The Scientific Education of Girls

Education Beyond Reproach?

Work carried out by the French Commission for UNESCO under the supervision of Renée Clair

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Chapter 1

Grandeur and Penury of International Statistics

Claude Musnil

ABSTRACT: *The text addresses the difficulties one researcher encountered while trying to study the situation of young women in the scientific and technical streams of secondary and higher education, working from international statistical yearbooks. It reports on the data compiled using vague indicators that are impossible to compare, given their heterogeneous reference dates, and that are particularly inapplicable due to the lack of any breakdown by gender. The fact that such statistics are unavailable may well prove that the question of women's access to scientific careers, and to scientific culture in general, has not been raised as yet by international organizations.*

Studies and research on women's access to education highlight their meager presence in scientific and technological training. A similar observation arises from work on female participation in professions in the science and technology sector. Given the convergence of conclusions reached at all levels (regional, national, international), it is clear that this situation exists on all five continents. This reveals to the need to obtain figures throughout the planet in order to achieve a better understanding of the scope and extent of the problem.

How can this panoramic vision be obtained? By using international statistics to build a reliable image of the present situation and to measure any progress or regression in women's access to science and technology over the past few years.

The 1993 edition of the *UNESCO Annual Statistical Yearbook* gathered up data from some 200 countries and territories. That made it a prime source, and the best suited to our purposes. A careful study of the tables on secondary and higher education, as well as of the human potential in the scientific and vocational fields, reveals how extremely difficult it is to carry out the proposed task, due to obstacles such as:

- the way the data is presented,
- the disparity in the dates of the latest available data,

- the absence of a breakdown by gender in many responses.

(1) PRESENTATION OF DATA

Data on secondary education falls into three categories:

- general education,
- pedagogical education (preparation for the teaching profession),
- technical and vocational education (preparation for a profession or a job other than in teaching).

As no distinction is made between the scientific and non-scientific streams of general education, this information is not pertinent. The structural differences between the educational systems obviously explain this globalization. Nevertheless, it would be extremely wise to design new survey questionnaires that indicate the main subjects in the secondary school streams, as the choices made at this level affect the type of university studies elected.

Technical and vocational education obviously includes service sector training (mainly attended by girls), and training in the industrial sector where their presence is to be inventoried. Unfortunately this presentation doesn't reflect the diversity of the data gathered, which resulted in an excellent document (*cf infra*) drawn up by UNESCO's Division of Statistics as part of the preparation of the Fourth World Conference on Women.

The data contained in this document would be far easier to utilize if UNESCO, like all the major international organizations, didn't conform to the ISCED (International Standard Classification of Education), whose fields of activities should be rethought and adapted to follow the changes in the professional world. Some headings are surprising (religion and theology), some are old-fashioned (home economics) or far too vast (commerce and service trades; craft and industrial production), which is even more serious.

If we look at the statistics on higher education, we find that activities are grouped in ways that are not very compatible with our approach:

- The 'natural sciences' heading groups physics, chemistry, biology and geology.
- Mathematics and computer science are put together.
- Health studies are combined.

Finally, the 'crafts and industry' heading makes no distinction between traditionally feminine trades (chiefly clothing, furs and leather) and sectors where women are rarely present, if at all.

Only the 'engineering' heading offers information that can be used, as it is less liable to group dissimilar situations. That is why it was possible to carry out a study based on the figures it contains (*cf infra*) and to present a view of female participation in this field of study in certain countries.

Turning away from the area of education, let's look at 'scientific and technical manpower', the subject of a table that gives the following information for a given nation:

- either the total 'stock' of people with the required qualifications to be classified in one of two categories: 'scientists and engineers' or 'technicians';
- or the number of such people working or actively seeking employment in any branch of the economy at a given date.

Here again, the 'technicians' heading is just as vague as the education field, and gives no information on the sector of qualification.

The grouping of the truly active population with job-seekers is even more problematic. A comparison between men and women regarding this specific point would shed precious light on the chances both sexes have of obtaining a job in scientific and technological fields. It would also be good to have a broader choice of responses, as they concern only 69 countries, of which 22 provide information on the 'stock' of qualified staff and 47 indicate the number of actively employed and job-seekers.

Information of this type, even partial, would provide a preliminary vision that is of interest if only the reference dates were not so diverse as to make any overall view impossible.

(2) REFERENCE DATES

In spite of the rather unsatisfactory character of the headings used, as pointed out above, data on higher education could be used to give an approximate assessment of the female population involved in scientific and technological studies, if the reference dates didn't vary so much from one response to the next. 149 states or territories are included in the 'higher education' tables in the 1993 edition of the *Statistical Yearbook*. Only 45 responses date from 1991, 41 from 1990, 28 from 1989 and the remaining 35 go back even further, including 10 prior to 1985. Obviously, any attempt to make a comparative assessment of female

movement would concern a very limited number of countries and be of no significance.

The possibilities of using the data on 'human manpower' are even worse. Out of 69 responses, 30 refer to the years 1980 through 1984, and there are only 17 entries for 1990 and 1991.

(3) ABSENCE OF BREAKDOWN BY GENDER

As we have seen, the inadequate, heterogeneous classification of data entry dates is a serious handicap in drawing up any coherent statistics on female participation in education and professions in the fields of science and technology. This is of less consequence, however, when the data, no matter how imperfect, makes a distinction according to gender. Some countries do not even follow UNESCO's recommendations on this subject; 28 of them quoted figures for the total student body for higher education in the surveys between 1985 and 1991. Nineteen responses to the questionnaires on 'human potential' adopted the same approach. In this specific case, 25% of the total data gathered cannot be used, due solely to the absence of any breakdown by gender.

Consequently, a credible statistical approach to the presence of women in the fields of science and technology is necessarily very limited. Only the years 1990 and 1991 can be used to measure an evolution in comparison with the five preceding years. Of the 86 entries on higher education corresponding to these dates, 14 give no information as to the female public. That leaves 72 usable responses, less than half of the 149 responses gathered (48%).

Charting any evolution in female workers from 1985 to 1990–91 would require using only 55 countries, due to the total absence of data for 1985 or to the lack of any gender breakdown. Instead of the desired panorama, all we would get is a partial view limited to 37% of the countries and territories having responded to the survey.

As for 'human potential', 1990 and 1991 are covered in only 17 responses out of 69, and five of those give global figures that cannot be used. Obviously, these low figures make any utilization impossible.

On the eve of the Fourth World Conference on Women, it seems somewhat surprising that there isn't sufficient material to give as exhaustive a vision as possible of women's access to science and technology. Inadequate international classification, heterogeneity in the reference dates and the incomplete responses provided by the countries are all obstacles to a conscientious study.

A major effort must be made regarding the conception and gathering of statistical data. The choice of indicators should be rethought in order to obtain classifications that are sufficiently precise to pinpoint what studies and professions in science and technology are chosen by women. With these improvements, the statistics would provide in-depth knowledge of the scholastic path girls and boys follow through schools and universities, and would make a major contribution to present reflection on education in the twenty-first century.

Chapter 2

International Statistics and National Statistics... An Indispensable Entente

Anne-Garance Primel

ABSTRACT: *The integration of national statistics in the international data gathering system must be rethought, especially as concerns gender breakdown, which has been somewhat overlooked in the past.*

Gathering statistical data is a complex process. As the survey grows in size and the authorities and levels of authority increase, this complexity is compounded. Will the solutions devised by international organizations in response to the problems of gathering international statistical data[1] suffice to solve the overall statistics problem? In this realm, it is hard to dismiss the interaction between the international and national levels.

What statistics database does each country use when responding to the questionnaires of international organizations? And even when the responses of each country to international data compilations *do* come from national statistics – as is often the case for statistics on education[2] – it isn't surprising to find serious shortcomings. How much do defective or imperfect national statistics affect international compilations?

By comparing national statistical yearbooks with international statistical yearbooks, we find that the problems observed with international statistics are duplicated at the national level (insufficient breakdown by gender, very broad headings, disparity in dates of latest statistical data according to region or province, etc.). To this can be

1 Concerning international statistics in particular, see the previous chapter by C. Musnil.

2 It is hard to imagine that each country would carry out statistical surveys merely to respond to a questionnaire from international organizations.

added specific shortcomings in the production procedure of national statistics sources.

Some figures (for the same year and the same heading) vary from one national source to the next, and sometimes even within the same statistical yearbook.

Educational systems are not identical in all countries. Some types of schools don't depend on the Education Ministries[3] and therefore are not included in the national statistical yearbooks on education. Data on some countries as included in the international compilation come only from the statistical indicators of yearbooks published by the Education Ministries; consequently a certain number of schools, streams, students and teachers are *left out* of the statistics!

How does the breakdown of the student body in the main fields of study defined by each country correspond to that of the international yearbooks, as the International Standard Classification of Education (ISCED) very often differs from the national classification? The variations between national statistics and international statistics linked with the classification problem are sometimes significant. Are certain international headings 'blown up', or on the contrary 'deflated'?

There is also the problem of reliability and the production procedure used for national statistical data. Official statistical data on education come largely from censuses and statistics drawn up by educational establishments and passed on by various local authorities. Given the relatively fluctuating nature of the material (specific to education), it is necessary to take into consideration the bias and errors inherent in any statistical headcount, accentuated by the many intermediaries and the local material shortcomings.

Thanks to new tools and more in-depth reflection, the production and publication of international and national statistics has made great progress overall in terms of number (quantity), reliability and uniformity. Lately certain statistics compilations have explained how they produce and compile data, thus warning the reader of any bias or

3 In several countries, certain schools don't depend on the Education Ministry, as do most, but rather on the Labor Ministry or another ministry. These administrations vary according to the country and the type of educational establishment. Regarding the problems linked to the multiplicity of the administrations, see the next chapter, *Secondary technical and vocational education: female enrolement in the various fields of study (1980 and 1992)* in this publication.

eventual problems. Nevertheless, many shortcomings remain. For instance, certain national yearbooks provide no statistics on gender breakdown per main field of study in the various types of education. Consequently we can see how difficult it is for international organizations to produce this type of statistics. If, as C. Musnil suggests, the question of the representation of girls in education and women in the sciences seems not to have been raised by the international organizations, it is raised even less at the national level by certain countries.

In order to respond to new international classifications – indispensable for comprehending certain problems – it may prove necessary to redefine and coordinate the gathering of statistical data on the national level and to promote the relations between countries and international organizations. A joint reflection by the two types of partner seems inevitable if progress is to be made in statistical competency, which is vital to all those striving to understand today's social phenomena.