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ABSTRACT

This paper presents the results of a 2-year study conducted in Japanese junior high schools to examine the changes in attitude towards science with regard to gender difference. The Third International Mathematics and Science Study (TIMSS) identifies Japan as the country with the largest gender gap in "liking science." The results of the study indicate a significant gender difference among 7th and 8th grade students. (YDS)

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Gender Differences in Science Learning of Japanese Junior High School Students

—A Two Year Study —

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Gender Differences in Science Learning of Japanese Junior High School Students

—A Two Year Study—

In a recent international study (the Third International Mathematics and Science Study: TIMSS), among participating countries, gender differences in science achievement of junior high school students in Japan was larger than other countries (IEA, 1996, 1997). Moreover, the gender gap in "liking science" in Japanese students was the largest among those countries. Gender differences significantly influence students' course choices in high school and college (Japanese Association for University Women, 1995; Muramatsu, et al., 1996). These curriculum choices significantly influence Japanese women's and men's options in occupations related to science and technology.

I Purpose

1) To examine gender differences in attitudes toward science between junior high school girls and boys.
2) To examine change of gender differences from 7th to 8th grade.
3) To analyze relationships between gender difference in attitudes toward science and factors such as the influence of school and family on those attitudes.

Goal of presentation

1) To examine change between grades, 7th to 8th, regarding gender difference in attitudes toward science.
2) To analyze Japanese science education in order to uncover possible reasons for gender discrepancies in attitudes toward science.

II Methods

A two year study of Japanese junior high school students using questionnaire.

Survey 1 (June and July, 1999)

Subjects: Seventh grade students* (437 girls and 470 boys) from 9 public co-educational schools in 9 regions of Japan.

Survey 2 (June and July, 2000)

Subjects: Eighth grade students* (408 girls and 443 boys) chosen from the same schools participated in Survey 1 (one school declined to participate in Survey 2: 8 out of 9 schools).

* 7th and 8th grade correspond to Japanese 1st and 2nd grade of junior high school.

Questionnaire

Eighteen questions with 102 items in Survey 1 and 16 questions with 62 items in Survey 2 were asked. Five questions were asked in both surveys; liking and disliking of science, reasons of like/dislike of science, interests in science, reasons of learning science, role in science experiments, and attitudes and beliefs toward science.

In Survey 1, science- and nature-related experiences in everyday life were also asked. In Survey 2, self evaluation of achievement, and future occupation were asked.

Procedure and Data Analysis

Both Surveys were conducted in the first trimester of each grade. In most schools, science teachers administered the questionnaire to their classes. Analysis was conducted by cross tabulation with χ^2 analysis to examine the change in responses to common items from 7th (Survey 1) to 8th grade (Survey 2) within gender, and increase/decrease of gender difference in each item between grades.

Ⅲ Results

1) Like/dislike of science

Table 1 Like/dislike of studying science (7th to 8th grade) (%)

		N	Like	Somewhat Like	Somewhat Dislike	Dislike	χ^2
Girls	7th	435	10.3	42.8	36.3	10.6	*
	8th	408	11.3	32.4	40.7	15.7	
Boys	7th	468	20.7	44.7	24.1	10.5	n.s.
	8th	443	17.2	43.3	26.9	12.6	

*p<.05 **p<.01 ***p<.001

- Significant gender differences are found both in 7th and 8th grade. More girls dislike studying science than boys in both grades.
- Gender differences increase between 7th and 8th grade. More girls at 8th become disliking science than when they were at 7th grade.

Table 2 Reasons of liking science (7th to 8th grade) (%)

		Girls			Boys		
		7th	8th		7th	8th	
		230	180	χ^2	305	275	χ^2
1	It is interesting to do experiments and observations.	80.9	75.6	n.s.	82.3	74.9	*
2	Nature and scientific matters are interesting.	58.3	51.7	n.s.	68.5	60.0	n.s.
3	It relates to everyday life.	27.0	24.4	n.s.	32.5	16.0	***
4	It is fun to think for myself.	30.0	19.4	**	32.1	19.6	***
5	I like my science teacher.	20.4	17.2	n.s.	15.4	8.0	**
6	Science class is easy to understand.	30.0	16.1	**	29.8	12.4	***
7	The correct answer is clear.	26.5	15.6	**	29.8	22.9	*
8	Science requires learning by heart.	8.7	7.2	n.s.	13.8	10.9	n.s.
9	Examinations are easy.	6.5	6.1	n.s.	8.9	14.2	*
10	Science requires calculation.	0.9	1.7	n.s.	6.6	4.7	n.s.

*p<.05 **p<.01 ***p<.001

- The best reason for liking science for both gender in both grades is "it is interesting to do experiments and observations".

Table 3 Reasons of disliking science (7th to 8th grade) (%)

		Girls			Boys		
		7th	8th		7th	8th	
		203	229	χ^2	160	176	χ^2
1	Examinations are difficult.	54.8	52.4	n.s.	58.5	46.6	*
2	Science requires calculation.	13.8	49.3	***	17.5	34.7	***
3	I am not good at thinking for myself.	50.2	45.0	n.s.	50.0	30.7	***
4	It doesn't relate to everyday life.	32.5	44.1	**	37.5	35.2	n.s.
5	Science requires learning by heart.	47.3	42.8	n.s.	45.6	31.3	**
6	Science class is hard to understand.	33.5	42.4	*	37.5	47.7	*
7	The terms in class are difficult.	49.3	41.0	n.s.	51.3	33.0	***
8	I'm not interested in nature and scientific matters.	36.0	39.7	n.s.	28.8	30.1	n.s.
9	I don't like my science teacher.	19.2	27.1	*	23.1	31.8	*
10	Experiments and observations are tiresome.	28.6	19.7	*	30.0	17.6	**

*p<.05 **p<.01 ***p<.001

- Both girls and boys choose more reasons at 8th than 7th grade.
- More girls at 8th than at 7th choose, "Science requires calculation" and "It doesn't relate to everyday life".

2) Interest in science

Table 4 Interest in each science field (7^{th} to 8^{th} grade) (%)

			N	Very much	A little	Less	Not at all	χ^2
Function of electricity and/or magnet	Girls	7^{th}	435	5.5	33.1	46.9	14.5	***
		8^{th}	408	2.7	19.9	52.0	25.5	
	Boys	7^{th}	466	24.2	36.3	27.3	12.2	n.s.
		8^{th}	443	24.6	39.5	24.6	11.3	
Change of water by temperature	Girls	7^{th}	436	13.3	39.4	33.0	14.2	***
		8^{th}	408	4.7	33.6	42.6	19.1	
	Boys	7^{th}	467	16.1	34.9	32.5	16.5	*
		8^{th}	442	10.4	36.7	39.6	13.3	
Growing process of animals and/or plants	Girls	7^{th}	437	29.3	40.5	21.5	8.7	*
		8^{th}	408	21.8	38.5	27.7	12.0	
	Boys	7^{th}	466	25.5	29.6	30.3	14.6	n.s.
		8^{th}	441	20.0	29.9	35.4	14.7	
Change of weather	Girls	7^{th}	435	13.1	39.3	33.8	13.8	n.s.
		8^{th}	407	8.4	38.6	34.9	18.2	
	Boys	7^{th}	465	16.3	31.4	32.5	19.8	n.s.
		8^{th}	442	15.2	36.9	30.3	17.9	

*p<.05 **p<.01 ***p<.001

- Between the two grades, girls' interest decreased dramatically on the items "funcion of electricity and/or magnet" and "change of water by temperature". In the same period, boys' interest remained almost the same.

3) Role in science experiments

Table 5 Role in science experiments (7^{th} to 8^{th} grade) (%)

	Girls		Boys	
	Elementary + middle school*	Junior high school	Elementary + middle school*	Junior high school
	429	384	440	410
I play a main role using equipment.	20.5	15.9	39.9	29.0
I do not play a main role, although I use equipment a little.	47.6	37.5	37.3	41.0
I only prepare or put back equipment.	9.1	15.9	8.0	11.5
I am a recorder.	14.5	12.2	2.6	1.2
I always just look.	8.4	18.5	12.3	17.3
χ^2	***		**	

*p<.05 **p<.01 ***p<.001

- Girls and boys play different roles in science experiments.
- More boys than girls play main roles, and more girls than boys are recorders.
- More 8th grade girls only prepare or put back equipment, or just look on experiments than when they were elementary and middle school age.

*Students were asked to answer about roles in experiments as they were elementary and middle school age in Survey 1.

4) Attitudes and beliefs toward science

Table 6 Attitude toward science (7^{th} to 8^{th} grade) (%)

			N	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	χ^2
I want someone to teach me an answer rather than to solve the problem by myself.	Girls	7^{th}	435	17.0	25.1	36.3	21.6	***
		8^{th}	352	30.4	31.0	29.3	9.4	
	Boys	7^{th}	465	14.4	17.6	36.6	31.4	***
		8^{th}	381	20.5	27.6	31.8	20.2	

*p<.05 **p<.01 ***p<.001

- The number of girls and boys who agreed on the item, "I want someone to teach me an answer rather than to solve the problem by myself" increased in the 8^{th} grade. This increase is more significant for girls than for boys.

Table 7 Importance and necessity of science (7^{th} to 8^{th} grade) (%)

			N	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	χ^2
I will need scientific knowledge when I work in the future.	Girls	7^{th}	435	15.9	34.0	34.9	15.2	***
		8^{th}	356	8.1	31.5	35.1	25.3	
	Boys	7^{th}	461	24.5	33.2	21.3	21.0	***
		8^{th}	385	13.0	36.6	28.8	21.6	

*p<.05**p<.01 ***p<.001

- The number of students from each gender who agreed on the item, "I will need science knowledge when I work in the future" decreased in the 8^{th} grade. This decrease was more significant for girls than it was for boys.

Ⅳ Discussion

By the time Japanese students enter junior high school(7th grade), there is considerable difference in attitudes toward science between girls and boys. As they progress in school, girls attitudes towards science tend to become increasingly negative.

The followings are the factors that can be considered as some of possible reasons of this tendency.

1) More mathematical factors (computation, equation, and so on) and more abstract thinking (unrelated to everyday life) in contents of science occurs in the 7th grade than in the elementary school.
2) Japanese traditional gender roles(female supportive role) might be reflected to boys and girls' roles in science experiments(girls not playing main role).
3) Lack of role models for girls in science field.
4) Teacher's influence (expectation, unconscious gender bias, and teaching).
5) Peer influence.
6) Parental influence (occupation, expectations, gender bias, and beliefs about science).

Future study:

First, we will examine relationships betweengender differences in science and the above factors. Second, we will interview science teachers concerning their attitudes toward teaching science to girls and boys.

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