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Trends in Education and Polices for Women in Korea: Focusing on Mathematics, Science, and Career Choice

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Abstract

This study is focused on the trends in education and polices for women in Korea. First, historical background of education for women in Korea revealed that a biased view of education for women was deeply rooted. Next, several findings such as international comparison of performance on the PISA, TIMSS, and National Assessment including gender differences especially in Mathematical and Science performance were analyzed. In international assessments, female students perform better in reading literacy, but still fall behind male students in mathematical and scientific literacy, and the gap between the genders are wider than most OECD countries. The change in status of women in contemporary Korea is examined focusing on educational system and women's educational and vocational performance, etc. Additionally, policies planned by Ministry of Science and Technology which show the many execution plans for training and supporting female professionals were presented. Finally, possible reasons for gender differences in educational performance is examined and some suggestions are provided to reduce the gender gap in mathematical and scientific literacy of Korean students.

Key words : Education for Korean Women, Gender Difference, Mathematical and scientific literacy

In Korea, where the society had long been under the influence of Confucian culture, records of discussions on sexual dominance can be found in many Confucian literatures from the past. These Confucian literatures, including the Four Books and Five Classics, had a dominant influence on the lifestyle in the traditional Korean society. Especially the Four Books and Five Classics was one of the well-respected guidelines of women education.

In a Confucian society, women were endowed with three roles from birth to death, as a daughter, as a wife, as a mother (Park, 2000). All women were taught to value the virtue of obedience, chastity and fidelity. These virtues limited opportunities for women to think and act as an independent individual. In fact, independent existence of women were denied.

Women in a Confucian society were negatively viewed and treated. People believed that whereas talented men raise nations up, talented women destroy nations, figuratively saying that a home with a hen crying at dawn is doomed. When a girl is born, she was given a bobbin to play with. Also, a biased view on women's education was deeply rooted in Korea. Women were only informally educated within the boundaries of the home. The focus of education was only on basic etiquette and cultivation of character, such as being gentle and modest or speaking discreetly and learning to do chores to help homekeeping. The seven cardinal sins of womanhood, which included indecency, theft, talkativeness, arrogance, infertility, disease and jealousy against other women(wives), symbolizes the biased view of women that was prevalent in the society.

Confucianism has been a longstanding obstacle for normal female education in Korea. Due to the historical background, Korean women have had less educational opportunity compared to men, and their entry into the society was also relatively limited. However as Korea evolved into an industrialized nation, there has been a gradual increase in opportunities of education and social participation provided for women, which eventually led to the current status of virtually equal gender opportunities. Especially in the case of middle and high school students, female students often show superior academic achievement compared to male students.

Female students have not only proven to be competent in their academic achievement, but also in their performance in different projects, presentations and debates. Many examples of female superiority can be found at Korean universities. The proportion of A-graders among female students in the college of business administration at Seoul National University was 45%, whereas it was 33.4% among male students. In 12 out of 16 colleges at Seoul National University, female graduates each received the summa cum laude honor. The percentage of female MBA students at Yonsei University in 2005 was 49.8%, which is 14 times bigger compared to that of 1990. The percentage of female engineering students at Yonsei University in 2005 was 17%, compared to 6.1% in 1990. The same phenomena can also be observed not only in the academic realm, but also in the social realm. For example, a female student was elected president of the Taekwondo Club at Choongang University for the first time in 15 years. Such phenomenon was unimaginable in the past. (Chosunilbo Oct. 15th, A10).

The career choice patterns among women, or the proportion of females in the professional occupation group in Korea is continuously changing. As opposed to the past, more female students who excel in mathematics and science are opting to enter Science High School or Korea Advanced Institute of Science and Technology (KAIST). The proportion of female professionals in such areas as medical doctors or professors, or the proportion of successful female candidates in the Civil Service Examination, such as the judicial examination, is also gradually increasing.

Nonetheless, the female economic activity rate in Korea only slightly increased from 47% in 1990, to 48.9% in 2003. This evidently shows that a huge pool of female manpower still remains unexploited, compared to the other OECD member countries. Especially, if confining the figure to the highly educated females only (university graduate or more), the female economic activity rate is the lowest among all OECD member countries (Lee, 2004). Also, there still exists a serious dearth of female manpower in the science and technology field.

Thus, the purpose of this research is:

1) To search for differences between the academic abilities of male and

female students by examining various academic achievement results.
2) To examine how academic achievements of male and female students are changing respectively.
3) To investigate how women are changing with regard to their career and professions
4) To research what kind of policies the government currently offers to promote the involvement of women in the science and technology field.

I. Overview of Educational Achievement Between the Genders

1. Performance of Educational Achievement in PISA 2003

PISA (Programme for International Student Assessment) is an international comparison study of assessment results of reading literacy, mathematical literacy, scientific literacy and problem-solving literacy, conducted among students under 15 years of age in the respective countries. PISA was designed in 1998 to be a long-term project, and has been held every 3 years since. The purpose of PISA is to evaluate the effects of educational systems and to provide information necessary for establishing educational policies in each country.

1) International Comparison of Performance on the PISA 2003

41 countries participated in PISA 2003 and the results are presented in <Table 1>. According to the international comparison of performance shown in <Table 1>, Korean students scored third place in mathematical literacy, second in reading literacy, fourth in scientific literacy, and first in problem-solving literacy. Reading literacy, which scored sixth place in 2000, advanced to second place and problem-solving literacy, previously evaluated to be relatively uncompetitive, unexpectedly ranked first place. While mathematical literacy remained at third place, scientific literacy dropped from first to fourth place.

<Table 1> International Comparison of Performance in PISA 2003

Rank	Mathematical literacy			Reading literacy			Scientific literacy			Problem - solving literacy		
	Country	Mean	SD	Country	Mean	SD	Country	Mean	SD	Country	Mean	SD
1	HKG	550	100	FIN	543	81	FIN	548	91	KOR	**550**	**96**
2	FIN	544	84	KOR	534	83	JPN	548	109	HKG	548	97
3	KOR	**542**	**92**	CAN	528	89	HKG	539	94	FIN	548	82
4	NLD	538	93	AUS	525	97	KOR	**538**	**101**	JPN	547	105
5	LIE	536	99	LIE	525	90	LIE	525	103	NZL	533	96
6	JPN	534	101	NZL	522	105	AUS	525	102	MAC	532	91
7	CAN	532	87	IRL	515	87	MAC	525	98	AUS	530	91
OECD Total		489	104	OECD Total	488	104	OECD Total	496	109	OECD Total	490	106
OECD Average		500	100	OECD Average	494	100	OECD Average	500	105	OECD Average	500	100

2) Gender Differences in Mean Scores of Mathematical Literacy

The gender difference in the mean scores of mathematical literacy of Korean students is 23 points. This shows that the mean score of male students is significantly higher than that of females. Korea shows the second biggest difference between the genders among all participanting countries, and the biggest difference among the OECD countries (see Table 2). In PISA 2000 also, Korean students showed the biggest gender gap in the mean scores of mathematical literacy. (Choi & others, 2001).

< Table 2> Gender Differences in Mean Scores of Mathematical Literacy

		Total		Gender difference		
Rank	Nation	Mean	SD	Male	Female	Difference
1	LIE	536	99	550	521	29*
2	KOR	**542**	**92**	**552**	**528**	**23***
3	MAC	527	87	538	517	21*
4	GRC	445	94	455	436	19*
5	SVK	498	93	507	489	19*
OECD Total		489	104	494	484	10
OECD Average		500	100	506	494	11

* Positive differences indicate that males performed better than female.

* Differences that are statistically significant are indicated in *

Austria, which tied with Korea for the biggest test score gender gap of 27 points in PISA 2000, narrowed the gap to 8 points in PISA 2003, which is a statistically insignificant difference. As for the test score gap in 2003, of all the OECD countries that showed relatively big score gaps in PISA 2000, Portugal managed to decrease the difference from 19 to 12, Spain from 18 to 9, Germany from 15 to 9, France also from 14 to 9. Although mathematical literacy of male and female students in these countries still shows a statistically significant difference, they seem to have succeeded in mitigating the gender imbalance of mathematical literacy as compared to 2000 (Lee & others, 2004).

3) The Percentage of Male and Female Students at Each Performance Level in Mathematical Literacy

In PISA 2003, mathematical literacy is divided into 6 performance levels, in order to give more concrete explanation of student achievements. Looking into the proportion of Korean male and female students ranked in high achievement levels <Table 3>, there is a 4% difference between the proportion of male and female students in Level 6, 5.5% in Level 5 and 2.3% in Level 4. The proportion of male students in high achievement levels (from Level 4 to Level 6) is 11.8% higher than that of females. Such difference in the proportion of students in the high achievement levels contributed to the gap of 23 points in the average scores of male and female.

<Table 3> The Percentage of Male and Female Students at Each Performance Level in Mathematical Literacy

Rank	Nation	Total	below level 1		Level 1		Level 2		Level 3		Level 4		Level 5		level 6	
			below 395		358~420		421~484		483~544		545~606		607~668		above 668	
			%	SD	%	SD	%	SD	%	SD	%	SD	%	SD	%	SD
1	HKG	Total	3.9	0.7	6.5	0.6	13.9	1.0	20.0	1.2	25.0	1.2	20.2	1.0	10.5	0.9
		Male	5.1	1.1	6.7	0.9	13.0	0.9	18.1	1.0	23.9	1.6	20.4	1.5	12.7	1.5
		Female	2.7	0.7	6.3	0.9	14.9	1.6	21.8	2.3	26.1	1.3	19.9	1.6	8.3	1.0

2	FIN	Total	1.5	0.2	5.3	0.4	16.0	0.6	27.7	0.7	28.1	0.9	16.7	0.6	6.7	0.5
		Male	1.6	0.3	5.8	0.6	15.4	0.8	25.9	0.9	25.4	1.1	17.7	1.1	8.2	0.8
		Female	1.4	0.3	4.9	0.6	16.7	0.8	29.5	1.1	28.9	1.2	15.7	0.8	5.1	0.5
3	KOR	Total	**2.5**	**0.3**	**7.1**	**0.7**	**18.6**	**0.8**	**24.1**	**1.0**	**25.0**	**1.1**	**16.7**	**0.8**	**8.1**	**0.9**
		Male	**2.3**	**0.4**	**6.2**	**0.8**	**14.6**	**1.0**	**22.3**	**1.0**	**25.9**	**1.4**	**18.9**	**1.2**	**9.7**	**1.0**
		Female	**2.7**	**0.5**	**8.3**	**1.0**	**19.6**	**1.7**	**26.7**	**1.5**	**23.6**	**1.5**	**13.4**	**1.2**	**5.7**	**1.2**
4	NLD	Total	2.6	0.7	8.4	0.9	18.0	1.1	23.0	1.1	22.6	1.3	18.2	1.1	7.3	0.6
		Male	2.2	0.7	8.0	1.2	18.2	1.5	22.9	1.6	22.6	1.7	18.1	1.5	8.0	0.8
		Female	2.9	0.8	8.7	1.2	17.9	1.4	23.0	1.3	22.5	1.5	18.3	1.2	6.6	0.7
5	LIE	Total	4.8	1.3	7.5	1.7	17.3	2.8	21.8	2.5	23.2	3.1	18.3	3.2	7.3	1.7
		Male	4.7	1.8	5.5	2.2	15.6	3.1	19.6	3.5	22.2	4.9	21.5	5.5	10.6	2.7
		Female	4.9	2.4	9.6	3.0	19.2	3.9	23.6	3.7	24.2	4.5	15.0	3.6	3.6	1.8

4) Gender Differences in the Mean Scores of Scientific Literacy

Table 4 shows the scientific literacy of participating countries in PISA 2003, in the order of biggest score gap between genders. In twelve countries, including Korea, male students recorded significantly higher averages in scientific literacy compared to females. The average scientific literacy of male students from Korea scored higher than that of females by 18 points, making Korea the country with the second biggest gender gap in scores, next to Lichtenstein.

<Table 4> Gender Differences in Mean Scores of Scientific Literacy

Rank	Nation	Male		Female		Gender difference
		Mean	SD	Mean	SD	
1	LIE	538	108	512	96	26*
2	**KOR**	**546**	**102**	**527**	**98**	**18***
3	DNK	484	103	467	100	17*
4	NLD	529	107	513	101	16*
5	SVK	502	104	487	100	15*
6	LUX	489	108	477	98	13*
7	GRC	487	105	475	96	12*
8	CAN	527	104	516	95	11*
9	SWI	518	110	508	105	10*
10	MEX	410	89	400	84	9*
OECD Total		499	112	493	106	6*
OECD Average		503	109	497	102	6*

*p<.05

* Positive differences indicate that males perform better than females

In cases of Finland (female score higher by 6 points), Japan (male score higher by 4 points) and Hong Kong (female score higher by 3 points), each having achieved higher average in scientific literacy than Korea, the gender difference is virtually nonexistent, or females performed relatively better than males.

2. Performance of Educational Achievement in TIMSS 2003

TIMSS 2003 (Trends in International Mathematics and Science Study) examines the change in mathematical and scientific literacy of middle school students from 50 participating countries, providing member countries with information to inspect and improve their educational system.

1) Gender Differences in Mathematical Performance on the TIMSS 2003

Second-year middle school students from Korea achieved an average score of 589 points in mathematical literacy, only second to Singapore. The score is quite high compared to the international average of 467 points, but there exists a score gap of 16 points from Singapore, which is a significantly big difference (Park & others, 2004).

Regarding the mathematical literacy of male and females students <Table 5>, female students scored 586, whereas male students scored 592. This is not a statistically significant difference, but male students still continue to perform better. However, in the international average, female students showed slightly better performance, although statistically insignificant. In the top 5 countries except for Korea and Japan, the results followed the international trend, with female students excelling males in mathematical literacy. Especially in Singapore, the score of females was higher than that of males by 10 points, showing a statistically significant difference.

<Table 5> Gender Differences in Mathematical Performance on the TIMSS 2003

Performance in Mathematics			
Nation	Female	Male	Mean Score Difference
SGP	611	601	10
KOR	586	592	-5
HKG	587	585	2
TAI	589	582	7
JPN	569	571	-3
International Mean Score	467	466	1

* +: Case in which female students scored higher
* −: Case in which male students scored higher

2) Changes in the Gender Difference of Mathematical Performance

Table 6 schematizes the difference between mathematical performance of male and female students recorded in TIMSS 1995, 1999 and 2003. Despite the significant decrease in the gender difference of mathematical performance from 1995 to 1999, the gap remained stagnant afterwards.

<Table 6> Changes in the Gender Difference of Mathematical Performance

Performance in Mathematics			
Nation	1995 Gender difference	1999 Gender difference	2003 Gender difference
SGP	2	-2	10
KOR	-18	-5	-5
HKG	-18	2	2
TAI	◇	-3	7
JPN	-8	-7	-3
International Mean Score	-3	7	1

◇: Did not participate in the evaluation.
+: Cases in which female students scored higher.
−: Case in which male students scored higher.

3) Gender Difference in Scientific Performance on the TIMSS 2003 /Changes in the Gender Difference of Scientific Performance

In TIMSS 2003, scientific performance of middle school students in Korea scored 558, taking third place after Singapore and Taiwan. Korean male students showed significantly higher performance than female students, according to the record of gender-specific scientific performance shown in <Table 7>. Although the trend in <Table 8> shows that the faster increase of scientific performance shown by female students is gradually closing the gender gap, a significant difference still remains.

<Table 7> Gender Difference in Scientific Performance on the TIMSS 2003

Gender Differences			
Nation	**Female**	**Male**	**Mean Score Difference**
SGP	576	579	-3
TAI	571	572	-1
KOR	**552**	**564**	**-12**
HKG	552	561	-9
JPN	548	557	-9
International Mean Score	471	477	-6

+ : Case where the female student's score was higher.
-: Case where the male student's score was higher.

<Table 8> Changes in the Difference of Scientific Performance by Gender

Scientific Performance			
Nation	**1995 Gender difference**	**1999 Gender difference**	**2003 Gender difference**
SGP	-14	-21	-3
TAI	◇	-17	-1
KOR	**-28**	**-21**	**-12**
HKG	-33	-14	-9
JPN	-19	-14	-9
International Mean Score	-17	-16	-6

◇: Did not participate in the evaluation.
+ : Case where the female student's score was higher.
-: Case where the male student's score was higher.

3. Performance of Educational Achievement on the National Assessment 2002

Beginning from 1998 Korea Institute of Curriculum and Evaluation takes a comprehensive assessment of academic achievements of primary, middle and high school students in Korea annually at a national level. The purpose of the assessment is to analyze evaluation results and provide concrete and objective data required for establishing educational policies, thus ultimately facilitating the systematic and scientific management of the quality of school education.

1) Analysis on the Gender Comparison of Academic Achievement by Subject (National Assessment 2002)

Table 9 shows the result of a research conducted in 2002, a gender comparison of subject averages and the proportion of students not meeting the basic academic standards among third year students in middle school and first year students in high school. As shown in <Table 9>, the average academic achievement of female students in Korean language, social sciences and English was significantly higher in both middle and high school students. However, the average academic achievement in mathematics and science did not show a significant difference. The proportion of students not meeting the basic academic standards was higher for male students in all subjects.

<Table 9> Analysis on the Gender Comparison of Academic Achievement by Subject(National Assessment 2002)

Subject	Sex	Middle school 3rd			High school 1th		
		Mean	SD	Percentage of LD	Mean	SD	Percentage of LD
Korean Language	male	46.85	19.27	9.2	42.03	16.39	13.7
	female	53.93	17.49	2.9	49.27	16.41	6.4
Social Science	male	48.73	21.98	9.5	45.39	19.97	13.5
	female	52.70	20.15	4.6	46.88	19.11	9.9
Mathematics	male	49.95	26.93	8.9	38.93	22.57	14.4
	female	50.63	26.05	6.1	38.91	21.49	11.4
Science	male	39.53	19.40	7.3	44.64	22.22	9.1
	female	40.32	17.84	3.9	45.67	20.79	5.8
English	male	40.96	22.14	11.7	35.31	19.53	10.9
	female	45.51	22.09	6.1	40.75	21.35	6.8

2) The Percentage of Achievement Levels by Gender (National Assessment 2003

Comparing the level of academic achievement of male and female students in middle and high schools in 2003 <Table 10>, female third graders in middle school excelled males in Korean language, social sciences and English, showing a statistically significant difference. The average scores were similar in mathematics and science. However, the proportion of academically excellent students was higher for males in social studies, mathematics and science.

Female first graders in high school excelled males in Korean and English, with a statistically significant difference, whereas the average scores were similar in social studies, mathematics, and science. However, proportion of academically excellent students was higher for males in social studies, mathematics and science.

<Table 10> The Percentage of Achievement Levels by Gender (National Assessment 2003)

Subject	sex	Middle school 3rd				High school 1st			
		excellent	fair	passing	poor	excellent	fair	passing	poor
Korean Language	male	12.5	34.3	44.3	8.9	10.9	39	36.8	13.4
	female	21.0	43.5	32.8	2.7	17.0	50.2	27.8	4.9
Social Science	male	12.6	46.1	34.6	6.7	11.6	31.2	46.4	10.8
	female	10.9	52.9	31.7	4.6	9.3	33.3	51.4	6.0
Mathematics	male	14.3	32.7	40.4	12.6	17.3	35.5	34.7	12.5
	female	12.5	33.7	43.7	10.1	14.0	40.3	37.7	8.0
Science	male	12.6	36.2	40.3	10.9	11.9	36.3	36.8	15.1
	female	10.6	39.0	42.6	7.8	7.8	38.4	43.2	10.5
English	male	13.1	37.1	43.1	6.7	8.0	35.3	46.5	10.1
	female	18.7	40.2	37.8	3.4	8.9	41.8	45.4	3.9

II. Trends of Career Choice for Women

The career choices of Korean females or the proportion of females in a professional occupation is showing a continuous change. In contrast to the past, more female students who excel in mathematics and science are opting to enter Science High Schools or KAIST. The proportion of successful female candidates in the Civil Service Examination is also showing a gradual increase.

1 Change in the Number of Science High School Students

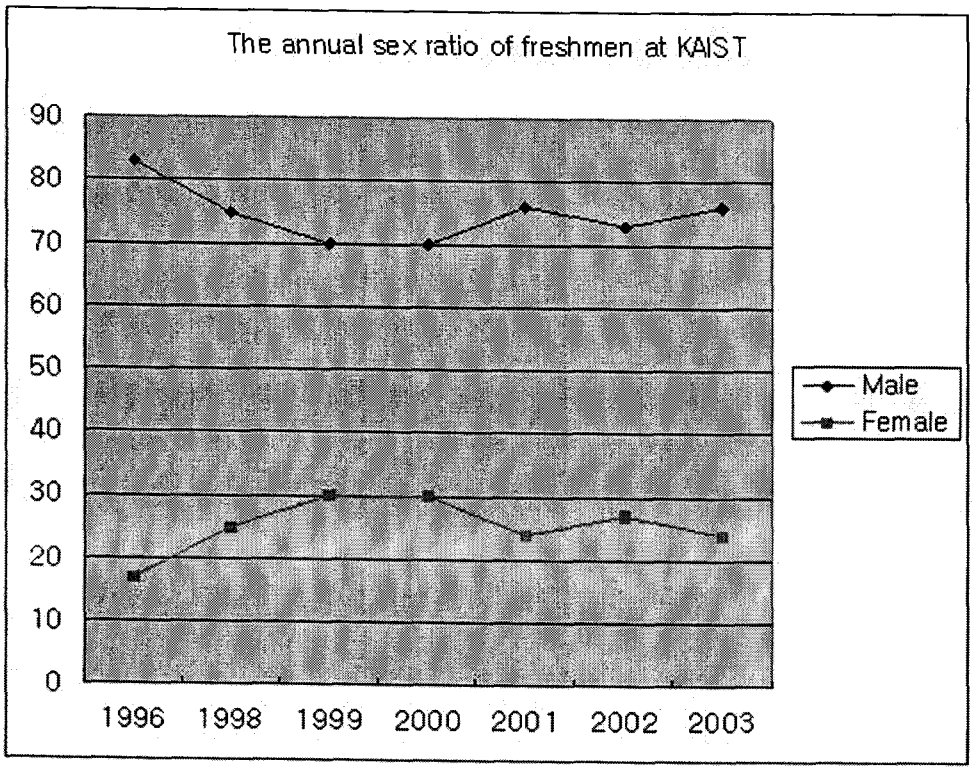
As Shown in <Table 11> there were no female students in Science High Schools from 1983 to 1987, because female students were not allowed to apply for the entrance exam. The reason for this phenomena is that at the time it was deemed inappropriate for male and females students to share the same dormitory building, and male students were thought to be better candidates for studying mathematics and science. Since 1988, Science High Schools started to accept female students, and the number of female enrollment continuously increased after the 1990s. This is owed to the fact that while previous entrance exam for Science High Schools was mainly a mathematical and scientific problem-solving written exam, it is currently diversified to include a variety of factors into evaluation, such as awards and honors, portfolio, academic records, achievements, oral tests, etc. (Cho & others, 2002).

<Table 11> Change in the Number of Science High School Students in Korea

	'83	'84	'86	'87	'88	'89	'90	'92	'94	'96	'98	'00	'02	'04	'05
total	60	240	663	591	655	709	744	1909	3194	3738	3664	3340	2887	3092	3340
female	-	-	-	-	6	71	120	358	708	862	1205	1190	1007	965	968
ratio	-	-	-	-	0.9	10.0	16.1	18.8	22.2	23.1	32.9	35.6	34.9	31.2	29.0

2 The Annual Gender Ratio of Freshmen in KAIST

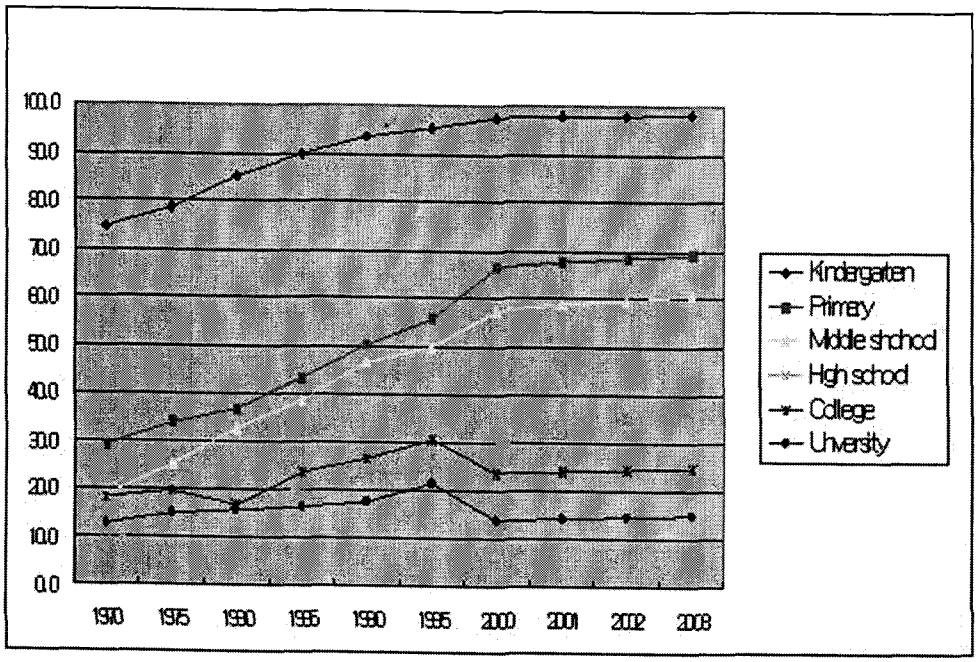
According to the results shown in (Figure 1) (Shim & Park, 2004), which is the annual gender ratio of freshmen at KAIST, the proportion of male freshmen decreased from 83% in 1996 to 76% in 2003, whereas the proportion of female freshmen increased from 17% to 24%. In 2000, the proportion of female freshmen reached 30%.



(Figure 1) The Annual Gender Ratio of Freshmen at KAIST

3 Annual Ratio of Female Teachers

Looking at (Figure 2), females account for 98% of teachers in kindergartens and 69% in primary schools. As compared to higher grade schools, males account for greater percentage of teachers in high schools and account for a large percentage of college and university faculties.



[Figure 2] Yearly Ratio of Female Teachers

4 The Proportion of Successful Female Candidates in Civil Service Exams

As shown in <Table 12>, the proportion of successful female candidates in the Civil Service Examination also shows a gradual increase. The proportion of successful female candidates in the Judicial Examination increased from 4.5% in 1989 to 17.5% in 2001, from 2.7% to 28.4% in the Administration Examination, from 5.0% to 45.7% in the Foreign Affairs Examination, and from 0% to 6% in the Technology Examination.

Besides these, according to the records of Central Election Management Committee, the proportion of female parliament members also increased from 0.5% in 1954 to 13.0% in 2004.

<Table 12> The Proportion of Successful Female Candidates in Civil Service Exams

Examination	'99			'90			'95			'00			'01			'02		
	total	female	ratio	total	female	ratio	total	female	ratio	total	female	ratio	total	female	ratio	total	female	ratio
Judicial	300	14	4.5	299	12	4.0	309	27	8.8	801	151	18.9	991	173	17.5	-	-	-
Administration	149	4	2.7	173	3	1.7	183	19	10.4	203	51	25.1	233	59	25.3	257	73	28.4
Foreign affairs	20	1	5.0	35	0	0.0	35	2	5.7	30	6	20.0	30	11	36.7	35	16	45.7
Technical	35	0	0.0	30	0	0.0	39	1	2.6	47	3	6.4	41	5	12.2	50	3	6.0

Ⅲ. Policies and Plans to Increase Female Workforce in Science and Technology Areas

In order to utilize the female workforce into the science and technology field and to overcome the reduction of science and technology professionals, it is necessary to promote policies to encourage women to enter in this area. MOST (Ministry of Science and Technology, 2004~2005) has developed some policies toward this direction. The main policy guidelines for training and supporting female professionals in the science and technology field can be summarized into the next four categories.

1) Maximum utilization of S&T workforce by facilitating female workers' advance into the field

To promote female workers' advance into the S&T field, female student friendly science education programs should be developed. Currently some effort is being put into effect through the WISE program.

Also, maintaining a certain ratio of female students in colleges majoring in Natural Science and Engineering can help this purpose. Implementing affirmative measures such as setting official target of employment for

female professionals and encouraging female professionals' participation in policy-making procedures can help to facilitate the utilization of female S&T professionals.

2 Fortifying national infrastructure for supporting female S&T workers' capabilities.

To improve female S&T professionals' capabilities, such policies as giving scholarship priority to able female students, giving more employment and research opportunities through special funds, and rendering favorable treatment to female applicants in the selection procedure of college IT research center and college professor support program can upgrade female professionals' competitiveness. In addition, offering training programs and holding leader's workshops under the lead of National Institute for Supporting Women in Science and Technology can be a helpful means to the end.

3 Establishing an infrastructure for supporting S&T workers

To enhance policy effectiveness, establishing supportive systematic infrastructure such as building more nursery facilities and accumulating database for female workers can help support female professionals in the long run.

4 Contributing to the creation of positive social, cultural environment and a balanced development of regional areas

Implementing favorable social, cultural climate toward female S&T professionals, such as seeking out role models and awarding them, promoting and utilizing female workers in regional areas can create supportive social cultural climate.

Ⅳ. Summary and Suggestions

In the past, Confucianism restricted women's education and their entry into the society. However nowadays, social reforms have brought changes to women in many aspects. First, among a variety of analyses into academic achievement of males and females, academic assessments conducted locally in Korea clearly show that female students have shown equal performances not only in general academic achievements, but also in mathematics and science. However in international assessments, female students perform better in reading literacy, but still fall behind male students in mathematical and scientific literacy. In other words, female students excel in exams that evaluate the delivered course materials, but male students are stronger in international assessments such as PISA or TIMSS. The ability that PISA aims to assess is not about gathering fragments of knowledge, but about 'acquiring a wide range of ideas and concepts', which will allow students to analyze what is around them, make logical deductions from it and express their opinions based upon knowledge about academic subjects and individual abilities. Assessing these 'literacies' can give a totally different result from academic achievement assessments of the past that had only been focused on course materials.

In PISA 2003, Korean students recorded the biggest gender gap in mathematical literacy among all the OECD participants. Also in PISA 2000, Korean students showed the biggest gender gap in the mean scores of Mathematical literacy. This is an evidence that shows the governmental effort during 2000 and 2003 to mitigate the serious imbalance between male and female mathematical literacy had either been incompetent or insufficient (Lee & others, 2004).

On the other hand, a number of countries that showed large gender gap in scores in PISA 2000, managed to reduce it in PISA 2003. This implies that the gender gap in mathematical literacy does not just inevitably result from the difference in innate abilities (OECD, 2004).

Korean students recorded the second biggest gender gap in mathematical

literacy in PISA 2003, as well as in PISA 2000. Regarding the fact that there was either only negligible gender differences among students from other countries which achieved higher scores than Korean students, or that female students from those countries rather showed better achievement, the large gender gap between Korean students does stand out.

In order to reduce the gender gap in mathematical and scientific literacy of Korean students, it is crucial for the government to establish and practice more fundamental and effective policies. Causes of the difference in mathematical and scientific literacy should be sought in multiple aspects. In order to adopt effective educational policies, the government should benchmark countries that showed little gender difference in academic literacy.

Especially today, when there is a critical demand for science and engineering experts, it is absolutely necessary to utilize the female talents in mathematics and science. A range of national educational policies is in practice for this, but most of all, the prerequisite is education that can stimulate interest in mathematics and science for both males and females. Effort of parents and teachers in many aspects is especially crucial. When female talents are prescribed by the society to comply to traditional gender role, it is difficult for them to fully develop their individual capabilities. Especially when educational experiences provided by parents had mostly been focused on cultivating femininity, it is difficult for women to show their scientific talents (Cho & others, 2004)

In fact, it was shown that teachers in coeducational mathematics and physics classes give preferential treatment to boys in that boys are more frequently called upon for classroom activities than girls (70% to 30%). Girls are praised more often than boys for inferior accomplishments. This strengthens the prejudice that women are less talented in mathematics, natural sciences and technology, which is detrimental to the self-concept of their talents (Heller & Ziegler, 1996).

There was also a clear gender difference in the reason for studying science, as male students cited future careers and pure interest as the main reason, while female students mainly mentioned exams and entrance into

higher education (Jeong & others, 2003).

Thus the attitude of teachers influence the ability of female students. Most importantly, teacher should develop teaching materials and methods in order to encourage female students to develop more interest in mathematics and science, and to take the self-initiative in studying.

The career choice patterns of women is transforming, and more females are choosing to work in scientific fields or professional occupations. However, compared to the excellent academic achievements that female students possess, the Korean society significantly lags in its ability to accommodate the entry of female labor. As an example, the proportion of females in university faculties is only about 15%. Regarding the fact that females students account for 37% in universities and 40% in graduate schools, the proportion of female professors seems to be overly low. In order to resolve such gender imbalance, plans should be continuously sought to increase recruitment opportunities for female professors of excellent performance (Park, 2004).

Moreover, the role of education is crucial for encouraging the involvement of women in economic activity, and promote the social status of females. Only when there is appropriate education to establish proper sexual identity and social roles of women, is it possible to successfully cultivate and utilize the female talents for the benefit of the individual and the nation.

References

Cho, S., Choi, H., Kim, H., Yoon, H. & Kwon, K. (2002). Factors influenced Korean gifted girls and boys to become International Math and Science Olympians. Journal of Gifted & Talented Education, 12(1) 31-59.

Cho, S.,Kim, D. I. Park, S. I. Cho, S. H., Park, I. H., & Moon, H. J. (2004), Plans to encourage educational policies for the gifted, RM 2004-1, Korean Educational Development Institute.

Choi, S. H., Noh, K. H. & Park, K. M. (2001). The Results of PISA 2000. RRE 2001-9-3. Korea Institute of Curriculum & Evaluation.

Chosunilbo, Oct. 15th, 2005, A10.

Heller, K. A. & Ziegler, A.(1996). Gender differences in Mathematics and the Natural sciences: Can attributional retraining improve the performance of gifted females? Gifted Child Quarterly, 40, 200-210.

Jeong, K., Jeong, H., Shin, D. & Seo, H. (2003). A Study of educational policies to reduce gender difference in scientific literacy of middle and high school students. Policy Study 2003-14, Ministry of Education and Human Resources Development.

Lee, M. Kwak, Y., Min, K., Chae, S., Choi, S., Choi, M. & Na, G. (2004). The Results from PISA 2003. RRE 2004-2-1. Korea Institute of Curriculum & Evaluation.

Lee, S. D. (2004). Utilizing female manpower, what is the problem? Opinions on Education.

OECD (2004). Learning for Tomorrow's World--First Results from PISA 2003.

Park, H. J. (2003). Statistics on Korean education: the proportion of female teachers. Educational Policy Forum, 29. Korean Educational Development Institute.

Park, C., Jeong, E., Kim, K. Han, K. & Lee, S. (2004). Findings from trends
in international Mathematics and Science study for Korea : TIMSS 2003 report in Korea. RRE 2004-3-2. Korea Institute of Curriculum & Evaluation.

Park, K. S. (2000). The Influence of the Confucian Classics on woman education. The Journal of Korean Education, 27(2), 21 -42.

Shim, J. & Park, E. (2003). Research on the change of consciousness of the gifted students in Science. Journal of Gifted/talented Education. 13(2), 95-112.

요 약

한국의 여성교육과 정책의 흐름 : 수학, 과학, 직업선택을 중심으로

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본 연구는 한국 여성들의 교육과 정책 변화의 흐름을 알아보는 것이다. 먼저 여성 교육에 대한 편견이 깊이 뿌리박혀 있는 한국에서의 여성 교육의 역사적 배경을 살펴보았다. PISA와 TIMSS와 같은 학업성취도 국제 비교 연구와, 국가수준 학업성취도 연구를 통해 특별히 과학과 수학에서 남녀 학생의 성취 수준의 차이를 알아보았다. 여학생들이 일반적인 학업성취에서는 남학생보다 우수하거나 같았고, 국제평가에서는 읽기 소양에서는 남학생보다 높은 성취를 보였으나, 수학과 과학에서는 남학생보다 훨씬 낮은 수준이었다. 남여 학생 간의 성취도의 차이는 OECD 회원국 중에서 가장 컸다. 또한 교육 제도와 학업과 직업적 성취를 중심으로 현대사회에서 여성의 위치가 어떻게 변하고 있는지를 조사했다. 더불어 여성 전문가 양성을 지원하는 다양한 계획과 정책에 대해서도 소개했다. 끝으로, 남학생과 여학생의 학업성취 격차에 대한 원인들을 살펴보았고, 수학과 과학의 남녀 학생의 차이를 줄이기 위한 몇 가지 제안을 했다.