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ABSTRACT

This document discusses an investigation describing attitudes about school for a national sample of academically talented seventh graders. In particular, it considered how much students liked selected school subjects and how much they thought they would like particular college majors. The purpose of the study was to compare the attitudes of males and females of this group due to the noted shortage of women in mathematics and science related fields of study and work. The primary objective of this investigation was to compare the school-related attitudes of academically talented male and female seventh graders. A sample of 1,272 applicants to the Duke University Talent Identification Program Talent Search served as subjects for this study. Subjects rated school subjects and college majors in terms of how much they would like or dislike each and indicated subject preferences according to a forced choice scheme. Girls and boys both rated mathematics and science among their three favorite school subjects, although boys rated mathematics and the sciences higher than girls, and girls rated the arts and languages higher than boys. This pattern of results is echoed in ratings of college majors. A 17-item bibliography is included. Five tables illustrate: (1) mean ratings of school subjects as a function of sex; (2) rank order of school subjects according to rating of school subjects as a function of sex; (3) percentages of boys and girls preferring school subjects in rows over school subjects in columns; (4) mean liking of college majors as a function of sex; and (5) ranking of college majors as a function of sex. (Author/DK)

Attitudes about School of Academically Talented Seventh Graders

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Running head: ATTITUDES ABOUT SCHOOL OF TALENTED SEVENTH-GRADERS

Abstract

The primary objective of this investigation was to compare the school-related attitudes of academically talented male and female seventh-graders. A sample of 1272 applicants to the Duke University Talent Identification Program Talent Search served as subjects for this study. Subjects rated school subjects and college majors in terms of how much they would like or dislike each and indicated subject preferences according to a forced-choice scheme. Girls and boys both rated mathematics and science among their three favorite school subjects, although boys rated mathematics and the sciences higher than girls, and girls rated the arts and languages higher than boys. This pattern of results is echoed in ratings of college majors.

Attitudes about School of Academically Talented Seventh Graders

An increasingly important area of research relevant to academically talented students concerns the attitudes students hold about school and school subjects. The literature is replete with warnings that, while students need to become engaged in their studies in order to achieve, schools are failing to provide the stimulation necessary for students to become interested. Academically talented students are particularly at risk of losing interest due to inadequate stimulation (e.g., Ponder & Hirsch, 1981). For example, Yager (1982) cites NAEP data reflecting generally negative attitudes about science class in 13 and 17 year-olds. These attitudes have implications for college study; it has been suggested that participation in high school math and science is a strong predictor of majoring in those fields in college, with possibly varying patterns of predictors for males and females (e.g., Ethington & Wolfle, 1988; Ware & Lee, 1988).

The current investigation describes attitudes about school for a national sample of academically talented seventh graders. In particular, we consider how much students like selected school subjects and how much they think they would like particular college majors. Our main objective is to compare the attitudes of males and females of this group due to the noted shortage of women in math- and science-related fields of study and work.

Method

Subjects

Participants for this study were selected through the Talent Search conducted by the Talent Duke University Identification Program (TIP). Through this Talent Search, which covers a 16 state region in the

southeastern and midwestern United States, seventh graders who score in the top three percent on their in-school achievement tests are contacted through their schools and invited to take the Scholastic Aptitude Test (SAT) or American College Test (ACT); generally, 80 percent of these Talent Search applicants do take one of these tests during seventh grade. Scores on these tests determine eligibility for the Summer Residential Program (SRP), a three-week scholastic program held on the Duke University campus. Approximately six percent of the students taking either test subsequently qualify for the SRP. TIP provides all Talent Search applicants with a variety of publications (e.g., newsletters, magazines) and informative materials (e.g., listings of special educational programs) for four years, regardless of whether or not a given student takes the SAT or ACT or what score a student received on one of these tests.

The participants in this study were chosen from the 1991 Talent Search pool of 57,000 applicants. We sampled 1,000 each White males and females, and 500 each non-White males and females, for a total of 3,000 students. Of the students that were contacted, 1,272 (42.4%) participated in this study by returning completed questionnaires, 618 (48.6%) boys and 654 (51.4%) girls. Subjects were solicited from each of the sixteen Talent Search states (Alabama, Arkansas, Florida, Georgia, Iowa, Kansas, Kentucky, Louisiana, Missouri, Mississippi, North Carolina, Nebraska, Oklahoma, South Carolina, Tennessee, and Texas). The participants were representative of the mail-out sample in terms of gender, race, and state of residence (Stocking, Oppler, Porter, & Goldstein, 1992).

Instrumentation

Data were collected using the 1991 Talent Search Questionnaire (TSQ). Various generations of this questionnaire have served as the primary method of annual data collection for TIP over the course of the program's 13-year history. Historically, the TSQ has been administered to the entire pool of Talent Search applicants or some subset to address a particular question of interest. The 1991 version of the TSQ, the pilot for a future longitudinal project to be conducted by TIP in collaboration with the American Institutes for Research (AIR), built upon earlier versions of the TSQ and incorporated concepts found in other longitudinal work (e.g., Project TALENT, National Educational Longitudinal Study). TIP administers the Talent Search Questionnaire for research purposes only; the independence of completion of the TSQ and admittance to any of TIP's programs is stressed to the students and their parents.

The TSQ used in this study is comprised of two separate questionnaires, one each for students and parents. Each household received both questionnaires. The current investigation involves only the Student Questionnaire. The Student Questionnaire is a 240-item measure with items reflecting a variety of behavioral and attitudinal constructs, such as academic performance, interest in college majors, interest in occupations, and attitudes about school. Students indicate their responses to items on a computer-readable answer sheet.

Included in the Student Questionnaire are the following sets of items concerning attitudes about school: (a) how much students usually like particular subjects, (b) forced-choice comparisons of subjects, and (c) how much students think they would like particular college majors.

Students indicated how much they usually like each of 10 school subjects (Art/Music, Computer Science, English, Foreign languages, Home Economics, Mathematics, Physical Education, Science, Social Studies, and Vocational Education). Students rated each subject along a 5-point Likert-type scale (A = I would like this subject very much to E = I would dislike this subject very much).

Students completed 15 forced-choice comparisons of pairs of 6 of the 10 subjects noted above. The subjects included in these comparisons were Art/Music, English, Mathematics, Physical Education, Science, and Social Studies.

Students indicated how much they think they would like each of 18 types of college majors according to a 5-point Likert-type scale (A = I would like this major very much to E = I would dislike this major very much).

Procedure

Questionnaire packets were mailed in early February of 1991. This project was conducted independently of other TIP procedures, such as other mailings, and students were assured in the cover letter and in the TSQ itself that completion of the TSQ had no relation to their decision of whether or not to take the SAT or ACT, or to their subsequent potential selection for TIP.

Analysis

The objective of this investigation was to compare the school-related attitudes of academically talented male and female seventh graders. As described above, attitudes about 10 school subjects and 18 college majors were assessed using 5-point rating scales. Attitudes about six of the school subjects were additionally assessed via responses to forced-choice paired comparisons.

Comparisons of boys' and girls' responses to the two sets of rating scales (school subjects and college majors) were analyzed separately using repeated measures analysis of variance techniques, followed by univariate comparisons. Comparisons of boys' and girls' responses to the forced-choice paired comparisons were conducted using chi-square procedures.

Results

School Subjects: Rating scales

As a first step in comparing the school subject ratings by sex, we conducted a two-way repeated measures analysis of variance, with one between-subjects factor (sex of the respondent) and one within-subjects factor (school subject). Because the repeated measures analysis requires respondents with complete data (i.e., responses for each of the 10 school subjects), the sample size was reduced to 1230 (595 boys and 635 girls). The results indicated that the main effect for school subject was significant ($F(9,1220)196.64$, $p<.0001$), as was the interaction between school subject and sex of the respondent ($F(9,1220)=43.46$, $p<.0001$). The main effect for sex was not significant ($F(1,1228)=0.11$, n.s.). The interaction between sex of respondent and school subject signifies that the mean ratings of boys and girls differed significantly for one or more of the school subjects included in the questionnaire.

Given the significant findings of the multivariate analysis, we conducted a series of t-tests comparing the ratings of boys and girls for all 10 school subjects. The results of these comparisons are reported in Table 1. This table shows the means and standard deviations of boys' and girls' ratings for each of the 10 school subjects, as well as the t-value and effect size (d) for each comparison. (Effect sizes were computed by subtracting the mean of the girls' ratings from the mean of the boys' ratings and dividing by the pooled standard

deviation. Thus, a positive effect size for a given school subject indicates that boys' ratings were greater than girls' ratings for that school subject.) Because respondents were not required to have complete data across all 10 school subjects to be included in these comparisons, the numbers of boys and girls indicated in Table 1 are greater than those reported for the repeated measures analysis.

Insert Table 1 about here

The t-test results indicate that there were significant differences between the mean ratings of boys and girls in all 10 school subjects. Specifically, boys provided significantly greater mean ratings than girls in Computer Science (d=.45), Mathematics (d=-.14), Physical Education (d=.29), Science (d=.18), Social Studies (d=-.12), and Vocational Education (d=.51), and girls provided significantly greater mean ratings than boys in Art/Music (d=-.42), English (d=-.26), Foreign Languages (d=-.34), and Home Economics (d=-.50).

In addition to comparing boys' and girls' mean ratings within each of the 10 subjects, we also examined their relative mean ratings across these subjects. Table 2 lists the 10 school subjects in order of preference for boys and girls (as indicated by the mean ratings reported in Table 1). Interestingly, this table shows that these girls defied the "traditional" mold by rating Science and Mathematics higher than English and Foreign Languages. Girls and boys agreed on two of their three top choices, listing Math and Science as two of the most favored classes, with Physical Education receiving the third highest mean ratings for boys and Art/Music receiving the highest mean ratings for girls. Likewise, Vocational Education and Home Economics were among the

three lowest rated subjects for both boys and girls, with Foreign Languages receiving the third lowest mean ratings for boys, and Computer Science receiving the second lowest mean ratings for girls.

Insert Table 2 about here

School Subjects: Forced-choice paired comparisons

Table 3 summarizes the responses of boys and girls to the 15 forced-choice paired comparisons included on the questionnaire. The two numbers in each cell of the table report the percentage of boys and girls, respectively, that indicated a preference for the school subject listed in the row of the cell over the school subject listed in the cell's column. For example, the numbers in the cell corresponding to the first row (Mathematics) and the second column (Science) of Table 3 are 51 and 55, indicating that 51 percent of the boys and 55 percent of the girls expressed a preference for Mathematics over Science. The two values in each cell were compared using the chi-square statistic, and values that are significantly different from one another are indicated by asterisks. Note that the results for each pair of school subjects appear twice in the table--once in the upper off-diagonal (in which the percentages of boys and girls preferring one of the two subjects are reported) and again in the lower off-diagonal (in which the percentages of boys and girls preferring the other subject are reported). Because these two sets of numbers represent the exact same information, significance tests reported in the upper and lower off- diagonals (for corresponding pairs of school subjects) are redundant. However, to simplify the examination of results associated with

each of the six subjects, Table 3 reports the results for each pair of subjects in both places.

Insert Table 3 about here

The results indicate a number of systematic differences between the responses of boys and girls to the paired comparisons. Specifically, the percentage of boys that indicated a preference for Mathematics, Science, or Physical Education over English, Social Studies, or Art/Music was significantly greater than the percentage of girls for all but one paired comparison (Mathematics vs. Social Studies). For instance, 66 percent of the boys indicated a preference for Mathematics over Art/Music, in comparison to only 49 percent of the girls (χ^2 (1) = 37.20, $p < .0001$). Likewise, whereas 78 percent of the boys selected Science over English, only 56 percent of the girls made a similar choice (χ^2 (1) = 70.34, $p < .0001$). Interestingly, the percentages of boys and girls preferring Mathematics over Science were approximately the same (51 percent vs. 55 percent, χ^2 (1) = 1.99, n.s.).

College Majors: Rating scales

To compare boys' and girls' ratings of college majors, we used the same procedures reported above for comparing boys' and girls' ratings of school subjects. First, we conducted a two-way repeated measures analysis of variance, with one between-subjects factor (sex of respondent) and one within-subjects factor (college major). The number of respondents with complete data for this analysis was 1223 (592 boys and 631 girls). The results indicated that the main effect for college majors ($F(17,1205)=156.22$, $p<.0001$) and the interaction between college major and sex of the respondent ($F(17,1205)=61.76$,

$p<.0001$) were both significant, but the main effect for sex of the respondent was not ($F(1,1221)=2.77$, n.s.). The interaction between sex of respondent and college major signifies that the mean ratings of boys and girls differed significantly for one or more of the college majors included in the questionnaire.

Next, we conducted a series of t-tests comparing the ratings of boys and girls for all 18 college majors. The results of these comparisons are reported in Table 4. Similar to Table 1, this table shows the means and standard deviations of boys' and girls' ratings of each of the 18 college majors, as well as the t-value and effect size for each comparison.

Insert Table 4 about here

The results of the t-tests indicate that there were significant differences between the mean ratings of boys and girls for 13 of the 18 college majors. Boys provided significantly greater mean ratings for Agriculture ($d=.14$), Computer Science ($d=.49$), Engineering ($d=.73$), Mathematics ($d=.16$), Physical Education/Recreation ($d=.22$), Physical Sciences ($d=.41$), and Political Science/Economics ($d=.16$), and girls provided significantly greater mean ratings in Fine Arts ($d=-.60$), Foreign Languages ($d=-.40$), Journalism ($d=-.32$), Nursing ($d=-.69$), Pre-law ($d=-.28$), and Social Sciences ($d=-.30$). There were no significant differences found between boys' and girls' ratings of Biological Sciences, Business Administration, Other Liberal Arts, Pre-dental, or Pre-medical.

Finally, Table 5 ranks the 18 school subjects in order of the mean ratings provided by boys and girls, respectively. Although two majors (Mathematics

and Pre-medical) appear among the five most highly rated majors for both boys and girls, the two groups differed dramatically in their relative ratings of several other majors. For example, Computer Science was tied with Mathematics as the highest rated major among boys, but ranked only 11th among girls. Likewise, Physical Sciences and Engineering were the third and fourth highest rated majors for boys, but ranked 10th and 15th, respectively, among girls. Conversely, the highest rated major for girls, Fine Arts, was only the 11th highest rated major among boys, and Foreign Languages, the fourth highest rated major for girls, was ranked 10th among boys.

Insert Table 5 about here

Discussion

It is important for educators to understand the attitudes students have about school, and the possible relationship of these attitudes with future plans (e.g., plans for future study, occupational choice). We have a growing need for individuals versed in technical and academic fields, and it is valuable to note the patterns of academic interests in students as they develop (e.g., Clark, 1988). It is especially crucial to identify when negative attitudes begin, particularly as they are differentiated by gender (Bartkovich, 1988).

The pattern of results reported here is consistent with related work which found gender-based course selection in a sample of talented students (Stocking & Goldstein, 1992; Wilson, Stocking, & Goldstein, 1993). In all areas of comparison, males rated mathematics and the sciences higher than females, and females rated the arts and languages higher than males. However, it is interesting and encouraging to note that these highly talented

females "broke tradition" by rating Mathematics and Science as subjects higher than English and languages and ranking Mathematics and Pre-medical among their five favorite college majors. Although these girls rated mathe and science lower than males, they did not exhibit negative attitudes toward these disciplines. Perhaps these seventh-grade girls have not developed the negative attitudes (e.g., anxiety, low expectations for success) females often display regarding these areas of study. In fact, results of research reported earlier suggests that these girls perceive their competence in mathematics to exceed that of the boys (Stocking, Oppler, Porter, & Goldstein, 1992).

The case remains that there is a significant literature documenting the involvement and achievement of girls in traditionally sex-stereotyped curricula (i.e., mathematics and science; Chipman, & Wilson, 1985; Kerr & Colangelo, 1988; Reis, 1987; Strauss, 1988; Subotnik & Strauss, 1990; see Armstrong, 1985, for a review). Even an extremely able groups of students, those selected to participate in the Duke University TIP Summer Residential Program, has been shown to choose courses along "traditional" gender lines (Stocking & Goldstein, 1992; Wilson, Stocking, & Goldstein, 1993), although males and females perform equally well in all courses (Stocking & Goldstein, 1992; see also Linn & Hyde's 1989 meta-analysis). Concern has been expressed about low levels of females' interest in the sciences and mathematics (Malcolm, 1988), a situation perhaps leading to lower participation of women in higher levels of study in these areas and entry into related future occupations. This study does not indicate how to avoid lack of interest in or dislike of a given area of study, but it does tell us that negative school-related attitudes are not necessarily always present in a given sample of students.

The study reported here is the pilot for future longitudinal work, which will be able to address at what point students begin to exhibit negative attitudes about school subjects and majors, if those negative processes do, in fact, occur. Perhaps we will begin to understand what types of interventions may be possible in preventing these processes, and at what point those interventions should be implemented for highest effectiveness.

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Table 1

Mean Ratings of School Subjects as a Function of Sex

	Males		Females		t	d
	N	Mean (SD)	N	Mean (SD)		
Art/Music	614	0.93(1.20)	653	1.40(.92)	-7.85**	-0.415
Computer Science	610	0.84(.99)	645	0.42(.96)	6.23**	0.450
English	613	0.58(1.23)	648	1.00(1.13)	-6.42**	-0.259
Foreign languages	608	0.36(1.06)	649	0.73(1.02)	-7.81**	-0.343
Home Economics	608	0.04(.81)	646	0.43(.95)	-7.41**	-0.50
Mathematics	616	1.32(1.09)	653	1.13(1.21)	-2.83**	-.138
Physical Education	615	1.21(1.09)	653	0.78(1.34)	6.31**	0.286
Science	616	1.35(1.00)	653	1.15(1.10)	3.42**	0.183
Social Studies	617	0.94(1.13)	653	0.78(1.26)	2.39*	0.112
Vocational Education	608	0.28(.87)	642	0.06(.76)	7.75**	0.514

Note: Ratings based on the following scale: -2 = I dislike this subject very much, -1 = I dislike this subject a little, 0 = I have no opinion or do not know much about this subject, 1 = I like this subject a little, and 2 = I like this subject very much.

Table 2

Rank Order of School Subjects according to Rating of School Subjects as a Function of Sex

Rank	Girls (Mean)	Boys (Mean)
1	Art/Music (1.40)	Science (1.35)
2	Science (1.15)	Mathematics (1.32)
3	Mathematics (1.13)	Physical Education (1.21)
4	English (1.00)	Social Studies (0.94)
5	Social Studies (0.78)	Art/Music (0.93)
6	Physical Education (0.78)	Computer Science (0.84)
7	Foreign languages (0.73)	English (0.58)
8	Home Economics (0.43)	Foreign languages (0.36)
9	Computer Science (0.42)	Vocational Education (0.28)
10	Vocational Education (0.28)	Home Economics (0.04)

Note: Subjects ranked 1 are the most preferred; those ranked 10 are the least preferred.

Table 3

Percentages of Boys and Girls Preferring School Subjects in Rows over School Subjects in Columns

	Math	Science	English	Social Studies	Art/ Music	Physical Education
Math	--/--	51/55	77/60***	71/67	66/49***	50/59**
Science	49/45	--/--	78/56***	67/59**	67/47***	56/57
English	23/40***	22/44***	--/--	40/58***	39/35	31/55***
Social Studies	29/33	33/41**	60/42***	--/--	48/35***	39/51***
Art/ Music	34/51***	33/53***	61/65	52/65***	--/--	39/62***
Physical Education	50/41**	44/43	69/45***	60/49***	61/38***	--/--

Note: Number appearing above the slash indicates percentage of boys preferring given subject; number below the slash indicates percentage of girls.

* $p < .05$ ** $p < .01$ *** $p < .0001$

Table 4

Mean Liking of College Majors as a Function of Sex

	Girls		Boys		t	d
	N	Mean (SD)	N	Mean (SD)		
Agriculture	653	-.72(1.13)	614	-.54(1.17)	-2.82**	.14
Biological sciences	649	.39(1.26)	611	.47(1.21)	-1.19	.054
Business administration	653	.37(1.17)	615	.33(1.14)	.68	-.03
Computer Science	646	.24(1.22)	613	.91(1.11)	-10.09**	.49
Engineering	647	-.26(1.23)	611	.79(1.17)	-15.55**	.73
Fine arts (music, art, ballet, drama, etc.)	645	1.04(1.17)	610	.009(1.45	13.89**	-.60
Foreign languages	648	.68(1.20)	611	.07(1.27)	8.85**	-.40
Journalism	653	.32(1.30)	616	-.21(1.24)	7.31**	-.32
Mathematics	648	.64(1.34)	611	.91(1.26)	3.75**	.16
Nursing	647	.13(1.33)	606	-.91(1.11)	15.05**	-.69
Other liberal arts (e.g., philosophy, history)	647	.04(1.26)	613	-.07(1.21)	1.65	-.08
Physical education or recreation	648	-.02(1.38)	610	.39(1.32)	-5.39**	.22
Physical sciences	644	.28(1.26)	610	.87(1.15)	-8.73**	.41
Political science or economics	646	-.29(1.17)	612	-.06(1.18)	-3.42**	.16
Pre-dental	648	-.42(1.25)	611	.50(1.22)	1.14	-.052

Continued on next page

Table 4

Mean Liking of College Majors as a Function of Sex (cont.)

	Girls		Boys		t	d
	N	Mean (SD)	N	Mean (SD)		
Pre-law	642	.79(1.30)	608	.36(1.32)	5.80**	-.28
Pre-medical	647	.69(1.32)	611	.60(1.30)	1.28	-.06
Social sciences	647	.41(1.19)	611	.003(1.13)	6.29**	-.30

Note: Mean ratings based on the following scale: -2 = I would dislike this major very much, -1 = I would dislike this major a little, 0 = I have no opinion or do not know much about this major, 1 = I would like this major a little, and 2 = I would like this major very much.

Table 5

Ranking of College Majors as a Function of Sex

	Boys	Girls
Rank	Major (mean)	Major (mean)
1	Mathematics (0.91)	Fine arts (1.01)
2	Computer science (0.91)	Pre-law (0.79)
3	Physical sciences (0.87)	Pre-medical (0.69)
4	Engineering (0.79)	Foreign languages (0.68)
5	Pre-medical (0.60)	Mathematics (0.64)
6	Biological sciences (0.47)	Social sciences (0.41)
7	Physical education or recreation (0.39)	Biological sciences (0.39)
8	Pre-law (0.36)	Business administration (0.37)
9	Business administration (0.33)	Journalism (0.32)
10	Foreign languages (0.07)	Physical sciences (0.28)
11	Fine arts (0.01)	Computer science (0.24)
12	Social sciences (-0.003)	Nursing (0.13)
13	Political science or Economics (-0.06)	Other liberal arts (0.04)
14	Other liberal arts (-0.07)	Physical education or recreation (-0.02)
15	Journalism (-0.21)	Engineering (-0.26)
16	Pre-dental (-0.50)	Political science or Economics (-0.29)
17	Agriculture (-0.54)	Pre-dental (-0.42)
18	Nursing (-0.91)	Agriculture (-0.72)

Note: Majors ranked 1 are the most preferred; those ranked 18 are the least preferred.