
67.	I dislike listening to other people's opinions.	0.606
39.	I find it boring to hear about new ideas.	0.511
32.	I like to listen to people whose opinions are different from mine.	0.465
4.	I enjoy reading about things which disagree with my previous ideas.	0.461
40.	Science classes are a waste of time.	0.326

Table 8

TOSRA Factor Intercorrelation Matrix (n=470)[a]

Factor	1	2	3	4	5	6
Factor 1	1.000					
Factor 2	0.229	1.000				
Factor 3	0.345	0.205	1.000			
Factor 4	0.172	0.129	0.331	1.000		
Factor 5	0.461	0.229	0.258	0.282	1.000	
Factor 6	0.263	0.298	0.255	0.282	0.324	1.000

Note. Principle Factor Analysis, oblique rotation.
BMDP program 4M.
[a]multivariate outliers and cases with missing data removed

Table 9
Summary of Discriminant Analysis

Factor	Male Mean (SD)	Female Mean (SD)	Mean Diference	Univar. Effect Size
TOSRA 1	3.20 (.70)	3.00 (.79)	+0.20*	0.27
TOSRA 2	3.77 (.57)	3.80 (.64)	-0.03	
TOSRA 3	3.76 (.58)	3.75 (.53)	+0.01	
TOSRA 4	3.55 (.56)	3.68 (.51)	-0.13*	0.24
TOSRA 5	3.72 (.83)	3.53 (.96)	+0.19	
TOSRA 6	3.69 (.59)	3.80 (.63)	-0.11*	0.18

Note. BMDP Program 7M.
Males: n=253, Females: n=302.

TOSRA 1 - Attitude toward science/career & leisure enjoyment

TOSRA 2 - Preference for experimentation

TOSRA 3 - Social importance of science

TOSRA 4 - Normality of scientists

TOSRA 5 - Attitude toward science classes

TOSRA 6 - Openness to new ideas

Appendix

TEST OF SCIENCE-RELATED ATTITUDES

Barry J. Fraser

This "test" contains a number of statements about science. There are no "right" or "wrong" answers. Your opinion is what is wanted.

For each statement, draw a circle around

SA if you **STRONGLY AGREE** with the statement;

A if you **AGREE** with the statement;

N if you are **NOT SURE**;

D if you **DISAGREE** with the statement;

SD if you **STRONGLY DISAGREE** with the statement.

Although some of the statements are fairly similar to others, you are asked to indicate your opinion about all the statements. However, you are not required to finish the test and you may omit any items that you do not want to answer.

SA	A	N	D	SD	1. Money spent on science is well worth spending.
SA	A	N	D	SD	2. Scientists usually like to go to their laboratories when they have a day off.
SA	A	N	D	SD	3. I would prefer to find out why something happens by doing an experiment than by being told.
SA	A	N	D	SD	4. I enjoy reading about things which disagree with my previous ideas.
SA	A	N	D	SD	5. Science classes are fun.
SA	A	N	D	SD	6. I would like to belong to a science club.
SA	A	N	D	SD	7. I would dislike being a scientist after I leave school.
SA	A	N	D	SD	8. Science is the world's worst enemy.
SA	A	N	D	SD	9. Scientists are about as fit and healthy as other people.
SA	A	N	D	SD	10. Doing experiments is not as good as finding out information from teachers.

SA A N D SD	11. I dislike repeating experiments to check that I get the same results.
SA A N D SD	12. I dislike science classes.
SA A N D SD	13. I get bored when watching science programs on TV at home.
SA A N D SD	14. When I leave school, I would like to work with people who make discoveries in science.
SA A N D SD	15. Public money spent on science in the last few years has been spent wisely.
SA A N D SD	16. Scientists do not have enough time to spend with their families.
SA A N D SD	17. I would prefer to do experiments than to read about them.
SA A N D SD	18. I am curious about the world in which we live.
SA A N D SD	19. School should have more science classes each week.
SA A N D SD	20. I would like to be given a science book or a piece of science equipment as a present.
SA A N D SD	21. I would dislike a job in a science laboratory after I leave school.
SA A N D SD	22. Scientific discoveries are doing more harm than good.
SA A N D SD	23. Scientists like sports as much as other people do.
SA A N D SD	24. I would rather agree with other people than do an experiment to find out for myself.
SA A N D SD	25. Finding out about new things is unimportant.
SA A N D SD	26. Science classes bore me.
SA A N D SD	27. I dislike reading books about science during my vacations.
SA A N D SD	28. Working in a science laboratory would be an interesting way to earn a living.
SA A N D SD	29. The government should spend more money on scientific research.
SA A N D SD	30. Scientists are less friendly than other people.

SA	A	N	D	SD	31. I would prefer to do my own experiments than to find out information from a teacher.
SA	A	N	D	SD	32. I like to listen to people whose opinions are different from mine.
SA	A	N	D	SD	33. Science is one of the most interesting school subjects.
SA	A	N	D	SD	34. I would like to do science experiments at home.
SA	A	N	D	SD	35. A career in science would be dull and boring.
SA	A	N	D	SD	36. Too many laboratories are being built at the expense of the rest of education.
SA	A	N	D	SD	37. Scientists can have a normal family life.
SA	A	N	D	SD	38. I would rather find out about things by asking an expert than by doing an experiment.
SA	A	N	D	SD	39. I find it boring to hear about new ideas.
SA	A	N	D	SD	40. Science classes are a waste of time.
SA	A	N	D	SD	41. Talking to friends about science after school would be boring.
SA	A	N	D	SD	42. I would like to teach science when I leave school.
SA	A	N	D	SD	43. Science helps to make life better.
SA	A	N	D	SD	44. Scientists do not care about their working conditions.
SA	A	N	D	SD	45. I would rather solve a problem by doing an experiment than be told the answer.
SA	A	N	D	SD	46. In science experiments, I like to use new methods which I have not used before.
SA	A	N	D	SD	47. I really enjoy going to science classes.
SA	A	N	D	SD	48. I would enjoy having a job in a science laboratory during my school vacations.
SA	A	N	D	SD	49. A job as a scientist would be boring.
SA	A	N	D	SD	50. This country is spending too much money on science.

SA A N D SD 51. Scientists are just as interested in art and music as other people are.

SA A N D SD 52. It is better to ask the teacher the answer than to find out be doing experiments.

SA A N D SD 53. I am unwilling to change my ideas when evidence shows that the ideas are poor.

SA A N D SD 54. The material covered in science classes is uninteresting.

SA A N D SD 55. Listening to talk about science on the radio would be boring.

SA A N D SD 56. A job as scientist would be interesting.

SA A N D SD 57. Science can help to make the world a better place in the future.

SA A N D SD 58. Few scientists are happily married.

SA A N D SD 59. I would prefer to do an experiment on a topic than to read about it in science magazines.

SA A N D SD 60. In science experiments, I report unexpected results as well as expected ones.

SA A N D SD 61. I look forward to science classes.

SA A N D SD 62. I would enjoy visiting a science museum on the weekend.

SA A N D SD 63. I would dislike becoming a scientist because it needs too much education.

SA A N D SD 64. Money used on scientific projects is wasted.

SA A N D SD 65. If you met a scientist, he/she would probably look like anyone else you might meet.

SA A N D SD 66. It is better to be told scientific facts than to find them out from experiments.

SA A N D SD 67. I dislike listening to other people's opinions.

SA A N D SD 68. I would enjoy school more if there were no science classes.

SA A N D SD 69. I dislike reading newspaper articles about science.

SA A N D SD 70. I would like to be scientist when I leave school.

American Educational Research Association
April 4-8, 1994

TM021710

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