

Reaching Gender Equity in Mathematics Education

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Equity in mathematics education has been viewed by Fennema (1990) and by the American Association of University Women (AAUW) Educational Foundation (1992, 1998) as comprising several elements, among them equity of educational outcome. Equity of outcome is taken here to mean outcomes which, though they may vary from individual to individual, are not correlated with gender, race, class, or ethnicity. This paper will concern itself with the factor of gender alone, however, and from that point of view will consider two aspects of educational outcome: Part I will discuss the relative mathematics achievement (student performance) of boys and girls at the elementary and secondary levels, while Part II will discuss the relative representation of males and females at all levels of education in general and in the mathematical sciences in particular. The paper will present information on the progress towards gender equity in mathematics outcomes that has been made since the early sixties.

An overview of research in gender differences

Equality for women in society in general and in education in particular has been a concern of many for a long time, but until the sixties the position of women in mathematics and science did not figure prominently in the scientific literature. In the course of that decade, however, equality of access to education in mathematics and science for women became one of the predominant aims of the feminist movement, and researchers increasingly turned their attention to this issue.

It was the position of feminists and of others that equity required the creation of conditions that would ensure equal representation of males and females in mathematics and science courses in high school, including the advanced courses, as well as in the mathematics and science programs in the universities. The full participation of women in society required, in this view, that they have equal opportunities to take up careers in science and technology. Unequal representation at any level, it was reasoned, would perpetuate unequal representation at higher levels of education and ultimately an existing pattern of gender segregation across the work force.

Much of the research on equality of outcome published up to the early seventies, the so-called "first generation of research" summarized by Fennema (1974) and Leder (1992), attempted to explain the low participation and achievement of women in mathematics and science by deficient spatial ability and by other cognitive disadvantages. Their allegedly inferior ability in mathematics was viewed by many as due to innate biological factors.

This first wave of research into gender differences also looked at other factors inhibiting females' pursuit of the study of mathematics, however. Among them were the generally held beliefs that mathematics and science are male domains, that only people with "mathematical minds," mostly men, can do mathematics, and that one cannot be good in both language arts and mathematics (with the corollary that women, held to be good in language arts, cannot also be good in mathematics).

Another factor explored was disabling behaviours among female students, such as the lack of confidence they often displayed even when successful. (Females were found to be likely to attribute success to sheer luck and failure to poor ability, whereas male students tend to attribute success to high ability and failure to external factors such as bad teaching or lack of effort.) Such beliefs and behaviours were seen as a serious hindrance to the learning of mathematics, but they too tended to be viewed at the time as reflections of a reality rooted in biology.

From the early seventies, however, sociologists, psychologists and educational researchers have moved to a “second generation of research,” turning away from the assumption that innate biological factors and their derivative beliefs and behaviours dictate the observed gender differences in participation and achievement. Most modern educational research on gender similarities and differences came to be based on the premise that there is no physical or intellectual barrier to the participation of women in mathematics, science, or technology.

Indeed, it is now generally accepted that women have been and continue to be under-represented in these fields mainly because of social and cultural barriers that did not and may still not accord them equal opportunities. For the most part, these barriers were not raised intentionally, but formed an integral part of a social order that reflected an often unconscious gender discrimination. Thus the second wave of educational research focussed upon such social and cultural factors as the stereotyped sex-role identifications, the curriculum, the learning situation, and the differential treatment by teachers and parents.

This research found that such social and cultural factors did play a crucial role in both the low achievement and the low participation of women in mathematics and science. Researchers of this second generation identified, for example, a “chilly climate” for females in the classroom, finding that boys tended to get more attention than girls, and that boys were channelled into advanced courses in mathematics and science even when their grades in these subjects were lower than those of girls. The seminal work of several researchers, published in scholarly journals and in edited books such as, Burton (1990), Fennema and Leder (1990), Grevholm and Hanna (1995), Hanna (1996), Rogers and Kaiser (1995), directed the attention of mathematics and science educators to the important role that teachers, administrators, school board members and parents can play in promoting gender equality in both achievement and representation.

Part I: Equity of outcome as equality in educational achievement

In looking at educational achievement by gender it is helpful to consult the three studies conducted by the International Association for the Evaluation of Educational Achievement (IEA) in 1964, 1980-82, and 1995. The First, Second, and Third International Mathematics Study have come to be known as FIMS, SIMS, and TIMSS respectively (the additional S in TIMSS stands for Science). It was never a declared aim of the IEA to investigate gender differences in achievement or in attitudes towards mathematics, but its studies have in fact been particularly important to our understanding of gender differences, mainly because they have made it possible to conduct reliable cross-cultural investigations.

The IEA studies provided convincing evidence that gender differences in achievement vary widely from country to country, with the degree and direction of variation depending greatly on topic and grade level. In some countries the studies revealed marked gender differences favouring males in some topics, in other countries no gender differences were found, and in a few countries the studies showed gender differences that favoured females. These findings are potentially of major importance. They indicate, first of all, that some educational systems do provide, wittingly or unwittingly, educational conditions that work to prevent an achievement gap between males and females in mathematics. Secondly, in showing that gender differences in mathematics achievement vary in magnitude and direction from country to country, the IEA findings call into question the validity of the claim made by a number of researchers that there are innate differences between males and females in mathematical ability.

The IEA studies did more than reveal great inconsistencies among school systems. They also

provided a wealth of information about the degree and direction of gender differences as they relate to other variables, such as the curriculum, the organization of the classroom, and attitudes towards mathematics. In so doing they opened the door to a much more detailed understanding of gender differences in achievement.

More than thirty years elapsed between the first and third IEA studies. Over this interval, from 1964 to 1995, gender issues assumed a much higher profile among educators, as in society as a whole, and substantial changes were made in the mathematics curricula and the classroom practices of most of the participating countries in response to the demand for educational equity. In addition, the presence of women in mathematics and in science increased dramatically during this period, partly as a result of intervention programs aimed at encouraging their participation and of policies based on considerations of gender equity.

FIMS

Population I

Keeves (1973) found that boys performed better than girls in overall mathematics achievement at the 13-year-old level (Population I) in all the ten original FIMS countries. He also found some variation among countries in the size of the gender differences at this level, with the smallest gender difference in the United States and the largest in Belgium and the Netherlands.

When Steinkamp, Harnisch, Walberg, and Tsai (1985) re-analyzed the 1964 and 1970 FIMS data for Population I (13-year-olds), using the data from all twelve FIMS countries, they found that boys outperformed girls in 10 out of 12 countries in overall mathematical achievement, with eight of these differences reaching statistical significance; the range of effect was quite small, accounting for only 1% to 9% of population variance.

Steinkamp and her colleagues also identified a number of important contextual variables for gender differences in mathematics subjects, such as student attitude, opportunity to learn, and the amount of homework. Their conclusions on overall mathematical achievement were that: (1) gender differences are small; (2) it is impossible to know whether or not initial potential is equal; (3) psycho-social factors play a role in creating or reducing differences; (4) in light of the pervasiveness of differences, biology may well play a role; and (5) the differences in school achievement are not large enough in themselves to produce the huge differences that exist in course selection, occupational choice and professional status.

Population II

Comparisons between sexes were more complex at the pre-university level (Population II), because of the large differences in the participation rates of the sexes. Keeves (1973) concluded that the differences in achievement between the sexes were even greater in Population II than in Population I.

Harnisch, Steinkamp, Tsai and Walberg (1986), in a re-analysis of the FIMS data, were able to determine the magnitude, direction, and nature of gender differences among 17-year-olds in ten countries. They came to the conclusion that achievement differences were small but pervasive across cultures. Males scored higher on overall achievement in all ten countries. In all but one of the ten countries, these differences, though small, were statistically significant (possibly as a result of the large sample size). Percentages of variance accounted for by gender as measured by the ω^2 index were rather small, ranging from 0% to 12%.

Despite the above findings, the authors added that *A*the pattern of differences -- which are pervasive, always favor males, and persist across cultures -- are not inconsistent with a biological etiology@ (p. 236). In the part of their paper devoted to summary and implications the authors did back off somewhat from this statement, saying that *A*patterns emerging in the data suggest that differences between the sexes are not immutable, however, and provide empirical evidence that non-biological factors play a role in determining the magnitude of gender differences@ (p. 241).

SIMS

Population A

The Second International Mathematics Study (SIMS) investigated two groups: students aged 13 (Population A) and students in the last year of secondary school (Population B). Twenty countries were represented in Population A and 15 in Population B.

Analysis of the SIMS data on mathematics achievement collected in 1981-1982 for Population A showed not only that gender differences vary widely from country to country, but also that they are smaller than differences among countries (Hanna, 1989, 1994). The tests items were grouped into five subtests: Arithmetic, Algebra, Geometry, Measurement, and Descriptive Statistics. In five of the 20 participating countries girls did as well as boys or outperformed boys in one or two of the five subtests, in five other countries no gender-related differences were observed in any subtest, while in the remaining ten countries it was boys who did as well as girls or better on one to five of the subtests.

Population B

In Population B (last year of secondary school) the results of the seven subtests (Sets, Number Systems, Algebra, Geometry, Finite Mathematics, Analysis, and Probability) for the 15 participating countries showed an overall increase in the gender gap as compared with Population A, with girls clearly less successful than boys. In no country did girls perform better than boys on any of the seven subtests, and only in two countries did girls perform about the same as boys in most of the subtests. In three of the 15 countries there were gender differences in the boys= favour in up to three of the subtests, while in all the remaining ten countries boys performed better on four to six of the seven subtests.

TIMSS

Population 1

TIMSS surpassed its two predecessors in the number of countries participating, in the number of populations tested, and in the types of test included. Over 40 countries took part, and three populations were tested. Population 1 consisted of students in the adjacent grades 3 or 4 (where most of the students were 9-year-olds) and Population 2 of students in the adjacent grades 7 or 8 (where most of the students were 13-year-olds). Population 3 comprised students in their final year of secondary school, as well as other students who were taking an advanced mathematics course containing calculus. Unlike FIMS and SIMS, where tests consisted solely of multiple-choice items, the TIMSS tests included open and extended response items.

The findings presented here are based on initial TIMSS reports, as distributed in hard copy and posted on the World Wide Web by Mullis et al. (1997 and 1998), by Beaton et al. (1996) and by Beaton and Robitaille (1999). Gender-difference analyses of the data by other researchers have not yet been published.

For Population 1, according to Beaton and Robitaille (1999), gender differences were small or essentially non-existent in most countries. The few gender differences that did exist tended to favour boys, however, in both Grade 3 and Grade 4.

The tests in Grades 3 and 4 covered the following content areas: 1) Mathematics overall, 2) Whole numbers, 3) Fractions and proportionality, 4) Measurement, estimation and number sense, 5) Data representation and probability, 6) Geometry, and 7) Patterns, relations and functions.

In Grade 3, as shown in Figure 1, there were no gender differences in eight of the 24 participating countries in any of these seven content areas. Boys did have higher scores than girls in one content area in six countries, in two content areas in three countries, and in three to five content areas in five of the 24 countries. Girls had higher scores than boys more rarely, in one content area in one country and in two content areas in two countries.

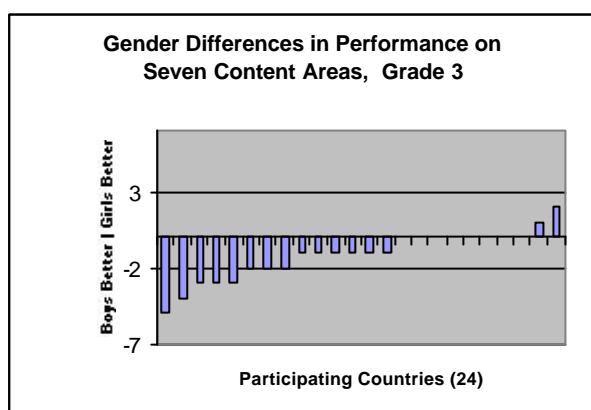


Figure 1: Grade 3 (TIMSS)

In Grade 4, as shown in Figure 2, the situation was a bit more favourable. In 11 of the 25 participating countries there were no gender differences at all, and in three countries there were differences in the girls' favour for one or three of the seven content areas. In seven of the other 11 countries boys did better only in one content area, while in the remaining four countries boys did better in 2 to 4 content areas.

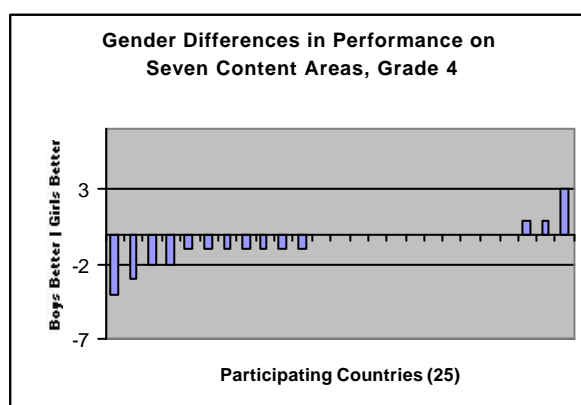


Figure 2: Grade 4 (TIMSS)

Population 2

In Population 2 (Grades 7 and 8) most countries showed no gender differences, but the few statistically significant differences again tended to favour boys. For these two grades, the content areas were: 1) Mathematics overall, 2) Fractions and number sense, 3) Geometry, 4) Algebra, 5) Data representation, analysis and probability, 6) Measurement, and 7) Proportionality.

In Grade 8, girls did better than boys in Algebra in most countries, though the differences were not statistically significant. There were no statistically significant differences between boys and girls in Proportionality either. Out of the 41 countries that participated in the testing, there were significant differences favouring boys in only one country for the three areas of Geometry, Fractions, and Data Representation, in two countries for Mathematics overall, and in four countries for the area of Measurement. The results for Grade 7 were quite similar. There were few gender differences. With the exception of Algebra, where girls did better, the few differences that did exist were in the boys' favour.

Population 3

In Population 3, the final year of secondary school, gender differences in mean achievement on the test as a whole, for students who had taken advanced mathematics, were statistically significant in eleven of the sixteen participating countries. Here there were three content areas: Numbers and equations, Calculus, and Geometry. The results by content area showed that in five countries there were no statistically significant differences between boys and girls in any content area, and that in four countries there were no significant differences in one or two of the areas. In the remaining seven countries, however, there were significant differences in all three content areas, with all of the differences favouring males.

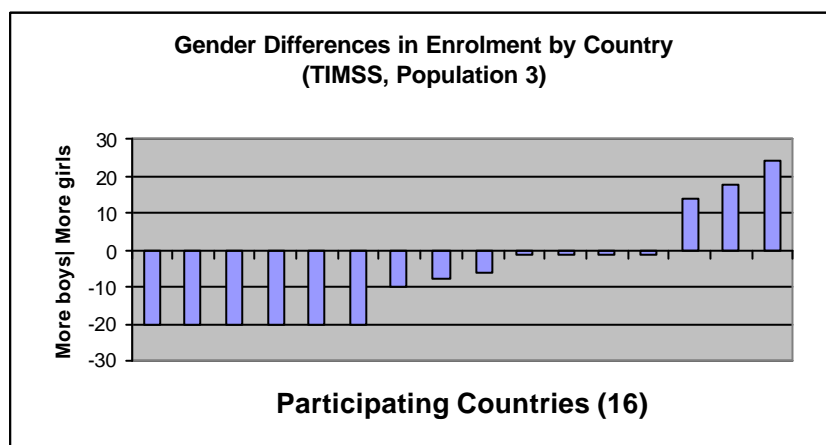


Figure 3: Difference in percentage of enrolments in mathematics courses

Population 3 also showed considerable variation in the relative number of male and female students taking advanced mathematics courses. In nine of the 16 countries there were more males than females in these courses (in six of these nine the proportion of males was 20 percentage points higher than that of females, while in three this difference in favour of males was smaller, ranging from six to ten percentage points). In four of the 16 countries males and females were almost equally represented. In the remaining three countries (Germany, the Czech Republic and Austria) more females than males were taking advanced mathematics, and their proportion exceeded that of males by 14, 18 and 24 percentage points respectively (see Figure 3).

In sum, the results of the TIMSS cross-national study, encompassing more than 40 countries and about half a million boys and girls, indicate that up to Grade 8 there are very few significant gender differences in achievement. The results also show that at the level of advanced mathematics (in the last grade of secondary school), five out of the 16 participating countries provide conditions which have led to an almost total disappearance of gender differences in achievement.

A comparison of the results of the three IEA studies (see Table 1) gives a clear indication that gender differences in mathematics achievement at age 13 have decreased dramatically and all but disappeared in all the participating countries. In effect, gender equity has been reached for this age group. At age 17, on the other hand, boys are still doing better than girls in some areas of mathematics, though the gender gap has considerably decreased over the years 1964 to 1995.

Conclusion

The clear message from the IEA cross-national studies is that gender differences in mathematics decreased considerably over the thirty years or so covered by these studies, and indeed are on the way to disappearing. Perhaps the most significant contribution of these international comparisons, in the context of gender studies, is to have revealed that several countries have in effect achieved gender equity in mathematics. This fact presents a challenge to those countries that have not yet done so. Clearly these countries should attempt to find out what specific educational practices were successful in bringing about gender equity elsewhere, and how these could be implemented in their own educational settings.

Table 1. The decreasing gender gap in mathematics achievement from FIMS to TIMSS for two age levels

	Age 13	Age 17 - 18
FIMS (1964)	1) Differences in boys' favour in 10 out of 12 countries. 2) Considerable variation between countries in the extent of gender differences.	1) Differences in boys' favour in all 10 countries. 2) Considerable variation between countries in the extent of gender differences.
SIMS (1980-1982)	1) No differences in 5 out of 20 countries on all subtests. 2) Differences in boys' favour in 10 countries, in up to 2 out of 5 subtests. 3) Differences in girls' favour in 5 countries in up to 2 out of 5 subtests.	1) No differences in 3 out of 15 countries on 6 out of 7 subtests. 2) Differences in boys' favour in 12 countries on 2 to 6 subtests.
TIMSS (1995)	1) No differences in overall achievement in 37 out of 39 countries 2) Slight differences in girls' favour in Algebra in 12 countries (in Grade 8).	1) No differences in 5 out of 16 countries 2) Differences in boys' favour in 4 countries on up to 2 content areas and in 7 countries on each of the 3 content areas.
	Equity achieved	Gap decreased but not eliminated

Part II. Equity of outcome as equality in representation

In terms of representation, full gender equity has not been reached, despite numerous policies

and legal measures put in place to encourage it. Women have achieved a considerable presence at all levels of education over the past few decades, and indeed have made a substantial advance in the sciences. In certain scientific disciplines, however, notably mathematics, physics and engineering, their presence still lags behind that of men.

The following section discusses the increasing participation of women in undergraduate programs, using data published in the UNESCO Statistical Yearbooks of 1972, 1988 and 1998 for a number of countries that participated in IEA studies. It discusses two other topics as well, based upon other data: the participation of women in undergraduate and graduate science and engineering programs in the US and Canada, and their representation in professional scientific and engineering occupations in the US.

The presence of women in university programs

Over the last few decades the participation of women in higher education has increased dramatically across the board. For ease of presentation, this topic is discussed here for three groups of countries: (1) four non-European English-speaking countries, (2) a selection of European countries and (3) a selection of other countries. In all cases the participation of women is measured in relative terms, as the proportion of the entire student body which they constitute.

In Canada, Australia, the USA and New Zealand, as shown in Figure 4, women made up well over half of all university students in 1994/1995. Their representation had increased steadily to this level from a low of well under 30% of all university students (in Australia in 1960).

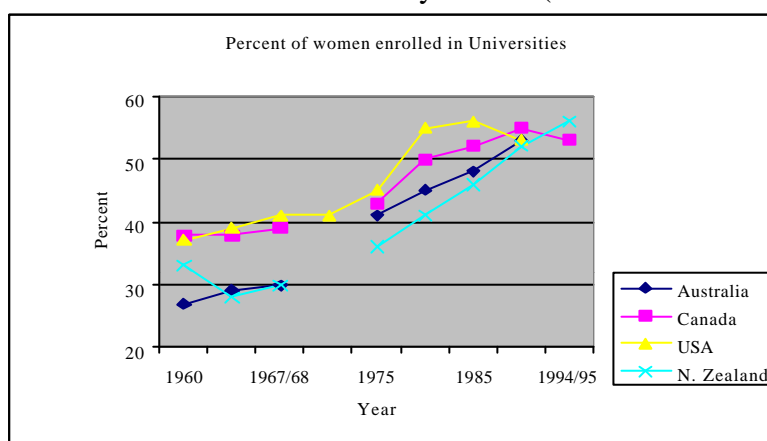


Figure 4: Percentage of women enrolled in universities in Australia, Canada, the US and New Zealand

The ten European countries for which data are presented in Figure 5 show widely differing proportions of women among university students. Though their participation did increase in all these countries over the entire period presented, 1960 to 1995, the rate of increase was far from uniform. In Switzerland, for example, there was actually a decline in their university enrolment from 17% of the student body in 1960 to 10% in 1965. This was followed, however, by a consistent increase from 1965 to 1995, reaching a high of 38% of all students in Swiss universities in 1995. In Norway, on the other hand, the proportion of women increased steadily over the entire period, from 21% in 1960 to 55% in 1995.

In 1960, Finland was ahead of the other nine countries, with the highest proportion of women among university students (46%). But by 1975 Finland had been overtaken by France and

Hungary, where women made up 48% of enrolments, and by 1990 by Norway as well. Unfortunately, data for Finland was not available beyond 1990. The countries where women had become 50% or more of all university students by 1995 were Finland (52%) France (54%), Greece (50%), Hungary (52%), Italy (53%) and Norway (55%).

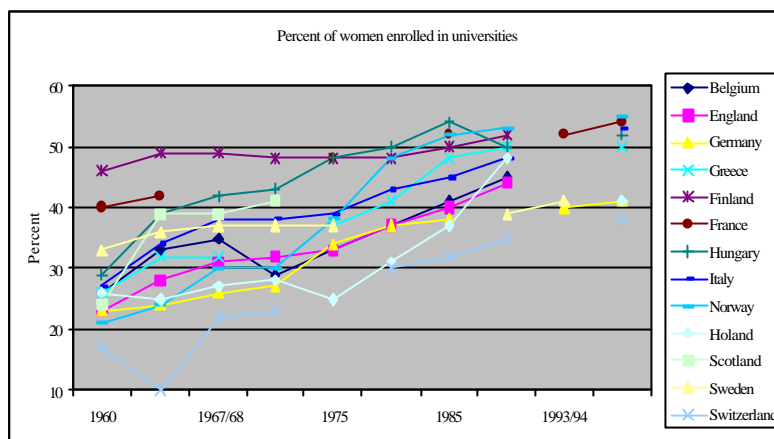


Figure 5: Percentage of women enrolled in universities in ten European countries

An upward trend can be seen in many other countries as well. In Cyprus, in fact, women made up over half of all university students in 1995, as shown in Figure 6. Their participation levels have reached 48% in South Africa, 47% in Jordan and 42% in Egypt. In Japan, however, women still represented less than 30% of all students in 1990 (the last year for which we have data), the lowest participation rate for that year of the five countries discussed here.

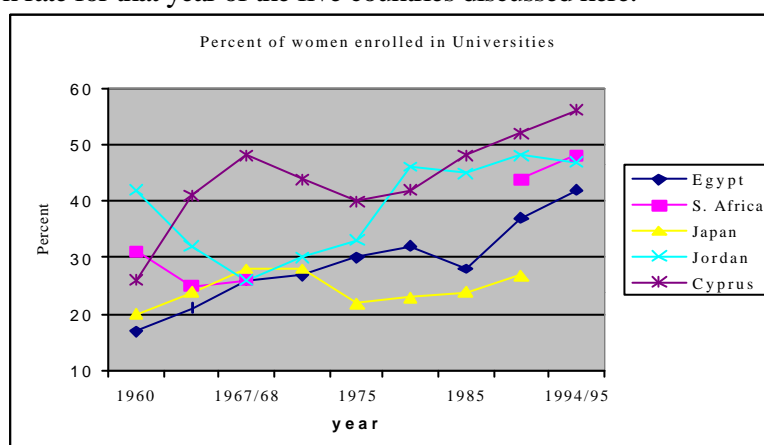
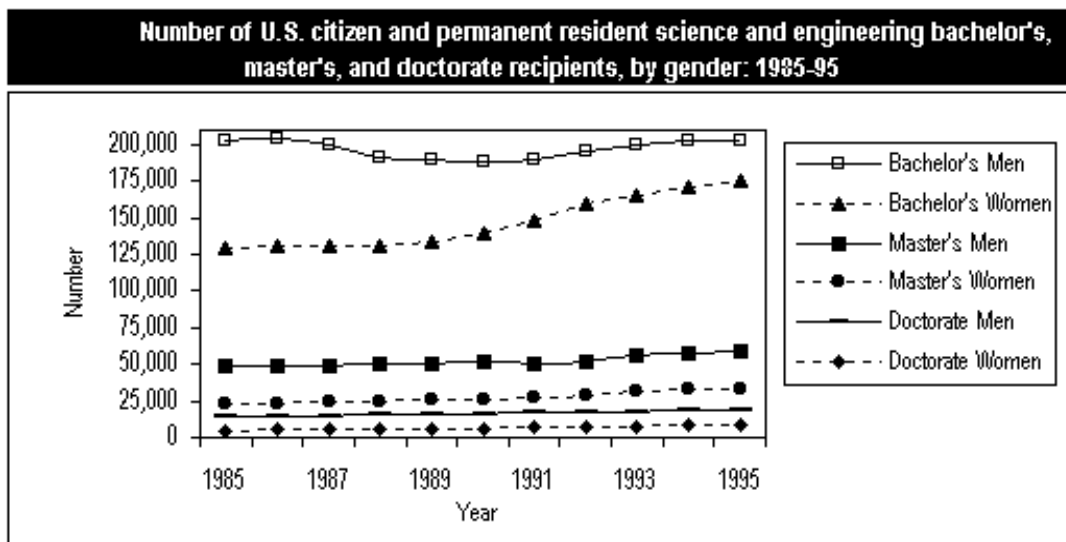


Figure 6: Percentage of women enrolled in universities in South Africa, Japan, Jordan and Cyprus

Participation in science and engineering in higher education in the US and in Canada

In her report to the United States National Science Foundation, Olson (1999) presented her conclusion that women were still under-represented in undergraduate and graduate science and engineering. Though in 1995 women were 50% of the US population in the 18 to 30 age bracket and their share of total undergraduate enrolment was 56%, they received only 46% of the bachelors' degrees in the mathematical sciences. Even this was a considerable improvement, however, over their participation in undergraduate science and engineering in earlier years. As shown in Figure 7, the number of women receiving bachelor's degrees in science and

engineering was 128,871 in 1985 and 175,931 in 1995, an increase of 36% between 1985 and 1995. During the same period, the number of men receiving bachelor's degrees in these two areas fluctuated somewhat, but remained close to 200,000.



SOURCE: National Science Foundation, Division of Science Resources Studies, *Women, Minorities, and Persons with Disabilities in Science and Engineering: 1998*, forthcoming.

Figure 7: Number of women and men in science and engineering programs, U.S.

The proportion of women in graduate science and engineering programs grew much faster than the proportion in undergraduate programs over the same decade, by 45%. But at the end of the decade women were still only 41% of all science and engineering graduate students. A similar pattern presents itself at the doctoral level. The proportion of women in doctoral programs increased by an impressive 65% between 1985 and 1995, but at the end of that period women still received only 10% of the doctorates in engineering and 40% of those in the biological sciences.

In Canada, in comparison, as shown in Figure 8, the proportion of women among students of mathematics rose from 30% in 1973 to 40% in 1995 at the undergraduate level, from 22% to 31% at the masters level and from 8% to 22% at the doctoral level. The increase in the proportion of women studying engineering was more dramatic, rising from 3% to 18% at the bachelor's and master's levels, and from 4% to 10% at the doctoral level.

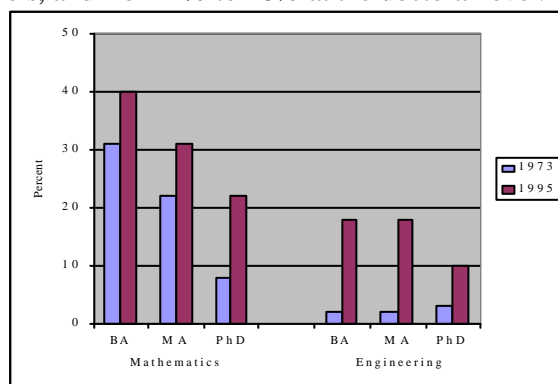


Figure 8: Percentage of women enrolled in mathematics and engineering by level of study, Canada

The presence of women in the professions

Not only did women increase their presence at the undergraduate level, they did so at the tertiary level as well, and in great numbers. The most recent data from the USA indicate that women were the recipients of 41.8% of all doctorate degrees in 1998, the highest number or percentage ever granted to that group, up from 40.6% in 1997 and continuing a 30 year upward trend (Sanderson, Dugoni, Hoffer, and Selfa, 1999).

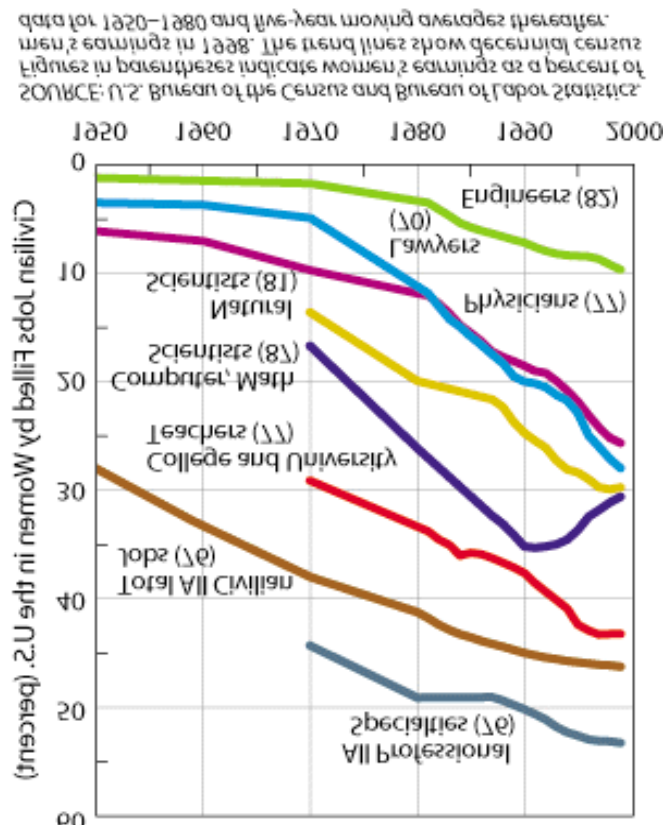


Figure 9: Jobs filled by women in the U.S. Source: Scientific American, April 2000

As reported by Doyle (2000) in the *Scientific American's* section "by the numbers" and shown in Figure 9, the proportion of women in the professions has steadily increased in the United States since the 1950s, but their level of participation varies widely from profession to profession. In 1998 women held 53% of all professional jobs in the US, including teaching and nursing, but only 28% of the jobs in the six better-paying professions (engineering, law, medicine, natural science, computer science, and college and university teaching). In addition, those women who did have jobs in these professions were less well paid. In 1998 women held between 10% and 42% of the jobs in these six better-paying professional jobs, but their earnings were only between 70% and 87% of those of men.

Epilogue: The battle over boys, a new equity concern

As we begin the new millennium, gender equity has not yet been achieved, but enormous strides have been made in that direction. Several organisations were very active in bringing about the changes that have been made, notably the American Association of University Women, a national organization in the US that has long promoted education and equity for all women and girls. In recent years the AAUW has published two influential reports analysing the situation and offering policies and programs: *How Schools Shortchange Girls* (1992) and *Gender Gaps: Where Schools Still Fail Our Children* (1998).

What seems to have made the difference, in particular over the two decades, is the attention paid to social and political factors. This attention owed much to the extensive research carried out on barriers to the equal participation of girls in school mathematics, such as inadequate parental support, inequitable treatment in the classroom (in particular inequitable interaction between teacher and student) and the preconceptions that mathematics is a male domain and in any case is useful in later life only to men.

In Canada and the United States there was a wide adoption over the last two decades of policies aimed at fostering equitable treatment of boys and girls, and in line with these policies many educational authorities have taken important steps to correct inequities. One such step was the introduction of female-friendly teaching techniques (which were found to help both men and women). Many of these interventions required special effort and political will, since they were designed to provide active and targeted encouragement and assistance to women in pursuing the study of mathematics and science. It is perhaps not surprising that such active gender-equity programs have spawned considerable criticism.

These intervention programs seem to have been very successful indeed, in both the United States and Canada. Some might think them too successful, judging by recent statistics showing that girls are beginning to outnumber boys in most secondary-schools mathematics and science courses. Data published by the US Department of Education on the 1990 and 1994 secondary-school graduation classes in the US reveal that there were more girls than boys in both biology and chemistry, for example, and that physics was the only subject in which male enrolments were still significantly higher than those of females (with a ratio of males to females of about 1.2). In every other science course (including mathematics courses) the difference between boys and girls was either slight or favoured girls. The figures also showed that 43% of the girls graduating from high school in 1994 had taken college-preparatory programs, compared with 35% of the boys.

The recent relatively low enrolment of boys in mathematics and science has become a subject of public discussion, notably in the *Wall Street Journal* (Ravitch, 1998). There is now a spate of books and articles on the plight of boys, in fact. Among the books are William Polack's *Real boys' voices* (2000) and Christina Hoff Sommers' *The war against boys: How misguided feminism is harming our young men* (2000).

Judith Kleinfeld's provocatively titled paper "The myth that schools shortchange girls: Social science in the service of deception" (1998), prepared for the Women's Freedom Network, claims that boys are the group that is shortchanged in schools. Kleinfeld states that it is the girls who regularly obtain high grades in schools in reading and writing and who graduate from colleges in

the greatest number. In addition, she claims, "There is strong evidence of bias against boys." (p. 3). She presents research data to support her contention that boys are more likely than girls to be labelled as educationally impaired and assigned to special education classes.

Kleinfeld also disagrees with the claim made in the AAUW reports (1992; 1998) that "males receive more teacher attention than do females." The studies she cites indicate that gender differences in teacher attention follow an inconsistent pattern, with some teachers paying more attention to girls and others more to boys. Recognising the success of the special programs introduced to improve mathematics and science teaching for females, Kleinfeld deplores the lack of such programs in areas where boys have done and continue to do poorly, mainly the language arts. In her conclusion she makes the strong statement that "The charge that the schools shortchange girls is false political propaganda."

It is perhaps ironic that the concern of educators has now turned to the low participation of males in science and mathematics courses. As discussed, the under-representation of females in these subjects up to the seventies had been ascribed by many to biological differences. It was suggested, in particular, that mathematics is inherently foreign to the female mind. Interestingly enough, the under-representation of men in science and mathematics today does not seem to have given rise to similar biological explanations. Instead, and rightly so, researchers have tended to invoke social influences. To motivate young men to pursue studies in mathematics and science, researchers and advocates of educational equity have thus come to propose the use of intervention programs of the sort that have proved so successful with women.

Acknowledgments

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