Women's Studies and Science
By Anne Fausto-Sterling

The following paper was originally a talk delivered at the Research Conference on Educational Environments and the Undergraduate Woman, sponsored by HERS, New England, at Wellesley College last year.

One manifestation of the rigid division of sex roles in our society is the fact that relatively few women are scientists, especially physical scientists and mathematicians. My interest in addressing the subject of women and the science curriculum stems from my desire to change this situation, to allow equal access of men and women into science. The college curriculum is only a small part of this problem. The different socialization of girls and boys, especially with regard to mathematical ability and career aspirations, starts early. We each have our own personal stories to tell in this regard. Mine is from the fifth grade when I had my "doctor-nurse" argument with my teacher. He insisted that I had not meant it when I had said I wanted to be a doctor, that I really intended to become a nurse. In the process of arguing indignantly with him, I learned a great deal about the outside world. The point, of course, is that many things shape the development of boys and girls well before they enter college. These include early socialization, the lack or presence of female role models, and the role of peer pressure.¹

In the past decade, many people have tried to root out from textbooks those elements which make it particularly difficult for women to relate to the curricular material. A great deal of important and necessary work has been done, some of which deals with the science curriculum. In mathematics and the physical sciences there are several general problems. The first is the omission of women from the textbooks. Consider, for example, a physics textbook which takes its workbook examples from problems observed on a construction site. Usually there are no women construction workers dropping their two-pound hammers from a height of thirty feet in order to find out the force with which they will hit the ground. A subcategory of the use of sex-stereotyped problems is the introduction of the incompetent female who needs male help to figure out the answer. The fact is that problems are usually designed around situations more familiar to men—working on a construction site, throwing a beer can out of a moving car, and so forth. Textbooks could contain examples and problems which come from many areas of our culture, including those with which women are more familiar. For example, what female doesn't know how carefully milk has to be watched so that it doesn't boil over? What physical and chemical lessons can be drawn from this observation?

In addition to the problem of "invisibility," we must still be on the lookout for the use of curricular material which is degrading or offensive to women. An example of this is a handout used in a mathematics class at Brown University in the very recent past. The instructor believed that students would find it clever and amusing. It is a table full of mathematical puns about one pretty little Polly Nomial. The gist of the story is that little Polly ventures out on her own, with the result that she is raped by a vulgar fraction named Curly Pi who approaches her with his power series extrapolated. (Although the word "rape" is never used, the interpretation is unmistakable.) The moral of the fable is that little Polly Nomial should never have wandered out in the first place. Needless to say, some of the women in the classroom where this handout was used felt angry, frightened, and hurt.

I believe that changing the design of textbooks so that they better reflect the multiple aspects of our culture is very important. However, there is an aspect to this approach which makes me uncomfortable. Suppose you have an old tumble-down brick wall in your yard. The first thing you want to do is to try chipping out the rotten cement and repairing the wall with freshly mixed concrete. This may in fact solve your problem, but whether or not it does depends on how rotten the wall is. At some point it may be necessary to ask if it isn't better to tear down the entire structure and build a new wall. We have come through a period in our examination of the curriculum of chipping out the rotten cement (or at least pointing to its presence), and we must now enter into a period in which we stop looking at the cement chips and ask some basic questions about the whole wall. I will address three topics: the hierarchical structure of science itself and science teaching in particular; a cultural view of scientific work as solitary rather than communal; and the emphasis in modern science on analysis, i.e., breaking the whole into its component parts, rather than on synthesis, the ability to abstract a whole from the many pieces.

Modern science is hierarchical in structure.² Generally research is done by a scientist who obtains a grant in her or his name and then employs a variety of underlings—postdoctoral fellows, technicians, dishwashers, and others—to aid in the work. Our society is in general hierarchical, and women are found more frequently on the lower rungs of the ladder. This is as true in a research laboratory as in the Senate. I would like to raise the following question (for which I have no clear answer): would more women participate in science if it were not so organized? Hierarchy in the classroom translates into the expert who stands before the class and delivers lectures, offering as revealed knowledge the "facts" and "laws" of science. The format of the science classroom is quite different from that of the literature classroom (which for one thing has many more women in it). It is typical at Brown, for instance, that

¹ A recent article by L. Fox, D. Tobin, and L. Brody, "Sex-Role Socialization and Achievement in Mathematics," in M. Wittig and A. Petersen, eds., Sex-Related Differences in Cognitive Functioning (New York: Academic Press, 1979), considers how a number of these factors relate to women's ability to pursue careers in mathematics and the physical sciences.

science teachers lecture through the pre-final-examination reading period, rather than assign reading intended to give an overview to the course. This happens much less frequently in humanities courses. In literature courses the raw material—novels, short stories, drama, poetry—is made directly available to the student, who is encouraged to read and judge it directly for herself or himself. This could be true of science teaching as well. Courses could be conducted by discussion and teacher-guided examination of the issues and processes of science (the so-called "facts" being learned as a side benefit). The expert with revealed knowledge could become an especially well-informed co-explorer with the students. I suggest that this is an avenue which the science curriculum will have to take in order to change the sex composition of the students who study it.

One way to break out of the fact-teaching syndrome is to discuss the historical development of a concept which we now hold to be "the truth." For instance, in one of my courses I teach students what biologists currently understand of the cellular events involved in fertilization. I could do this in either of two ways: (1) I could present the modern "facts" and leave it at that, or (2) I could offer some historical insight into the evolution of ideas about fertilization. The latter approach involves teaching about a scientific process, while the former simply involves stuffing information into the students' heads. Similar approaches to teaching chemistry, physics, and mathematics are surely possible.

If hierarchy forms one end of a spectrum, then communally planned and shared endeavor forms the other. Consider the following reflection from the Nobel-Prize-winning physicist Yukawa: "At middle school I was relatively fond of mathematics, the reason being that one could solve a problem by oneself, without relation to other people." If, in fact, this perception about mathematics, as currently taught, is correct, then it might not be surprising that some basic emotional needs felt by a majority of women are not met by the study of mathematics. We are all aware of the stereotype of the maladjusted computer freak who works late into the night, brilliant but lonely, and most of us do not envision that as a way to live.

Here again, we need to ask whether mathematics must be the sort of individualistic field that it is today. In my upper-level experimental embryology course, by contrast, students work cooperatively on their take-home exams, and the results are often quite exciting. Why, in the teaching of mathematics, can't problems be solved by teams of students? Why can't cooperative endeavor rather than individual prowess be stressed? There is no reason except that our entire educational system is geared to emphasize the successful individual and to weed out the "failures." Certainly the lack of emphasis on personal interactions in the sciences plays an important role in keeping women out of the area. And the remedy for this aspect of the problem is nothing short of a revolution in our views about education.

In an article entitled "Feminine Intellect and the Demands of Science," Eleanor Maccoby discusses the differences and similarities in intellectual skills between women and men. This article, written by a person whose authority is widely accepted, even by feminists, contains some remarkable assumptions about


critically examine some of the basic philosophical assumptions of Western science.

My conclusions may seem overwhelming and discouraging, but I don't feel that way. It might be useful to end by sharing the broad context out of which my thinking grows. I do not see the elimination of constrictive sex roles as something which can happen separately from a large number of other very profound and far-reaching changes in our society. When I think about women and science, I have to fight a strong feeling that in order to tackle the topic I must first write a treatise on world revolution (something I am not about to do).

In order to break out of the dilemma, I have to remember what I have come to understand—through many years of political activity—about how individuals effect social change. Our society is composed of intricate interconnecting networks. A particular social structure has many contributing factors, some of which we view as root causes, and some of which we understand to be superstructures. However, root causes and superstructures feed back and forth between one another in such a complex fashion that one is left with the impression that everything must be changed simultaneously. Let me give a concrete example: women's struggle to earn equal pay for equal work. The root cause for an unequal pay system lies in the profit motive: the owners of capital will pay the least amount possible in order to produce. The superstructure supporting and supported by this system includes all of the stereotypes about women and sex roles. Stereotypes provide justification for paying women less; they also keep women and men divided, making it less likely that they will struggle in a united way against the profit motive which is causing them to be underpaid in the first place. How does one break into this cycle? The answer is: in many ways and at many different levels. One way, for example, is through the fight for the Equal Rights Amendment, which will provide important tools for reaching the goal of equal pay. There is also the struggle to change the ideology of sexism—to rewrite the textbooks with boy nurses and girl doctors. And, of course, there are the more conventional kinds of class struggle—unionization drives, for example. In order to achieve equal pay for equal work, many issues must be attacked, on many levels, often all at once. Each of us, as a participant in political struggle, must choose where we can be most effective. Even if it is in only a small part of the arena, we can do whatever is individually possible, understanding how it fits into the larger picture.

During certain historical periods change happens slowly. It occurs through the daily accumulation of modifications made by limited struggles. These small changes, however, set the stage for periods when larger qualitative shifts are possible. Right now our struggles consist of redesigning a course here; fighting to hire a female scientist there; encouraging more women to think more broadly and to respect the skills they already have, while developing the ones they don't yet have. But out of these small changes will grow larger ones. And if the results are as widespread as some of us wish, they will be part of a revolutionary change in our way of viewing the world.

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Acknowledgment

A number of the ideas in this paper were stimulated and developed through discussions with Elizabeth Weed, Christina Crosby, and Karen Romer, and by a talk given at Brown by Walter Massey.

General Bibliography

There is a brand-new, excellently thorough bibliography about women in science, from which I have taken most of the background reading I did while developing these ideas: Henifin, M. “‘Bibliography: Women, Science and Health.’” In R. Hubbard, M. Henifin, and B. Fried, eds., Women Look at Biology Looking at Women. New York: Schenkman, 1979.

Women's Studies at Emma Willard School

By Edith Prescott

In our Fall issue (Vol. VII, No. 4), we published an article by historian Anne Firor Scott about Emma Willard, the pioneer feminist who founded the Troy Female Seminary in 1821. In the following article, a teacher at the school—now called Emma Willard School after its illustrious founder—brings us up to date on its continued progress in the area of women's education.

At Emma Willard School, three teachers have been teaching courses in women's studies, each with a different focus. Marcie Easterling's course, Women and the Rise of the Middle Class, uses a combination of history and literature to trace the women's movement as an integral part of the whole bourgeois revolution of the eighteenth and nineteenth centuries. The combination of history, stressing the factual and the intellectual, and literature, emphasizing the emotional, makes a strong impact on the adolescent. The texts are Daniel Defoe's "The Education of Women" (from the anthology Spencer to Goldsmith, edited by Kobler and Evans); Eleanor Flexner's Century of Struggle; Miriam Schneir's anthology, Feminism: The Essential Historical Writings; Mary Anne Ferguson's Images of Women in Literature; Henrik Ibsen's Hedda Gabler.

In previous years, other texts have been used, including
Madame Emma Willard and Her Pupils, by Mrs. A. W. Fairbanks. Students study both famous women, like Emma Willard, and unknown women, like the working-class women of Troy who fought for unionization and against the exploitation of women. Students learn that women have a history of struggle that has resulted in some significant and lasting changes. Especially for students who haven’t thought about such questions before, the course may produce changes in attitudes and values.

Liz Craiglow teaches two courses at Emma Willard School. Human Sexuality, a beginning course for grades nine and ten, uses as text Understanding Sex: A Young Person’s Guide, by Alan F. Guttmacher, a book deliberately simple and dull (i.e., no pictures!). The course begins with reading from the text and with trust-producing games, both of which help the girls to feel secure and to be somewhat frank in class. Once students begin to talk, the course covers whatever topics they ask for; it has always included contraception, pregnancy and birth, anatomy and physiology (both female and male), venereal disease, and sexual behavior, including homosexuality.

Through discussion of these and other topics, the students come to understand several underlying ideas: that there is no such thing as a stupid question; that there isn’t necessarily any one right or wrong for everyone, but that one must accept the consequences of her/his actions, and it’s best to figure out what these consequences will be, ahead of time; that values change for society and for individuals, depending on a myriad of factors. Most importantly, the teacher emphasizes that sexuality is more than intercourse. As Ms. Craiglow says, “I guess I just want the kids to know that with a little respect for your body, sex can be talked about and can be fun.”

Liz Craiglow’s second course, Female Sexuality, is for a class of older girls. The texts in this course are Woman’s Body: An Owner’s Manual, edited by The Diagram Group, and Our Bodies, Ourselves, edited by The Boston Women’s Health Collective. Some of the topics covered in the first course are also covered in this one, but this course focuses more exclusively on women, on how women view their bodies, and on how society views them. Topics include: “menses to menopause—and after”; lesbianism; masturbation; women’s own values about women and sex. The major purpose of the course is to help students understand “what being a woman means”; Ms. Craiglow says that she has found “so many girls trying to be a certain sort of woman, or trying not to be a woman.”

I am the third teacher of a women’s studies course at Emma Willard School, which I have been teaching for eight or nine years now. In its present state, I teach “The Status of Women” in two sections: one for grades nine and ten, and another for grades eleven and twelve. Both deliberately aim at being a smorgasbord, dealing with women from the points of view of literature, history, psychology, law, sociology, and economics.

The course starts off historically, with five chapters on the history of women from Simone de Beauvoir’s The Second Sex. This appraisal of women in history helps the students to see that they are going to have to read deeply and at length; that women have been discriminated against in nearly every period of history; and, as a salutary serendipity, that they themselves have previously studied far too little history. The text is advantageous, also, in that Simone de Beauvoir writes about France and England, as well as the United States and other countries.

Directly after the five historical chapters, we read Ibsen’s A Doll’s House. No class can read this play without erupting into violent discussion the next day. Even for the most quiet student, who has previously not uttered a word, the “my little squirrel!” is far too much!

The most important book in this course is Virginia Woolf’s A Room of One’s Own. This is difficult reading, with its long, involved sentences and its allusions to books and experiences unfamiliar to most of the students—especially difficult, of course, for the younger group. But every year the majority in both sections votes that it has been the outstanding text. This book speaks to them historically, as de Beauvoir does, but in a far more personal manner, thanks to “Judith Shakespeare.” Brief though the book is, it takes some time, as it must be read in short and well-discussed assignments.

Usually there are other texts as well: perhaps parts of Cynthia Epstein’s Woman’s Place; or Florence Howe and Ellen Bass’s No More Masks!; or Thomas Hess and Elizabeth Baker’s Art and Sexual Politics.

Still another text is any current issue of Seventeen, which never fails to abound in clichés. One year, the issue we chanced upon was filled with “Dating Do’s and Don’ts” that inspired three writing assignments, including an in-class-written Letter to the Editor.

Other writing assignments send students to the school library, where they may observe the large number of books being written about women and, ideally, develop an interest in reading more on their own.

Another vital component of the course is the inclusion of guest speakers. One of these is always the school lawyer, who describes current laws which discriminate against women. This period is animated by student questions. Another frequent speaker is a mathematics teacher who has managed to raise four children while teaching full time. She too answers questions—about how she manages her life. The local president of NOW has usually spoken to the class, since I believe that adolescents need a practical approach to how injustice can be fought. And usually the class has heard (in the same week if possible) from a representative from Planned Parenthood and one from the Right-to-Life League.

The course also includes a few movies. Those which I have found especially useful are the two segments of The Film Board of Canada’s excellent documentary, Women on the March, and Claudia Weill’s Joyce at 34. In addition, the class is encouraged to bring in relevant newspaper and magazine clippings, which are displayed on a bulletin board and, sometimes, read at the beginning of class, for discussion.

In sum, women’s studies courses at Emma Willard School carry on the ideals of its founder, enabling young women to grow in awareness, in intellectual power, in emotional strength, and in responsibility to themselves and to society.