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Women's EDUCATION *des femmes*

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DEDICATION

Like the first, this second issue in the two-part series on girls and women in science and technology is dedicated to:

Geneviève Bergeron
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Sonia Pelletier
Michele Richard
Annie St-Arneault
Annette Turcotte

and all other victims of men's violence. We mourn their absence while we also work for change.

GUEST EDITORS

Rachelle Sender Beaumamp has a Ph.D. in biology. She has been, since its inception, director of programs for the Women Inventors Project and just recently resigned to take up studies toward a doctorate in medicine at the University of Toronto. She was, with **Lisa Avedon**, a co-founder of the Women Inventors Project. Lisa is a former CCLOW president. Her educational background is in sociology, psychology, and adult education, and she is currently a

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CORRECTION

In "Sewing Shirts," a poem by Janis Andrews in the last issue (vol.9 no.1) the seventh last line should read "all hope hangs only by a thread".

Cover



The cover graphic was created by Magic Lantern Communications for their video series on Women in Science.

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Transforming the Science Curriculum

by **Rachelle Sender Beauchamp and Lisa Avedon**

"I was certainly not given the belief that I could. Give something to science and that it could give thing some back to me."

Student quoted by Sheila Tobias
in *They're Not Dumb, They're Different (1)*

Think back to your science and math classes in high school, college, or university. Did you and your classmates sit passively while the instructor lectured, delivering a series of facts and formulae which you noted and memorized in order to regurgitate later on the exam? There was little or no dialogue with the instructor and the interaction among students was largely limited to "what mark did you get?"

Contrast that with your experience in arts classes where there was stimulating, provocative discussion, topics that engaged you and related to real life, to which you felt you could contribute something meaningful, and that you could continue debating between classes.

Why can't science and math be taught in a way as engaging and relevant as the arts? Of course they can. One of us is a graduate of a high school science course where concepts were learned from field trips and hands-on experiments, where solid geometry and shop became a passion.

The other of us had an all-girls physics lab where the instructor encouraged us to prepare fabulous meals over the Bunsen burners. Despite this beginning, all of the students in that lab majored in science in university and three out of four received Ph.D.s.

Things haven't changed a great deal in the quarter century and more since then. In fact, today, fewer students, men as well as women, are choosing to study science, math, and technology.

Peggy McIntosh of the Stone Centre at Wellesley College in Massachusetts has developed an important five phase model of interactive curriculum development which is relevant to the education of women in science and technology (2). In the first phase, women are

absent from the curriculum and their absence is not noticed; in the I second, a few female Nobel prize winners--women who have succeeded on male terms--are included. Phase three is the "ism" phase in that it acknowledges and focuses on the barriers women face. The fourth and fifth phases are the "good stuff," the moving toward inclusive curriculum which reflects everyone's experiences and arrives at new definitions of greatness.

Our experience with the Women Inventors Project demonstrates that most educators are now at phase two or three. The challenge now is to make the leap from phase three to four. We need to move from a emphasis on women's access to a "status quo" curriculum, toward the implementation of a curriculum relevant to the entire population. The articles in this issue reflect the latter step, ranging from various kinds of program structures (Bohnen and Klie, Anderson-Clarke) to more fundamental changes in the way that the courses are taught (Rogers). Some include the voices of women who express their experiences (Davis and Steiger, Inch and Frize), and lest we assume that the transformation is well on its way, Binden's contribution reminds us of the resistance to change from professional groups and educators.

Finally, we want to acknowledge Margaret Benston's contribution to science and feminism in Canada and we dedicate this issue to her memory.

Radtdle Sender Beauchamp and **Lisa Avedon** are co-Guest-Editors of this issue of *Women's Education des femmes*.

1. Sheila Tobias, *They're Not Dumb, They're Different: Stalking The Second Tier*. Tucson, Arizona: Research Corporation, 1990.
2. Thanks to Professor Janice Kock of Hofstra University for this interpretation of curriculum development.

À changer: le programme de sciences

par Rachelle Sender Beauchamp et Lisa Avedon

«On ne m'a certainement pas donné l'impression que je pouvais apporter quelque chose au monde scientifique et qu'il pouvait me donner quelque chose en retour ».

Propos d'une étudiante cités par Sheila Tobias dans *They're Not Dumb, They're Different* (1)

Pensez un instant à vos cours de sciences et de maths à l'école secondaire, au collège ou à l'université. Est-ce que vos compagnes et vous preniez passivement en notes les données et les formules que débitait le professeur? Ensuite, vous les appreniez par coeur pour les ressortir à l'examen, n'est-ce pas? Il y avait peu, voire pas du tout, de dialogue avec l'enseignant et les échanges entre élèves se limitaient à "Quelle note tu as eu?".

Comparez ces cours à ceux d'arts visuels où les discussions étaient animées et stimulantes, les sujets abordés vous plaisaient et avaient trait à la vie, la vraie vie. Vous aviez l'impression que votre contribution avait du poids et que vous pouviez continuer à discuter entre les cours.

Pourquoi les maths et les sciences ne peuvent-elles pas être enseignées de manière aussi plaisante et stimulante que les matières plastiques? Le pire, c'est qu'elles peuvent l'être. L'une de nous deux est diplômée d'une école secondaire où les élèves apprenaient les concepts scientifiques au cours d'excursions sur le terrain et d'expériences sur le tas, et où la géométrie se transformait en passion.

L'autre a fait de la physique dans un laboratoire qui ne comptait que des filles et où l'enseignante poussait ces dernières à préparer des repas fabuleux sur les becs Bunsen. En dépit de ces débuts boiteux, toutes les élèves de ce laboratoire ont décroché un diplôme de sciences à l'université et trois sur quatre ont un doctorat.

Les choses n'ont guère changé depuis un quart de siècle. En fait, moins d'élèves, filles et garçons, choisissent aujourd'hui d'étudier les sciences, les maths et les matières techniques. Peggy McIntosh du Stone Centre au Collège Wellesley (Massachusetts) a mis au point un excellent modèle en cinq étapes pour élaborer un programme d'études interactif onde qui est fait pour enseigner les sciences et les matières techniques aux

femmes (2). Au cours de la première étape, les femmes ne participent pas au programme d'études et leur absence n'est pas remarquée. Au cours de la deuxième étape, sont incluses quelques femmes lauréates du Prix Nobel, soit des femmes qui ont réussi comme des hommes.

La troisième étape est l'étape des "ismes", c'est-à-dire qu'on se concentre sur les obstacles auxquels se heurtent les femmes. Aux quatrième et cinquième étapes, on en arrive à ce qui est bien, c'est-à-dire qu'on s'oriente vers un programme d'études global qui reflète les expériences de tout le monde et donne une nouvelle définition de la virtuosité.

D'après notre expérience au Women Inventors Project, la plupart des éducateurs et éducatrices se trouvent à l'heure actuelle à la phase deux ou trois. Le défi qui se présente à nous aujourd'hui est de sauter de la phase trois à la phase quatre. Jusqu'à présent l'accent était mis sur l'accès des femmes à un programmes d'études se caractérisant par le "statu quo"; aujourd'hui, il faut passer vers la mise en oeuvre d'un programme qui convienne à toute la population.

Les articles de ce numéro reflètent cette dernière étape; ils traitent de différentes sortes de structures de programmes (Bohnen et Klie, Anderson-Clarke), mais aussi des changements fondamentaux dont l'enseignement des cours doit faire l'objet (Rogers). Certains articles se font l'écho d'expériences vécues par des femmes (Davis et Steiger, Inch et Frieze). De crainte qu'on ne croit que les transformations sont en bonne voie, Binden nous rappelle que les groupes professionnels et les éducateurs s'opposent à tout changement.

Nous voudrions enfin rendre hommage à Margaret Benston pour le rôle qu'elle a joué dans les sciences et le mouvement féministe au Canada en dédiant ce numéro à sa mémoire.

Rachelle Sender Beauchamp et **Lisa Avedon** sont les deux rédactrices invitées de ce numéro de *Women's Education des femmes*.

1. Sheila Tobias, *They're Not Dumb, They're Different: Stalking The Second Tier*. Tucson, Arizona: Research Corporation, 1990.
2. Tous nos remerciements au professeur Janice Kock de l'Université Hofstra pour cette interprétation «d'élaboration d'un programme d'études».

Women Scientists: Contradictions and Connections

by Hilda Ching

*Can science
change to
become women-
centred as it has
been man-
centred*

In *Women Scientists in America.. Struggles and Strategies to 1940*, Margaret Rossiter describes how women scientists were caught between two 19th century stereotypes: as scientists they were atypical women, as women they were unusual scientists (1). While women have increased numerically in many fields of science in the 20th century, they still face variations of these stereotypes, of being treated as exceptional women and eccentric scientists at the end of a "normal" scale.

Because of predicted labour shortages in the future, more women are being encouraged into scientific careers especially in engineering. However, the few women who are now in science are mostly in biology and biochemistry and in jobs which pay less than men's and with fewer opportunities for advancement.

In this paper, I discuss some contradictory and contrasting feelings about women. To change the conditions of both science and women, I suggest making some connections. If we are going to encourage and increase the numbers of women in science, we need to understand and change the constructs of science and women.

Science and gender are complex and diverse subjects which feminists such as Keller, Hubbard, and Mura have criticized (2). Science as a subject, as a career, an institution, and a way of doing things must change to accommodate women. Harding has asked how a science which is male dominated and capitalistically driven can be used to emancipate women (3). While many women have rejected science to assure their femininity, some women have done very well in their careers following the male style of learning within a hierarchical structure. Can science change in focus to become women-centred as science has been man-centered? Some intriguing research by Canadian feminist scientists demonstrates how collaborative work on interactive research can result in empowerment of knowledge and social change (4).

Both men and women need to analyze the present conditions of women and science in order for women scientists to be successful in our society. Inevitably, when I discuss barriers that women have encountered in obtaining education and employment, there is at least one woman in the audience who claims not to have been treated differently because of gender. Young women who are studying in graduate school lack the awareness of the discriminatory employment situation. Other more experienced scientists tell me of sexist treatment, of outright rejection of their gender by professors and employers, of the intense competition and the need to sacrifice other interests in doing science.

Contradictions et liens

par **Hilda Ching**

Si le nombre des femmes a augmenté dans nombre de secteurs scientifiques, les femmes scientifiques sont encore traitées soit comme des femmes exceptionnelles, soit comme des excentriques. Si nous voulons encourager les femmes qui font des sciences, nous devons comprendre la structure des sciences et la changer.

Chaque fois que je discute avec des femmes scientifiques des obstacles auxquels elles se heurtent, il y en a au moins une qui prétend ne pas avoir fait l'objet d'un traitement différent. Beaucoup de femmes scientifiques estiment, je le sais, que difficultés et affronts sexistes ne représentent qu'un défi de plus qu'elles surmonteront grâce à la grande expérience qu'elles ont en matière de résolution de problèmes. A mon avis, cette attitude est due au fait que les femmes scientifiques n'ont pas eu le temps de réfléchir aux barrières qui empêchent les femmes d'appartenir au système.

Les jeunes femmes doivent apprendre à reconnaître les embûches que l'on place constamment sur leur chemin et à les écarter de façon créative. Elles ne doivent en aucun cas accepter ou feindre d'ignorer la situation ou encore se blâmer.

Bien que des mesures spéciales, dont ateliers de sciences et de maths, groupes d'appui, aient été prises pour améliorer la situation des femmes qui font des sciences, je conjure toutes les femmes scientifiques de se pencher sur leur identité et de créer des liens pour que surviennent des changements.

Most of the women scientists I know love their work and believe in meritocracy, that all they have to do is do science well. The sexist slights and problems they may face are just more challenges to their problem solving expertise, to be solved on a personal basis. They may truly believe that they are one of the boys or that they prefer the positions that they find themselves in. What it boils down to is that most women scientists haven't had much time to think of the systemic barriers which have kept women out of the system. This ignorance applies to men, too, as one of my colleagues wondered why our department had only one female faculty member in twenty years.



Hilda Ching

Since gender role stereotyping begins at an early age, it is important to pique the interest of girls in science at the start of schooling. We need to convince parents and teachers that girls need science just as much as boys and that they should provide role models for young girls interested in careers in science. While many girls are keen on science, they do

not have clear images of themselves as potential scientists. What should be top priority is the transformation of schooling so that the language, curriculum, packaging of the courses, and classroom interactions reflect the values and interests of women (5).

Though girls get better grades than boys in school through to university, they speak less often in the classroom and obtain less practical experiences in science. Career days, all day math and science conferences, videotapes on careers and women scientists are among the effective attraction strategies. Retention programs such as national scholarships and faculty awards and mentoring programs will help to keep women within the system.

However, these are all special measures which are not available to every girl in the country nor are they enough to offset the prevailing social attitudes towards women and work. Young women need to recognize the gender blocks continually being placed in front of them; for instance, being told they lack the ability to do science, that they are in the wrong field, or should get married and raise children. Women need to know how to deal with these blocks creatively; not just by coping, ignoring the situations, or by blaming themselves (6).

Although women have to work to earn a living, we have not provided supportive conditions or changed the work world to accommodate their needs. Career pathways, especially in the sciences, assume that someone is at home for the breadwinner after long hours in the laboratory. Women scientists particularly face the dilemma of establishing their scientific reputation, in publishing their research and supervising graduate students, at the same time they might be raising a family.

Superwomen or successful women who have juggled careers and a family life are in demand for discussions with students who seek out advice for their future long struggle in academia. I suggest that there be dual responsibilities for men for home and family life, universal child care, and flexible pathways including no-penalty leaves of absences from the work force. Employment equity programs in our universities and federal funding for new women faculty in the sciences bring hope that the numbers of women in academia will increase at a faster rate. While women comprise 17% of the faculty at Simon Fraser University, there are only one or two women in each of the science and engineering departments.

We have had informal hiring systems too long and if science departments had really been objective and impartial, we would have had a lot more women present in academia. Developing and monitoring standard methods of hiring and promotion will greatly improve employment opportunities for women and once women know that these opportunities are available, more will start applying to graduate school. The perceived threat of employment equity programs is that established numerical goals for hiring women will lower the standards of excellence. But both merit and excellence have not been achieved in the sciences if one considers that only contributions from one gender have been acknowledged.

Both merit and excellence have not been achieved in the sciences if only contributions from one gender have been acknowledged.

There is an awareness on university campuses that the quality of life for women must be improved by providing safety measures and censure against violence. Most universities have or are developing harassment policies and have officers in place for the report of offenses. Most students and faculty are aware of their legal rights against discrimination due to sex, color, race, and marital status. What they need are guidelines on sexism, harassment, and discrimination to prevent the kind of jokes, passes and differential treatment women receive in the science classrooms and laboratories. Sexist remarks cause women great concern as to how they should react: to be assertive and cause personal embarrassment, or to ignore

and hope the offenders will go away.

Because there are so few women in science, they should join status of women's groups, and national women in science organizations. Collective actions to promote equity and the identification of themselves as women can counteract feelings of tokenism and isolation. Women's' groups offer a chance to mentor and be mentored, and offer support and information (like the old boys network) on where the jobs are.

Feminists have asked if women scientists have unique qualities which will give them different perspectives in doing science. While I don't think women scientists in power will become like men in power, they will face more contradictions as more of them succeed in science. Harding has commented that learning to think and act effectively out of these contradictions is an important part of feminism and of becoming a feminist (7).

By activating our identities as women scientists, as women subjects and generators of thought, we can exploit the tension between multiple identities. These perspectives can be valuable in many fields, especially and including the natural sciences.

Being on the outside of the inside of science, looking at it from the standpoint of a woman of a minority group, I challenge other women scientists to explore their identities, to relate their experiences, and to make connections for change.

Hilda Ching is an active member of the Society for Canadian Women in Science and Technology, and is currently researching the area of women in science.

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2. Keller, Evelyn Fox. *Reflections on Gender and Science*. New Haven, Yale University Press: 1984; Hubbard, Ruth. *The Politics of Women's Biology*. New Brunswick, Rutgers University Press: 1990; and Mura, Roberta. *Searching for Subjectivity in the World of the Sciences: feminist viewpoints*. Toronto, CRIAW No. 25: 1991.
3. Harding, Sandra. *The Science Question in Feminism*. Ithaca, Cornell University Press: 1986.

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7. Harding, Sandra. *Whose Science? Whose Knowledge?* Ithaca, Cornell University Press: 1991.

Are Women Excluded from Careers in Science?

by Barbara Sherriff and J.P. Svenne

"You've come a long way, baby!" but you still have a long way to go. How will you know when you've arrived? You will have arrived when Margaret Thatcher is no longer referred to as a woman prime minister, but simply as a prime minister; when madam Justice Claire L'Heureux-Dubé is no longer known as a woman supreme court justice, but as a supreme court justice; when a TV news reporter no longer comments on what Audrey McLaughlin is wearing. Who ever comments on what Brian Mulroney is wearing? This article examines briefly the question of whether women have "arrived" as scientists.

*When we review
the history of
science, few
female names
come to mind.*

From any examination of the history of science, it is clear that in the past there has been a systematic and overt exclusion of women from scientific careers. Today, there are very few women scientists. Out of a total of 180 permanent faculty positions in the Faculty of Science of the University of Manitoba, only twelve are filled by women, which is a significant improvement over 1985, when there were only seven.

In 1988-89 at the University of Manitoba, nearly equal numbers of men and women started in science at the first year level (43.7% of the first-year students were female), but the attrition rate of women is higher than that of men. Even more significantly, female participation in post-graduate studies, to the M.Sc. and Ph.D. degrees, is abysmally low: only 20.6% of M.Sc. degrees were granted to women, and 14.3% of Ph.D. degrees.

These overall statistics mask the particularly low numbers of women (20% of the total

registration) who opt to enter the physical sciences (chemistry, geology and physics) and computer science (10% of the total). Though these statistics are specifically for the University of Manitoba, national statistics are very similar and improvement over time is very slow. Where does this low participation by women in the sciences, particularly the physical sciences, originate?

This question is discussed extensively in a recent book by Linda Schiebinger, *The Mind has no Sex?* (Harvard University Press, Cambridge, Mass., 1989) When we review the history of science, few female names come to mind. Everyone has heard of Madame Curie, but we are stuck for other examples. And even Madame Curie--the first person ever to obtain two Nobel prizes in physics--was not allowed to become a member of the renowned Académie des Sciences in Paris.

Est-ce que les femmes sont exclus des carrières scientifiques?

par Barbara Sherriff et J.P. Sevenne

La coutume de faire des sciences est née au Moyen Âge dans les monastères et les couvents où les religieuses se consacraient à l'avancement des connaissances. Toutefois, au fur et à mesure que les universités se propageaient et devenaient le bastion du savoir, les femmes en furent presque complètement exclues. En 1678, Ellen Piscopia fut la première femme à obtenir un doctorat à l'université de Padoue. Il fallut attendre trois siècles pour qu'une autre femme accomplisse le même exploit.

Il faut que davantage de femmes se sentent attirées vers les sciences. Si l'on pense que la plupart des femmes peuvent s'attendre à un moment ou à un autre d'être seul soutien de famille, une carrière scientifique peut s'avérer intéressante et stimulante.

De surcroît, il faut que davantage de femmes se lancent dans les sciences en raison de l'influence qu'elles pourraient y exercer. Enfin, les femmes; représentent une ressource humaine sous utilisée, alors qu'on s'attend que d'ici à la fin du siècle la demande en scientifiques augmente de façon aiguë.

Dans la mesure où les raisons pour lesquelles le taux de participation des femmes dans les domaines scientifiques est faible sont multiples et compliquées, il faudra trouver des solutions à plusieurs volets et complexes pour enrayer cette situation. Ce n'est certes pas demain que l'effectif des étudiants en sciences, des femmes scientifiques et des ingénieurs sera égal à celui des hommes.

The practice of science traces its origins back to medieval monasteries and universities. The church dominated all learning in the monasteries between the sixth and eleventh centuries. Women, in the holy orders, were active in preserving and advancing knowledge, including scientific knowledge. However, women were almost completely excluded in the early days of the universities.

As the universities took over from the monasteries as the seats of learning in the twelfth to sixteenth centuries, scientific advances became almost exclusively a male preserve. Schlesinger reports that in 1678 Elena Piscopia became the first woman at the University of Padua to obtain her Ph.D. degree. However, university officials decided not to set a precedent and for nearly three hundred years after Piscopia, no other woman received a Ph.D. degree from Padua.

To increase the numbers of role models, we have to persuade more women to study science.

Another historical seat of scientific study was in the great academies of science which developed in Europe in the seventeenth century. Though from the start there was no constitutional exclusion of women from these academies, they were, in fact, excluded. The Royal Society of London elected its first woman to full membership in 1945, though the Society was founded in 1662. Still, a number of women managed to make significant contributions to science "at the periphery," in Londa Schiebinger's words.

For example, in Paris there developed a number of "Salons": women would meet in the comfort of some noblewoman's residence and discuss scientific questions. Other women managed to get their work known through the aid of their husbands, sometimes by publishing in their names. Yet these rather sparse and informal contributions did not make a very visible impact on science. Today, the discriminations against women in the sciences are not so formal. In fact most male scientists, and even many female, will claim that there are no barriers to women in science. Then why are the numbers still so small?

There is no single, simple reason nor is there one easy solution. One explanation is the lack of role models for women scientists. Of course, to increase the numbers of role models, we first have to persuade more women to study science. We must break into the cycle somewhere.

To do so we need to know why more women do not choose science. Attitudes are set at an early age, by the family, by peers, the schools, and by society at large. How many cartoons showing scientists depict them as female? How many female scientists are seen on television? And these are two of the strongest influences on children today. Unfortunately we still hear of instances in the schools where, if a boy is struggling with his physics, he is helped and encouraged whereas a girl will be told, "This is too difficult for you. Why don't you choose some easier subject?"

But should more women be encouraged to become scientists, in particular, physical scientists? Perhaps they do not want to be scientists? We do not really know for sure whether they do not want to, or whether they have been truly persuaded that science is for

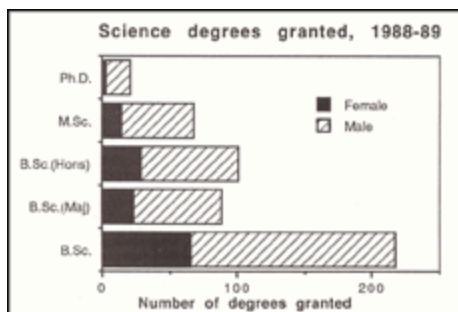
boys.

Women who have managed to pursue work in science despite the difficulties surely must have wanted to be scientists. A career in science is an interesting one, and a rewarding one. It affords women, who can no longer rely on "living happily ever after" with 2.2 children and a husband who reliably brings home a good pay cheque, financial independence. Present statistics indicate that, on average, a woman can expect to work outside the home only four years less than a man and also, for some time, to be the sole source of financial support for themselves and their family. Women need to pursue interesting and well-paid careers.



credit Ross
Stevenson

Another reason for increasing the numbers of women in science and technology is to make changes to science itself that might result from greater female participation. This turns the question around from "Why do so few women participate in science?" to "What is it about science that has limited the participation of women?" In recent years there has been considerable debate among feminists and some scientists on whether science is truly "value-free" and "gender-neutral". Would science be profoundly changed by greater participation by women? As physical scientists—a mineralogist and a theoretical physicist—we wonder how our understanding about minerals or fundamental particles would be enhanced if these sciences had equal participation of both genders.



*We must break
in to the cycle
somewhere.*

It is more clearly evident that the greater participation by women could change the life sciences, and in particular, medical science. In fact, most examples in the debate over whether women have changed science are drawn from the life sciences. One way of testing the question would be to use the scientific method itself do the experiment, get more women into science, and then see how science changes.

A third, more pragmatic, reason for encouraging more women to enter careers in science is an anticipated severe shortage of scientists and science-related personnel before the end of this century. The reasons for this anticipated shortage are a combination of increasing

demand for scientists to develop new technologies and to seek solutions to environmental problems, and because the current scientifically and technologically trained work force is aging and will soon be leaving in increasing numbers. At the same time, the anticipated supply of scientists from the traditional sources, immigration and male university graduates, is declining. Immigration cannot be expected to supply the demand as other countries, Europe, Japan and the United States, face the same shortages. Canadian attendance rates by males at university are already nearly the highest in the world and are unlikely to increase significantly. Women are an under-utilized human resource that could help meet the need in the coming years.

The reasons for the low participation of women in science and technology are many and complex. The solution will also have to be multi-faceted and complex. One approach is to take the message into the schools. In a joint project between the Faculties of Engineering and Science of the University of Manitoba (with the aid of some short-term funding provided primarily from the Universities Grants Commission), the Access Program for Women in Science and Engineering has been established.

Undergraduate women students in Engineering and Science have been hired as Access Coordinators. They go into schools to talk to groups of students in grades five to twelve about career prospects in science and engineering and the requirements students must meet to pursue university studies in these fields. They try, as much as possible, to talk to groups of girls only as the presence of boys often inhibits questions from girls, even in elementary school.

However, in many cases, the schools request that we talk to mixed-gender groups, as the boys need educating on equality issues as much as the girls. At the younger grades, elementary to lower Junior High, the talk is on a rather general level about science and scientists, engineering and engineers, illustrated by some hands-on demonstrations.

At the grade nine to ten level the focus is on what high school subjects students should select in order to qualify for entry into science and engineering. A particular message at this level is the importance of taking physics 200 and 300, which are required for entry into all engineering and physical science fields. At the present time, only about 30% of the students choosing physics 300 are girls. When talking to grades eleven and twelve, students in classes are advised about careers in science or engineering, and on what they might expect once they enter these fields at university.

We feel that this program has, over a short period of time, developed considerable momentum and is generally well received by the schools and by the students who have participated in the sessions. It is still too early to tell whether any increased enrollment by women in science or engineering will result, but the Engineering admissions officer does report an increased number of enquiries by women about studies in that faculty.

Yes, we've come a long way from the middle ages, but we have a long way to go before 50% of science students, faculty, professional scientists, and engineers are women.

Barbara Sherriff is an Assistant Professor in Geological Science, and **J.P. Svenne** is a professor in the Department of Physics and is Associate Dean of Science, both at The University of Manitoba.

POETRY

EMILY DICKINSON AND WALT WHITMAN

Behind her sealed wall in Amherst Emily writes:

How public-like a fog-

To tell one's name-the livelong June-

To an admiring bog,

while Walt *never made*

to live inside a fence

celebrates himself as *Kosmos,*

turbulent, fleshy, sensual

Even from his massive tomb in Camdem

he takes possession of the world,

sings: *I give myself,*

grows body-leaves.

Emily trembles and thinks:

how dreary to be Somebody.

Liliane Welch
New Brunswick

The Strange History of a Good Idea

by Kathryn Bindon

What follows is a personal account of an attempt to establish a new engineering program in one Canadian university. While the institutions and parties involved are not named, some of the singular circumstances mentioned will undoubtedly indicate their identities. I Nevertheless, what follows is a scholar's statement, not an institutional brief.

There is nothing unusual or provocative about the creation of new courses and programs in universities. Moreover, there is a relatively routine process that is followed in these manners, which resembles the basic research methodology of most disciplines. The question under discussion in this case was how the numbers of women studying engineering, and remaining in the field as both practitioners and teachers, might be increased.

The question was how the numbers of women studying engineering, and remaining in the field, might be increased.

Despite tremendous growth in their participation in tertiary education during the past decade, there has been no concomitant increase in engineering programs. While it is fair to note that "The share of degrees earned by women [in mathematics/physical sciences and engineering/applied sciences] ... has ... more than doubled between 1970 and 1988, from 8% to 19% of the total," the numbers remain relatively static in comparison to the increase in overall numbers of graduates (1). In 1988, 54% of graduates from undergraduate programs in Canadian universities were female; only 7% of graduates in engineering and applied science were women (2). These statistical conclusions, which have been remarkably consistent for the past two decades, have prompted a number of studies and inquiries into the matter of the participation, graduation and attrition of women in the profession.

Many of these studies identified environmental factors within schools of engineering as contributing to low female enrolments and ongoing involvement. These findings have been underscored by public debate about the life-style of engineering students. Everything from the content of student newspapers through the rituals of orientation and graduation have been critically scrutinized' and the low participation rate of women has been cast against these analyses.

L'étrange épopée d'une bonne idée

Par Kathryn Bindon

Dans la mesure où le nombre des femmes diplômées dans le secteur des sciences pures et des sciences appliquées n'a guère augmenté depuis vingt ans, il faut mettre à l'essai diverses solutions pour y accroître la participation des femmes.

J'ai proposé qu'un programme de liaison soit mis sur pied entre mon université, qui traditionnellement encourage les femmes à faire des études supérieures, et une école d'ingénierie affiliée. Il s'agissait de recruter trente femmes dans le programme d'ingénierie affilié. Elles passeraient deux ans dans un cadre qui les encouragerait et les soutiendrait et trois ans à la faculté pour terminer leurs études. Ma proposition a été accueillie avec froideur et hostilité. Il semble qu'un programme élaboré uniquement pour les femmes ne serait pas crédible, pour la simple raison qu'il est destiné aux femmes. Cette attitude soulève des questions à propos de l'éducation de toutes les femmes au Canada.

La responsabilité de changer et d'adapter les cours et les programmes incombe au système universitaire. Si celui-ci n'est pas capable de procéder à ces changements ou de s'autocritiquer pour progresser intellectuellement, les problèmes qui semblent exister sont alors très graves.

The remedies suggested in many of these reports, moreover, relate to environment and infrastructure. In addition to better math and science education at the primary and public school levels, the creation of contexts for women in universities that are less tolerant of gender stereotyping behaviour and harassment and more conducive to learning and shared perceptions of professional standards, is a frequent refrain. At the same time, Canadian educators have become increasingly aware of gender issues in teaching and learning, particularly in the areas of mathematics and science. Both research and practice have identified differences in pedagogical techniques that disadvantage female students, as well as traditional assumptions about learning and career paths that inhibit many young women from proceeding into areas of pure and applied sciences.

The time to identify and implement alternative solutions seemed to be at hand.

All of which information has been integrated into a socio-economic framework by the recognition of our national need to educate more engineers if Canada is to maintain a viable position in the global economy of the next century. Whichever statistical projection one accepts, it is clear that the resources of 51 % of our population must be tapped if we are to increase the absolute number of practicing engineers. Given that the next century is less than a decade away, and that two decades of rhetorical awareness have not solved the problem, the time to identify and implement alternative solutions seemed to be at hand.

So, as a scholar and an academic administrator, I found myself in the following position. In an extensive mix of research, debate and criticism, the problem had been clearly identified. The solution—that is, increasing the participation of women in the profession—invited a number of approaches. Given the levels of activity and awareness, as well as the scope of possible response, it seemed logical to me to begin discussing whether there was an institutional link that might provide an additional solution to the problem.

My university has a singular commitment to the higher education of women which is supported by more than a century of practice. Teaching is informed by both theoretical and practical knowledge of the relationship of learning to gender issues. Research is generally oriented to matters relating to women's issues and the environment for learning has evolved as one dedicated to the success of women as both students and professionals. Sixty percent of the faculty and 85% of the students are women. Role models and mentors are a part of the traditional fabric of the university, not an institutional veneer.

It is a learning environment and approach that we know supports the needs and fosters the ongoing success of many women graduates. Certainly, it is a time-tested approach in the United States, where statistics indicate that the success of women who attended women's colleges is outstanding, particularly in the professional areas.

Our program proposal emerged in part because of a particular approach to undergraduate engineering education in our province. A student attends, for the first two years of the five-year program, at anyone of a number of affiliated universities. There is some elective course work in these two years, but curricular content is carefully laid out in accordance with accredited standards. Mathematics, chemistry, physics and basic engineering figure largely. The arrangement permits students to participate, for two years, in the ambience of a university of their choice while consolidating the knowledge base that will support further studies at a specialized engineering school.

Given these two existing themes—one of an approach to the education of women, the other of an inter-institutional arrangement for engineering programs—it seemed logical to suppose that the abilities and approaches of two institutions could be merged in the establishment of an affiliated program that would recruit women into the first phase, and prepare them for success at the second.

Accordingly a somewhat modest proposal, in which a class of thirty women from my own

institution would be recruited into the affiliated engineering program, was formulated. The benefits of such a linkage proposal seemed obvious. A targeted recruitment plan would encourage women to pursue preliminary studies in engineering in an environment dedicated to their overall development as scholars and future professionals. It would also educate their parents, peers and guidance counselors to the possibilities of this study and career path.

The two-year experience at a university where the environment was predisposed to the education of women, with remedial and counselling services that would compensate for any gaps in their previous math and science learning, would serve to build confidence and adjust assumptions about the possibility of success in engineering. And the presence of a cohort of women who had shared this experience would provide a peer reference group for ongoing support during the subsequent years at the professional school.

POETRY

For the professional school, the group would provide an added number of female student candidates as well as an introduction to counseling and advising as a means of fostering the integration of women into their programs, since counseling and support services for the thirty students would be carried over to the technical school. If successful, even these modest numbers would alter the gender balance in a meaningful sense. The intention to review the effectiveness of the program in achieving these aims, moreover, was an important element of the plan.

The public response to this proposal, however, was less than logical or sympathetic. The notion that a program might be established exclusively for women was, and continues to be, greeted with very mixed reviews. The representatives of governmental agencies striving to encourage the participation of women were enthusiastic with

WHAT TO BELIEVE

Imagine that a man hands you a sheet of paper, says choose which you believe. On one side is written: *The statement on the other side of this paper is false.* And on the reverse: *The statement on the other side of this paper is true.*

You feel confused of course, know very well you can't possibly win at this. With either choice, you're back to where you started: unable to choose. A kind of verbal Escher, like the hand drawing the hand. Or the

their rhetoric, but not with resources or funding.

At the same time, within the region that was singularly suited to attempt this plan, a surge of antipathetic argument has been heard. The matter has escalated (without much consultation or reference to the bases of the proposal) throughout the realms of academic and professional associations, and the language of the critique has become laden with phrases such as "instituting segregation" and "self-interest".

To the scholar and academic, such language suggests a less than altruistic interest in solving the educational problem. After all, the impact of a maximum of thirty more women studying engineering in any given year is likely to be positive, or at worst neutral, on the profession as a whole. The presence of thirty additional students of any gender, it would seem, would prove an asset.

My personal analysis of the dynamics of opposition are not encouraging. If the fear of this program stems, at least partially, from unfamiliarity with the research relating to women in science, it evidences itself in language that is intolerant of alternatives and choice. It ignores the stated experience of many women who have succeeded in engineering programs, and sets up artificial barriers that others, given the current state of their education and perceptions, will be unable or unwilling to break through.

The criticism of the proposal does not fix upon the academic or professional elements of the program. Rather, it rejects the notion that a program involving women will be credible, simply because it is for women. This, in turn, suggests that any endeavour to create programs designed to respond to the problem of gender participation will, in and of themselves, create new levels of discrimination.

Old adage about the rock and the hard place.

You pour yourself a glass of wine, sit back, study the paper, the man who gave it to you. You would like to shake this man, this sly giver of paper. You are embarrassed by yourself, the way you continue sitting with him at the same table in the same house, your head cocked in fashionable bewilderment, shoulders slumping. Considering the nature of the choice, this is politically incorrect. You should be searching for a solution, at the very least countering with your own sheet: blank on both sides, stunningly silent.

But no: it's easier to gamble than to will. You bet he'll eventually grow tired of the game, take the paper from your hands, set his lighter to it. And all will be well not because you chose to end it well, but because it ended.

Eva Tihanyi
Ontario

Most intriguing, however, are the arguments against this proposal that suggest that women who enroll in the existing affiliated programs will choose to attend the targeted program. One possible response to this criticism is to argue that the need for gender specific introductory experiences is rather more pressing than we perceive. In all of this, the criticisms miss the essential point of the proposal--that is, that the net pool of female candidates, and thus of possible professionals, will be increased through its implementation.

It is difficult to understand why one solution must be vilified simply because it is gender specific.

It is difficult to understand why one solution, based upon both research and practice but proposed in the recognition that there must be a number of approaches to engineering education attempted during the next decade, must be vilified simply because it is gender specific. That, it seems to me, is at the core of the problem, and evidences an attitude that has implications far beyond the particular instance of engineering education.

The idea of engineering, or affiliated programs, targeted for women, is not a new one. It has been tested successfully in France, the U.K. and the United States. There is no implication of a loss of rigour, or of an academic program that would not meet the standards of the profession. The unique feature of the proposal is that the experience would provide for women, who are less sure of their abilities, an opportunity to test and strengthen their commitment to pursuing the profession of engineering. For those who are not "fast trackers" on route to the profession, there would be an additional educational stage in which to test their knowledge base and their personal inclinations. This foundation of confidence has, in other professions, proved to be a salient element of retention and achievement.

How do I summarize the experience? It is difficult to understand the intolerant reception this proposal has received, particularly in light of the general perception of the problem. If the attack had been on the core engineering program, rather than on the proposed makeup of a class of engineering students, it would be easier to deal with. But it was not. And the critique, in essence, poses some fundamental questions relevant to the education of all women in Canada. If we do not recognize differences in background preparation, in teaching and in learning, then we are only offering full career opportunities only to a very small number of highly motivated, well-placed women who are both willing and able to survive in the existing systems in higher education and the workplace.

Changing, adapting and executing programs and courses is a fundamental privilege of our university system. These are essential elements of our autonomy, and underpin our ability to respond to the social, economic and intellectual needs of our society and its future. If a discipline or a profession which is housed in the university is not capable of such change and adaptation, or of the constructive self-criticism that is typical of intellectual progress, the questions that suggest themselves are profound indeed.

Kathryn Bindon is an historian of Canada who was, at the time of writing, V.P., Academic, at Mount Saint Vincent University. She is now Principal of Sir Wilfred

Grenfell College (Memorial university) in Cornerbrook, Newfoundland.

1. "University degrees granted in mathematics, physical sciences, engineering and applied sciences, by sex, Canada, 1970 to 1988" in Department of the Secretary of State of Canada, *Profile of Higher Education in Canada*, Ottawa: December 1990, p. 19.
2. "Proportion of women among graduates of college career programs and among graduates from university programs leading to a degree, Canada, 1975 to 1988" and "Proportion of bachelor's and first professional degrees granted to women, by major fields of study, Canada, 178 and 1988", in *Ibid*, pp.15, 17.

AfriCan Training and Employment Centre

by Margaret Anderson-Clarke

It's Monday morning, and the telephone is already ringing off the hook. The voice on the other end says, "Hello? Is this the African Training and Employment Centre?" Before you can say a word, she continues in a desperate voice, "I am an African woman. I am a refugee, I have no money, I have no job--I need help."

She has already called at least a dozen places. This time she's lucky. She'll be coming in next week for an interview and she is a possible candidate for the Computer Numerical Control Operator Program, a novel course on state-of-the-art computer controlled manufacturing technology. At first blush she does seem an unlikely candidate but she will be given the opportunity to prove herself. She's not looking for a hand-out. She wants to learn, she wants to work, she wants a new life for herself--and needs a chance. This is a typical call and only one in a succession of calls to follow. Eighty percent will be from African women requiring employment related programs and services, women with poor English skills and no technical background, many of whom are refugees who have suffered tremendous hardship on their way to Canada.

The second floor of a renovated warehouse in Toronto's west end has been the home of the African Training and Employment Centre (A TEC) since its establishment in 1987. The grey carpeted hallways, classrooms and computer room have been one of the few alternatives for a community suffering from serious unemployment (the latest figure was 37.9% compared to a national rate of 10%), underemployment, and a myriad of barriers to gainful employment. The country's current economic situation has made matters worse; minorities are often targeted as scapegoats during hard times.



It's a tough course for a woman facing culture shock and rejection from those who do not understand her situation.

The needs of the African community are great and they are compounded by other factors. The community comprises over thirty national and/or ethnic African groups, each with their own characteristic languages and cultures. The diversity is enormous. But the "communities within the community" all experience similar problems in adjusting to a new environment and finding viable employment. Individuals are often "rejected due to language problems, non-transferable skills, unrecognized education! qualifications, and barriers such as racism.

Centre africain de formation et d'emploi (ATEC)

Par Margaret Anderson-Clarke

Fondé en 1987, l'ATEC représente une solution de rechange dans une collectivité où sévit un chômage endémique, le sous-emploi et la discrimination. Rejetée par les grands courants de la société, une femme possédant des compétences risque de se retrouver dans un cycle sans fin, un jour prestataire de l'aide sociale, le lendemain effectuant un travail mal rémunéré, et ainsi de suite.

L'an dernier, l'ATEC a offert un cours au Collège George Brown pour former vingt Africaines (immigrantes) à savoir se servir de robots (machines de haute précision utilisées pour fabriquer des pièces détachées ou des instruments médicaux). Ces emplois sont bien payés, mais les hommes y sont en plus grand nombre.

L'ATEC s'est heurté à une forte résistance lorsqu'il a essayé de trouver des postes à ces femmes. Toutefois, 75% des stagiaires ont été placées dans des usines adéquates. De plus, deux étudiantes travaillent comme apprenties.

La majorité des femmes qui consultent l'ATEC ont besoin d'appui ou de services d'orientation ainsi que d'une formation professionnelle. Le Centre a l'intention de se doter de services d'orientation complets et d'ajouter au programme normal des ateliers d'orientation professionnelle. Parmi les autres cours qu'offre le Centre, citons ceux d'informatique, d'anglais langue seconde, de préparation à la vie et à l'emploi.

Grâce à l'ATEC, vingt Africaines ont quelques atouts supplémentaires pour assurer leur avenir au Canada.

The social effects of employment related problems can be unfathomable, often rendering an individual powerless. Rejected by mainstream society, an otherwise talented person ends up in an ongoing cycle of social assistance and low-paying jobs. ATEC breaks that cycle by providing assistance, and community-specific employment related programs and service proven, highly effective adult learning approach.



The grey carpeted hallways and computer rooms are one of the few alternatives for a seriously underemployed community.

Last year, the African Training and Employment Centre made a major breakthrough in non-traditional technical training for African women. In a program offered jointly with George Brown College of Applied Arts and Technology, students learned how to work with computer controlled machinery. It was a thirty-six week course, twelve of which were on-the-job in work placements. It's a tough course for an individual trying to cope with culture shock and facing rejection from others who do not understand her background or situation.

But by the end of the program the women had a solid grounding in leading-edge computer numerical control machines (CNC machines) used in the manufacture of metal and plastic parts. CNC machines are used for high-precision work in the manufacture of everything from auto-parts to medical instruments to artificial limbs. Whenever you get into your car or flick a light switch to use any common instrument, it was probably manufactured on a CNC machine guided by a

skilled CNC operator.

CNC work is dominated by men. There are few women working on the shop floors of industries that use such technology. On top of learning a new job, then, the students in this first course also had to deal with sexual harassment and discrimination. "They've hardly had time to adapt to the general environment, never mind all the particular difficulties associated with non-traditional work," says ATEC executive director, Larissa Cairncross.

ATEC had an uphill climb as well, making as many as fifty to a hundred phone calls to find and confirm each work placement. In addition, the placement period for this first course coincided with the beginning of a major recession in the manufacturing industry. Many plants were either laying off workers or closing down indefinitely. Coupled with traditional prejudices, this produced some interesting responses. One firm pleaded that it would be forced to spend thousands of dollars to build new washrooms for female trainees. Another said that the presence of women in a factory would distract men from their work.

ATEC has not escaped the recession either and finds itself in a constant battle for shrinking funds increasingly being siphoned off to mainstream organizations. It's a battle we are determined to win, because the community demands it. Mainstream organizations are not and cannot be fully geared to the special employment related needs of the African community. ATEC effectively applies extensive knowledge and understanding of the African community to the development and delivery of its programs and services.

Despite the odds, ATEC managed to place 75% of the trainees in CNC plants. Two of them, Adanech and Paulette, became apprentices at Exacta Precision Products of Agincourt, Ontario, a manufacturer of punches and dies for piercing and forming systems. The firm was supportive of the program and also of the women. Plant Manager, Noubar

Kokorian, encouraged the trainees and had them working on CNC lathe machines. These machines are large and expensive, costing \$100,000 to \$200,000 each. They are equipped with innumerable controls and a single mistake could ruin a job and cost the company time and money.

It's demanding work. But in a just a few short months, the students learned to read blue prints, write computer programs, do precision measuring and calculations, set up tools and run the parts. It was a tough grind, and the students were among the first to admit it. "At first, I got into a bit of an accident, but they guided me through," says Paulette. Over the last four years, ATEC has provided a range of programs and services.

Besides the new CNC program, regular programs include a micro-computer skills training course, ESL, life skills, and pre-employment preparation. Like the CNC course, the micro-computer courses include placement components. In addition to training programs, the agency offers information, support and resources for personal growth and development.



Margaret Anderson-Clarke is a Program coordinator at the AfriCan Training and Employment centre.

Experience has shown that the majority of clients who come to ATEC for skills training also require help and support to develop their learning abilities and self-confidence. While job training is essential for the development or upgrading of marketable skills, there are other factors that make an individual "employable".

A TEC plans to add full counseling services and a series of workplace orientation workshops to the curriculum. The proposed counseling services program is expected to assist clients in individual and group counseling, and in placement services. The Centre is confident that clients will benefit from this new integrated approach to their skills training.

Twenty African women now have marketable skills in technical industry

Students have learned to read blueprints, write computer programs, do precision measuring, set tools and run the parts.

From the continent of Africa to the shop floor of a CNC plant in Toronto--that's quite a distance. With the help of A TEC, twenty African women now have marketable skills in a technical industry, which is one step closer to securing their future in Canada.

Listening to the women's Voices

by **Fran Davis and Arlene Steiger**

"Look at a classroom; look at the many kinds of women's faces, postures, expressions. Listen to the women's voices" (1). This injunction, written by Adrienne Rich in 1978 as part of her insistence that we "take women students seriously", has become an important theme in our research. We are working to document the impact of feminist pedagogy in traditional classrooms across a wide range of disciplines. We have, as a result, elaborated a set of teaching strategies out of our sense that the classroom is a political arena in which women students are likely to be disadvantaged in a variety of ways.

That men speak more than women in the classroom has implications for the very nature of women's learning .

Initially, we were most concerned about the unequal distribution of space and attention in the traditional classroom. The phenomenon is well documented. In general in mixed groups, men tend to speak more frequently and are more likely to interrupt a woman (2). Such patterns of interaction are carried into the classroom, where they continue to work upon the lives of young women in spite of the best egalitarian intentions of teachers.

The process by which men come to lay claim to more space in the classroom is undoubtedly complex. For example, several researchers have found that male students tend to intervene in the classroom in ways which draw the attention of the teachers more effectively than do the female students (3). For us, the crucial issue here is talk, and the fact that men seem to do more of it .

We think that speech is a critical step in the process by which students come to possess material. Certainly Stella Baruk, in her attempts to understand her students' difficulties in mathematics, reminds us of the indispensable role of talk at every turning. The language of everyday speech is literally the tool she uses to burrow through mathematical error toward understanding (4). That men speak more than women in the classroom has implications for the quality and perhaps even the very nature of women's learning.

À l'écoute des femmes

par **Fran Davis et Arlene Steiger**

Lorsque nous enjoignons les enseignants et enseignantes de suivre le conseil d'Adrienne Rich, soit celui «d'être à l'écoute des femmes», nous leur demandons de lutter contre des forces toute puissantes qui se manifestent dans les salles de classe. Dans la mesure où la parole est un des éléments clés permettant aux élèves d'acquérir des connaissances et dans la mesure où les garçons parlent davantage que les filles pendant les cours la qualité, voire la nature-même de l'apprentissage des femmes sont des le départ

contrecarrés.

Nos travaux dans le cadre de l'élaboration de méthodes pédagogiques féministes pouvant s'appliquer à diverses disciplines nous ont amenés à chercher d'autres moyens pour que les élèves et le personnel enseignant, mais aussi les élèves entre elles et eux arrivent à mieux communiquer.

Nous savons que la pédagogie que nous préconisons remet en question ce qui a été accepté jusqu'à présent comme le paradigme scientifique. Les liens existant entre l'affectif et rationnel, entre la détenteuse de connaissances et le connu, semblent caractériser les situations d'apprentissage dans lesquelles les femmes trouvent un réconfort. Les disciplines scientifiques mettent l'accent sur la division, la virtuosité et l'objectivité.

En interviewant des étudiantes dans le cadre de nos recherches sur la pédagogie féministe des sciences physiques, on a un de l'attitude des étudiantes du cycle supérieur à l'égard de l'étude de la physique.

If men speak more than women in the classroom, there is every reason to suspect that men exercise greater control over "the classroom agenda." Dale Spender describes how boys' behaviour (and misbehaviour) in the classroom works to shape the curriculum in primary and secondary schools (5). At the college level, we have no evidence to suggest that there is any fundamental shift in the balance of power. However, it is probably fair to say that in the sciences, all students enter a learning situation which is ever more ruthlessly driven forward by content, and the need to cover material takes ever more precedence over students' demands and needs.

And so, when we enjoin teachers to "listen to the women's voices", we are, in a very real sense, asking them to enter the fray and to work against some very powerful forces in classroom life. In truth, teachers are right when they complain that young women in their classes are unresponsive to cajoling, seem to prefer whispered conversations with friends to larger and more public exchange. In order to listen to the women's voices, we need to render these voices more audible.

We are asking teachers to enter the fray and work against some powerful forces in classroom life.

Our experience suggests that this apparently simple task becomes the basis for transforming the structure of interaction in the classroom. Our work has involved the search for alternative paths of communication between students and teachers and among students. We have encouraged teachers to experiment with the use of personal and collective journals, question and answer boxes, brief free-writes, and personal self-disclosures--all designed to allow students to use their voices and have them heard without raising them in a large classroom situation. We have also experimented with collaborative partnerships.

It is significant that all of the successful feminist strategies with which we have worked involve integration of subjective experience in learning. Students are asked to express what they feel and what they believe as well as what they think and know as they work through course material. Our pedagogy insists upon a connection between the knower and what is to be known. We are increasingly convinced that this connection more accurately reflects the psychological reality of women in patriarchal society than do the traditional distinctions of the academic world. We have found a good deal of evidence in support of the importance of connection and of relationship in women's lives, suggesting that the developmental paths traced by Nancy Chodorow, Dorothy Dinnerstein, Carol Gilligan, and Mary Belenky are important for us to consider.

As connection between the emotional and the rational, between the knower and the known, seem to characterize the learning situations in which women find comfort, it is particularly disturbing to explore the dominant imagery of the scientific disciplines. Here, distinction rather than connection holds sway. Objectivity is assured by the creation and maintenance of distance between the investigator and the object of his investigations. And in the history of science, the object of investigation has been almost invariably female. Nature has been variously tortured, raped, or seduced in order to gain access to her secrets. The scientific method is considered value-free; research is pure, facts are hard. Evelyn Fox Keller suggests that the masculine identity, defined through separation, may have a vested interest in maintaining the concept of objectivity, finding safety in the rigid boundaries which such objectivity implies (6).

We are now preparing to bring a range of feminist pedagogical strategies into two college-level physics classes. In doing so we are reminded that pedagogy and curriculum are and should be related. Much of what we do, as feminist teachers, flies in the face of what students expect from the sciences: we emphasize integration rather than separation, collaboration rather than competition, ambiguity rather than truth. And as we enter these physics classes, we have been intrigued to discover that the contradictions central to the place of women in the sciences must also be addressed.

As researchers, we have shifted from large-scale research designs involving thousands of students to small, more "clinical" studies. This too has been related to the desire to "listen to the women's voices," to attend to these individual , experiences. The overall hypothesis of our research is that feminist pedagogy, introduced into post-secondary physics classes, can produce more active, confident, and committed female learners. Our methodology involves in-depth interviews with students in both experimental and control classes, in both French and English. We are interviewing young women and young men because it seems important to explore the reactions of both women and men to feminist pedagogy.

We have completed an initial period of testing, revising and re-testing of our interview schedules. The results are a medley of voices, women's and men's, students at the top of their classes and students struggling to persist, but already certain themes are beginning to emerge. There are no conclusions to be drawn, but meaningful glimpses of some of the attitudes which these young people bring with them to the study of post-secondary physics.

The entire learning process is so hierarchical that it is sometimes hard to learn even from the teacher.

One of the points on which all the students seem to be agreed is that physics is a gateway subject to an elitist culture which they very much want to enter. It is seen as a "hard" subject, requiring "a lot of work," presenting "a real challenge" and imposing a kind of "discipline" or "structure" to the student's work habits. They are conscious that these are the very reasons why many students do not want to do physics, and they see this rejection as a failure of commitment to educational aspirations. Being able to fulfill these rigorous requirements is a virtue ("no pain no gain," said one young woman), and students talk about getting very positive feedback from both peers and parents for "working until you get it." This language is used indiscriminately by both males and females.

There are, however, some subtle differences between male and female descriptors of personal connections with this elitist culture. Without exception, the males we interviewed talked about hard work as an automatic door-opener: those who had not done well faulted themselves for not having worked hard enough, or, very occasionally, cited inappropriately high: or low standards of teachers. The female students talked about their choice of physics as "wondering whether I could do it" and their success as "Hey, I can do it too."

There is a sense among some of them that sometimes a person just "doesn't get it", despite great effort. These comments suggest that the girls feel a certain talent is required, an attitude the males tend not to reveal. The female comments also suggest, to us, a lesser degree of confidence if also a greater sense of realism. These young women talked about the adjusting their career goals if they didn't "make it in the sciences", whereas none of the males spoke about this possibility.

Not only did career goals among males appear to be stronger incentives to continue in physics, but so did general interest in the subject. When asked "Is physics connected to your life?" some of both the males and females talked about the way in which physics "explains things." But for the males, these "things" included concepts such as speed, magnetism, and gravity, whereas for the females it was just as likely to be the application of electricity or lasers to some specific technical process that they single out as interesting.

Some of the young women expressed a sense that chemistry and biology are "more connected to life": "why vinegar is acidic is more real to me than the speed of a car," said one young woman. Several of the females stated baldly that physics is "boring" and that they take it only because they "have to." All the males in our sample said they "like" physics. Early socialization seems to be responsible for this area of difference, and some of the young women openly acknowledged the fact.

One of the emerging realities that most concerns us is the way these young women describe their learning process within the context of the physics class. Their sense that the teacher is all-important (and that without teacher explanation learning physics is impossible) is no different from that of their male peers: all our post-secondary subjects

have described their learning as extremely teacher-dependent. They are also in agreement that the immediate goal of their learning is to arrive at correct solutions and that this process is very competitive among the students. How they see themselves within this dependent, isolating, and competitive context is very problematical, however, for many of the girls.

Where the boys usually admit enjoying the competition, the girls either "don't mind it" or "don't like it." They tend to see themselves apart from this arena, saying "I'm not really like that." It is clear that students do consult each other occasionally when they have problems with their work. But some of the young women experiencing difficulty with the subject talked about the problem of finding someone "who knows enough to help you," as if many of the better students are unwilling or unable to share their expertise, and that there is no sense of collaborating with someone of their own level.

Indeed, the entire learning process is seen as so hierarchical that it is sometimes hard to learn even from the teacher because "he's on such a higher level." These female students envision teachers preferring to talk with students who are "on their level." Classroom discourse is, for them, divided between apparently teacher-pleasing exchanges with bright students who are invariably males, and teacher-exasperating exchanges with students like themselves.

"They look at you, like, 'Why weren't you listening?' But you were listening, it's just you didn't understand it," said one girl. Another said, "It was like 'Aaaaaah!' You're asking me this again?" A third offered this comment: "They probably get bored of explaining and explaining you the basics, you know, so they like it when kids understand and start asking more complicated questions." When asked how these different levels of classroom discourse made them feel, they all replied that they felt "stupid", though they were quick to point out that some teachers are careful not to show these kinds of preferences.

Two rather lengthy comments from one of the young women are of such interest and concern to us that we would like to present them in full. These halting yet insightful remarks pose many of the issues about the way physics is presented in schools and colleges. The problems which Susie pinpoints and tries to work out for herself are some of the problems which we hope to begin to unravel as we proceed with our research.

«They probably get bored of explaining to you the basics.»

As an addendum to the question "How do you study physics?" , Susie said:
There was one thing I learned in Humanities - we were doing; um, The Realm of Science-that science and art and imagination are supposed to go together. In school you know, you're not supposed to imagine, you're supposed to learn and then memorize: da duh da duh da duh. But science is kind of like imagining things. You're just making a picture in your mind, you know. And that helps a lot. When you can take what you learn and--even if its not much--just kinda stretch it and reproduce whatever you have in your mind and how it works and keep on trying it. I didn't learn this from physics, though, I learned it from Humanities, and I thought WOW imagination and science together. I really didn't think

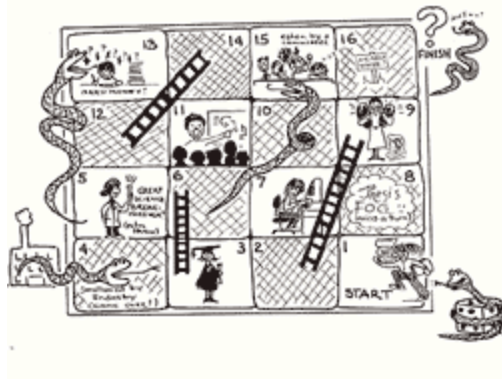
about it before because I thought it was all about facts.

When asked if she would like to add anything at the end of the interview, Susie said: *I think they should start physics a lot earlier. At least the kind-the way you have to think about it. Because people get into grade ten and they think "HEY What a big stump." They've never imagined or had the pictures in their mind: like, "I want to raise this object, how do I do it with a pulley or a string." They also come with this attitude "Aaaah!" This is physics, this is really scary." Its kind of like a straightjacket, automatically you're paranoid Like at the beginning of the semester, I-you know--I'm kinda intimidated; like I'm taking physics and chemistry, and how am I going to do? So, one of my teachers has this sticker that says [Susie raises her eyes and points to the ceiling! 'Physics is good for you, but it should be a lot lower. Maybe its just because I'm looking up at the ceiling--but it should be a lot lower, you know, to have a more relaxing atmosphere about it.*

Fran Davis and **Arlene Steiger** are working on the first year of their second Quebec Government grant for research in feminist pedagogy, focusing this time on the physical sciences in the CEGEPS. Since 1988 they have conducted numerous workshops and published articles on their research. The report of their first project, *A Practical Assessment of Feminist Pedagogy*, can be obtained from Vanier College, Montreal, where Fran teaches English, Arlene teaches Humanities, and both are actively involved in Women's Studies.

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Academic Snakes & Ladders



The University of Saskatchewan: A Portrait

by Lillian E. Dyck

The murder of fourteen young female engineering students at L'École Polytechnique in Montreal sent a chill across the nation. Suddenly a frightening dimension to being a woman in science, engineering, and technology was revealed. For the first time in our lives, we had to deal with the possibility that not just because we are women but women in a certain vocation, we could become targets for bullets or other physical attack.

Amazingly, debate continues as to the significance of this horrific event to the lives of women. The deliberate singling out and murder of these fourteen women was sexual harassment in its ugliest and most extreme form. Sexual harassment is expressed by a myriad of behaviours which range from sexist jokes on the one end of the spectrum to rape and murder on the other.

What relevance does sexual harassment, have to women at the University of Saskatchewan? We know that we have to be careful where we go, with whom we associate and so on, in order to avoid physical, sexual harassment. But in addition to the identifiable, often visible, sexual harassment, non-physical gender harassment also permeates the campus. Those of us who have studied or are studying in male-monopolized fields such as the natural sciences and engineering are too often targeted by this gender harassment or

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discrimination.

Let us look at the gender distribution of students and faculty at the University of Saskatchewan to see where the male monopolies are. In 1990-91, for the first time, women outnumbered men in the total undergraduate student population (by seventy-one). But too few of these women will graduate with degrees in the basic sciences. For the years 1988/89 and 1989/90, there were more female than male students in the first two years of the science program, but many of the female students leave to enter nursing, pharmacy, nutrition, medicine, physical therapy, and dentistry. Consequently, women no longer outnumber the men in the third and fourth years.

L'Université de la Saskatchewan: un portrait

par Lillian Dyck

A l'université de la Saskatchewan, bien qu'il y ait plus de femmes que d'hommes inscrites aux cours de base de sciences, les femmes sont petit à petit éliminées des sciences au cours de leurs études. Plus les études sont supérieures, moins on trouve de femmes: en 1989, trois fois plus d'hommes que de femmes obtenaient leur maîtrise et seuls neuf doctorats sur trente-sept étaient accordés à des femmes.

L'omniprésence du harcèlement des sexes explique en partie le peu de femmes que l'on trouve dans le secteur scientifique et technique et les difficultés auxquelles se heurtent celles qui y restent. Le harcèlement peut s'exprimer consciemment ou inconsciemment et se caractériser par une constante meurtrissure psychologique des femmes.

Des taquineries sexistes ou un mépris continu de nos travaux peuvent créer un milieu hostile. Nos talents ne sont pas reconnus et nos idées ignorées ou attribuées à des hommes. Nous ne bénéficions pas des mêmes salaires, avantages, équipement, bureaux et personnel de soutien que nos homologues masculins et nous devons travailler en dépit du peu d'appui financier accordé aux femmes scientifiques, auquel s'ajoute le refus de reconnaître que les femmes ont autant besoin d'un emploi que les hommes.

Heureusement, le climat général dans les campus semble mener à des changements positifs, et nous continuons à déployer des efforts pour créer ce modèle d'égalité qui devrait exister partout.

Table 1

Degrees granted and gender,
University of Saskatchewan 1989

Degree	Females	Males
B. Art*	400	304
B. Science*	98	183
B.Sc. Engineering	13	207
B. Sc. Nursing	86	1
B. Sc. Nutrition	22	1
Dr. Vet. Medicine	37	30
B. Sc. Pharmacy	45	29
B. Sc. Phys. Therapy	16	5
Dr. Medicine	26	31
Dr. Dental Medicine	10	8
M. Arts	30	13
M. Science	33	99
M. Vet. Science	3	4
M. Engineering	0	1
Ph.D.	9	37

* Includes general, advanced certificate, advanced, honours. Not all degrees listed.

These data were obtained from the University Studies Group, University of Saskatchewan, Statistics, Vol. 16, 1990

This side-streaming of women away from the basic sciences is perhaps best illustrated by looking at the numbers of women and men granted degrees in the arts and sciences. Table 1 shows that in 1989 at the University of Saskatchewan, more women than men were granted a Bachelor of Arts, but nearly twice as many men as women received a Bachelor of Science degree. Only 5.9% of the Bachelor of Engineering degrees were granted to women. By contrast, in what could be termed the applied or professional life science fields, either the majority or equal proportions of the degrees were awarded to women. More women than men obtained a Doctor of Veterinary Medicine (55% women), a Bachelor of Pharmacy (61 % women), a Bachelor of Physical Therapy (76%), and almost as many women as men (46%) obtained a Doctor of Medicine degree.

The disproportion becomes more exaggerated with more advanced degrees. Three times as many men as women were granted a Master of Science, while three times more women than men were granted a Master of Arts. Only nine out of a total of thirty-seven Ph.D. degrees were awarded to women.

This streaming by gender at the graduate student level is shown in

detail in Table 2 for 1990/91. In all the scientific fields of study, only nutrition had more female than male graduate students and only pharmacy and toxicology had approximately equal numbers of male and female graduate students. In the life sciences, geography, and in veterinary medicine, 36-42% of the graduate students were female. In chemistry, biology and mathematics, 20-26% of the graduate students were women.

There was only one female and thirty-nine male graduate students in physics. Pooling all of the science graduate students, the ratio of female to male was 1 to 3. By contrast, there were about equal numbers of male and female graduate students in sociology, law and in physical education, and in other areas women outnumbered men. In the Fine Arts, there were four times as many female than male graduate students. The overall ratio of female to male graduate students in these non-science fields (excluding Commerce) was 2 to 1.

Further up the academic hierarchy, at the faculty level, gender distribution is far from equitable. Only 15.4% of full-time faculty in 1989-90 were women (see Table 3). While about half of the male faculty are at the full professor rank, only 10% of the female faculty members are full professors. In the 1990/91 academic calendar, there were 248 professorships listed in the following selected science departments: biology, chemistry, mathematics, physics, engineering, anatomy, biochemistry, microbiology, physiology and pharmacology. Women in tenured or tenure-track positions accounted for only about six to ten of these 248 professorships.

A number of reasons why women do not choose to enter professions in the natural sciences and engineering have been proposed. These include presumed inherent biological differences between men and women, poor educational practices at all levels of schooling, lack of female role models in science, and the recent loss of appeal of science itself as a good career choice. I do not want to discuss any of these postulations here, but to focus on gender harassment and the thesis that its pervasive effects account not only for the paucity of women in science, engineering, and technology but for the difficult situation that many of us face in remaining in these fields.

Gender harassment or discrimination is expressed in many ways, deliberately and unintentionally. It may not even be identified or recognized by the target, and can spread over a spectrum of seemingly harmless behaviour to those which constitute persistent psychological battering of women. When women work or study in isolation from significant number of other women, as occurs in most of the basic science fields, we can face gender discrimination on a daily basis.

Sexist teasing results in an unfriendly work or study atmosphere while the continual putdown of our work or ideas creates a work environment so hostile that some of us may voluntarily resign to preserve our mental health. It is essential for us to learn how to recognize gender harassment, develop strategies to neutralize its effects, and if necessary, use whatever grievance processes are available.

In those departments where gender discrimination is practiced wittingly or unwittingly, women are neither encouraged to participate in the study of science, nor to remain and advance in the field. Gender discrimination can create an environment where our talents may go unrecognized; too often our ideas are ignored or undervalued, or if good, may be credited to a man. Some of us may

In departments where gender discrimination is practiced, women are neither encouraged to participate in science, nor to remain and advance the field.

not receive salaries, perks, equipment, office space or support staff equivalent to those of our male counterparts.

Other examples of gender harassment include showing pictures of nude women in class or at work as a joke, differential treatment of female and male students in the class, the continuing refusal to recognize that we need jobs just as much as men do and that we are as serious about our careers, the lack of encouragement or sponsorship of female students or employees for advancement, and the misuse of authority by some men to attempt to control subordinate female employees.

TABLE 2

**Analysis of Graduate student by discipline and gender
University of Saskatchewan 1990-91**

"SCIENCE"	Female	Males	"OTHER"	Female	Males
Physics	1	29	History	12	25
Math	4	14	English	36	25
Chemistry	9	25	Psychology	42	23
Engineering	22	158	Sociology	14	12
Geology	5	45	Law	6	7
Biology	11	43	Phys Ed	8	8
Geography	9	16	Education	243	129
Life Sciences	28	39	Fine Arts	21	6
Applied Scs.	45	124	Nursing	14	1
Vet. med	25	36	Sub-totals	399	236
Pharmacy	9	11	Ratio	2	1
Toxicology	8	9	Commerce	65	132
Nutrition	3	0	Other	30	20
Sub-Totals	179	549	Grand Total	670	937
Ratio(F:M)	1	3			

Eng = ag, civil, chem, elec, mech

Life sci = bioch, physiol. pharmacal. Neuropsiat, anat, microbial

Applied = hort, anim/soil/crop/food sci., appl microbiol

Bioi = biol. plant ecol

Fine arts = art, music, drama

Commerce = acct. mkt, etc.

These unofficial data were obtained in January 1991
from the College of Graduate Studies and Research.

Fortunately, gender harassment is no longer considered to be harmless nor is its practice acceptable. Such behaviour can constitute a violation of the Charter of Human Rights, and those individuals who discriminate on the basis of gender, as well as their employee, can be held accountable for their actions through the judiciary process. Moreover, the University of Saskatchewan has a sexual harassment policy to deal with the gender discrimination that creates a poisoned environment for a woman's (or a man's) work or study.

TABLE 3

**Full-time Academic Staff
by Rank and Gender 1989-90**

	Male	Female
Professor	53%	10%
Associate Prof.	28%	39%
Assistant Prof.	16%	38%
Lecturer	1%	7%
Instructor	2%	5%

There were 919 males and 167 females employed full-time. Data were obtained from the University Studies Group, University of Saskatchewan, Statistics, Vol.16,1990.

While there are certainly too few women on campus and too many of us working or studying in such environments, there is, nonetheless, a bright side to the picture. In the last year or two, a number of groups of women in science have emerged across the campus. These groups are organizing to offer support other women in science, sponsor workshops and seminars and increase the level of awareness of the difficulties faced by women on campus. Undergraduate female students in the College of Arts and Science have joined together in a group called WINS (Women in the Natural Sciences). A number of engineering students have formed an Encouraging Enrollment in Engineering Committee, whose focus has been on female students. Dean I. McDonald of the College of Medicine appointed female faculty to a Women in

Academic Medicine Committee and a career mentoring program geared to female high school students was launched by several established

organizations, including the National Hydrology Research Centre. A group of female graduate students meet as the No Name Grad Group; a Support Group for Women in Science and a Women in the Sciences group sprung up independently last year, and are collaborating in a number of common areas of interest. In addition, a number of women from associated research institutions on campus are forming their own group or joining

up with others.

Gender harassment includes showing pictures of nude women in class as a joke, differential treatment of students, and refusal to recognize that we are serious about our careers.

The formation of some of these groups was aided by a series of workshop sponsored by the Women's Program section of the Extension Division and called "You've Come A Long Way, Maybe". Two workshop in particular "Women in Science: Issues and Actions" and "The Burning Desk: Women in the Workplace" featuring Dr. Rose Sheinin and Nicole Morgan, respectively, were well received and timely.

The birth of these women's science groups may have been catalyzed by the discontent regarding equity issues in our individual places of work and study and by the belief that our new president, J.W.G. Ivany, is sensitive to "women's issues". The President's Adviser Committee on the Status of Women was formed in November, 1990 after representatives from various campus committees concerned with women's equity issues met with Dr. Ivany. In addition, an Employment Equity Advisory Committee has been created, and an agreement in principle to the formation of a Women's and Gender Studies Department has been achieved.

The overall political, if not economic, climate on campus appears to be conducive for change for the benefit of both women and men. We continue to be determined, active and optimistic in improving our individual places of work and study to meet the egalitarian model which should exist everywhere on the university campus.

Lillian E. Dyck is a co-Chair of the Women's Studies Research Unit, and a research scientist in the Neuropsychiatry research Unit in the Department of Psychiatry, at the University of Saskatchewan. She wishes to thank Glenis Joyce, Extension Division, University of Saskatchewan, for inspiration and for " mental stimulation and support. A number of women from various science backgrounds on campus have contributed in different ways to this article.

Pédagogie féministe en mathématiques

par **Hélène Kayler et Louise Lafortune**

Quiconque désire aborder des études dans le domaine des sciences et de la technologie doit posséder une connaissance raisonnable des mathématiques. En fait, il s'agit non seulement de satisfaire aux conditions d'admission des programmes correspondants, mais ce préalable est aussi incontestablement nécessaire. En effet, une base mathématique est essentielle ne serait-ce que pour manipuler des expressions algébriques, lire un graphique,

interpréter des données statiques. Bref, il est difficile de contester cette omniprésence des mathématiques dans tous les domaines de la science et de la technologie.

On sait bien cependant que beaucoup d'étudiantes et étudiants éprouvent des difficultés durant leurs cours de mathématiques, et développent une telle aversion à l'égard de cette discipline qu'ils l'évitent pendant toute étude ultérieure qui exige une base mathématique. Du même coup ces perceptions orientent leur choix de carrière en fonction de ce critère: une profession ou un emploi qui ne demande pas de connaissances préalables en mathématiques.

La culture traditionnelle encourage les filles et les femmes à penser qu'une formation mathématique ne leur est pas absolument nécessaire.

Ceci est plus fréquent chez les filles et les femmes car la culture traditionnelle les encourage à penser qu'une formation mathématique ne leur est pas absolument nécessaire. Par exemple, encore aujourd'hui la famille encourage un fils à s'inscrire à un cours d'informatique et une fille à faire de la danse classique. Il est donc fréquent d'observer que les femmes en situation de recyclage et les filles en cours d'études déterminent leur orientation (choix professionnel ou choix de programme d'étude) en éliminant l'obligation de suivre des ou même un seul cours à saveur mathématique.

À la lumière de ces deux seules remarques, il est évident que les chances sont très faibles de retrouver des femmes et des filles en grand nombre dans les domaines scientifique ou technique et nous pensons qu'une manière d'agir sur ce choix consiste à tenter d'en modifier les conditions. Un moyen d'action sur la situation globale consiste à créer un réseau de personnes compétentes pour intervenir auprès des femmes et des filles avant ou au moment de leur choix de carrière et de programme d'études.

A feminist pedagogy for mathematics

by Hélène Kayler and Louise Lafortune

The majority of scientific or technical disciplines require at least a basic knowledge of mathematics, but girls and women often limit their choice of study or career by eliminating the obligation to take even one course in math.

We believe that it is possible to change this situation by forming a network of women who, as mothers, teachers, counsellors, or others, can intervene in the lives of girls and women to influence their choice of study. It remains to reach these women and equip them with the necessary information and strategies. Three elements we feel are absolutely fundamental to be understood or utilized are: the attitude of women and girls towards mathematics; the need for a demystifying context in which to gain skills and competence in the subject; and a feminist pedagogy to teach it.

MOIFEM (Quebec section of the International Organization for Women and Mathematics Education) is currently developing a series of workshops incorporating these three basic elements for teachers and counsellors. Preliminary responses through evaluation forms and demand for more workshops indicate that we are indeed responding to some definite needs.

Il s'agit donc de repérer et de toucher au moins une partie des personnes qui jouent un rôle décisif à cette étape. Il y a évidemment l'influence importante de la famille et des amies, mais il y a aussi celle des professeurs et des autres intervenantes des milieux scolaires et parascolaires: les enseignantes du primaire ou les professeurs de mathématiques du secondaire, mais aussi toutes les animatrices et conseillères pédagogiques qui interviennent à un moment donné au cours de l'orientation, que ce soit à l'école primaire ou secondaire, ou dans les groupes de femmes, groupes institutionnalisés ou non. (Transition- Travail, Accès aux carrières technologiques, Formation préalable à une formation scientifique, etc).

Un moyen d'action consiste à créer un réseau de personnes pour intervenir auprès des filles au moment de leur choix de carrière.

Il s'agit de trouver la manière d'influencer l'action de ces personnes clés. Il faut à la fois les contacter et les munir d'outils adaptés et efficaces compte tenu de la responsabilité que nous leur attribuons. Pour l'élaboration de ces outils, notre réflexion nous amène à tenir compte de trois éléments principaux sur lesquels nous désirons nous attarder ici, soit les attitudes des femmes et des filles vis-à-vis des mathématiques, un contexte démythifiant pour l'acquisition d'habiletés et de connaissances mathématiques et une pédagogie féministe des mathématiques.

Une Pédagogie féministe des mathématiques.

Par pédagogie féministe, nous entendons une pédagogie favorable à l'apprentissage des femmes, et nous reprenons en partie les propos de Davis, Steiger et Tennehouse (1989) dans leur article publié dans *Quelles différences?* sur l'analyse de la salle de classe de mathématiques. Nous reconnaissons avec elles que la plupart du temps «tout se passe comme si l'environnement éducatif des demi ères années du cours secondaire et du cours collégial, en sciences comme en mathématiques, réunissaient en abrégé tout ce que les jeunes femmes aiment le moins» (1).

Pour réagir à cette situation ces auteurs proposent différentes voies en accord avec la plupart des travaux qui soutiennent une théorie de l'apprentissage des mathématiques. Nous retenons particulièrement quelques-unes des approches préconisées en les exprimant en partie en terme d'étape d'apprentissage que l'enseignement doit et peut respecter pour favoriser une approche féministe de l'enseignement des mathématiques. Il est d'ailleurs à noter que les filles et les femmes ne sont pas les seules à profiter d'une telle approche de l'enseignement mais qu'en général toute personne qui éprouve des difficultés dans l'enseignement traditionnel en bénéficie. Pour tenir compte tant de la nature des

mathématiques que de la manière d'apprendre des femmes, nous considérons que l'apprentissage des mathématiques peut se faire:

- par essais et erreurs, ce qui implique de longues périodes de travail avec bavures, hésitations, progrès et retours en arrière, tâtonnements et ce qui laisse aussi une place importante à l'estimation anticipée du résultat recherché;
- à partir de manipulations diverses, et cela demande à l'enseignant ou l'enseignante de penser les activités en ces termes pour avoir à la fois le temps, le matériel et un environnement propice;
- par le moment où intervient l'écriture symbolique: le symbole ne s'installe que tardivement et vient codifier les résultats observés lors des phases de manipulation, de discussion, de contrôle; par le rôle de la discussion entre étudiantes avec ou sans l'enseignant ou l'enseignante: rôle essentiel dans l'apprentissage des femmes et des filles qui remet considérablement en question l'habituelle concurrence. La discussion peut porter sur n'importe laquelle des étapes de travail: aussi bien lors des périodes de tâtonnement ou de contrôle à propos d'un résultat provisoire ou définitif ou lors de la mise en forme écrite de ce résultat;
- enfin par la place et la forme de l'évaluation, qui doivent être adaptées pour être cohérentes avec le type d'enseignement et d'apprentissage favorisé.

Cette démarche est bien illustrée par l'activité qui consiste à découvrir la formule exprimant la relation entre le diamètre et la circonférence d'un cercle. En effet, lors d'une première exploration, on observe que le diamètre est environ égal à trois fois la circonférence: la découverte peut se faire en reportant la longueur du diamètre sur celle de la circonférence, ou en mesurant les diamètre et circonférence de plusieurs disques ou encore en calculant les rapports entre les deux nombres obtenus pour chaque disque. Plus tard, la discussion entre les participantes, dirigées éventuellement par la professeur, conduit à des énoncés du genre: "la circonférence vaut environ trois fois le diamètre", énoncé qui devient éventuellement la formule connue: $C = \pi * d$

Les éléments importants sur lesquels nous désirons insister sont la manipulation d'objet, le tâtonnement (avec des possibilités d'erreurs en cours de route), le rôle de l'écriture qui vient codifier un résultat déjà observé, la discussion qui favorise la formulation d'explications cohérentes, et l'évaluation qui doit stimuler la pédagogie choisie.

Un contexte démythifiant pour l'acquisition d'habiletés en mathématiques

Plusieurs études et travaux, en particulier ceux de Lafortune et de Mura, montrent que les femmes et les filles en particulier sont influencées négativement par les mythes véhiculés dans l'enseignement traditionnel des mathématiques (2). Nous croyons qu'il faut d'abord faire prendre conscience de l'existence de cette situation et ensuite proposer des moyens de s'y attaquer. Rappelons que:

- le mythe de la bosse des mathématiques est persistant et sert souvent à expliquer les difficultés d'apprentissage et à déculpabiliser ceux qui éprouvent ces difficultés; en effet, reconnaître qu'on n'a pas ce talent-là, surtout si on considère en posséder d'autres, est une manière rassurante de ne pas réussir en mathématiques; or nous sommes bien convaincues que les études mathématiques prescrites par les programmes scolaires sont accessibles à toute personne qui réussit normalement dans les autres disciplines, et que ces études ne nécessitent pas de dispositions antérieures particulières;
- les filles et les garçons réussissent aussi bien les uns que les autres dans cette discipline: les résultats d'une étude internationale (1989) relève qu'au Québec les résultats scolaires des filles et des garçons sont sensiblement les mêmes;
- les hommes comme les femmes éprouvent de l'anxiété à l'égard des mathématiques: il nous apparaît qu'à cause des pressions sociales, les hommes sont poussés à essayer de surmonter cette inquiétude, tandis que les femmes l'utilisent comme une raison d'éviter cette discipline des que possible;
- les mathématiques ne sont pas aussi neutres et objectives qu'on le laisse croire: de vives émotions sont provoquées par l'apprentissage des mathématiques; des travaux portant à la fois sur l'histoire des mathématiques et sur la vie des élèves en classe le confirment;



Mme Curie,

Les attitudes des femmes et des filles à l'égard des mathématiques

Bien sûr les femmes ne sont pas les seules à ressentir des émotions à propos de l'apprentissage des mathématiques mais nous croyons que l'incidence de ces émotions sur leur comportement et leur choix d'étude en particulier est plus important que chez les hommes. A la suite de différentes expériences et travaux nous sommes amenées à considérer que l'on peut étudier l'attitude vis-à-vis des mathématiques selon trois axes principaux : l'anxiété, la motivation et la confiance en soi.

Le simple fait de prendre conscience que ces émotions existent est déjà important; une autre étape consiste à proposer des manières de les gérer ou de les réduire à partir de

l'étude de situations particulières. Certains moments provoquent plus d'émotions que d'autres dans l'apprentissage des mathématiques. Le premier cours suscite le plus souvent de l'inquiétude et on doit agir sur les attitudes afin que les femmes et les filles soient davantage ouvertes à recevoir les explications, comprennent davantage et soient ainsi rassurées quant à leurs capacités de réussir dans cette discipline.

L'examen est souvent source de stress, voire même d'anxiété et de panique, ce qui empêche les femmes et les filles de réussir selon leurs capacités. Il s'agit de prendre conscience de ce stress, considérer qu'il a sa raison d'être et apprendre à le gérer.

Le début d'une nouvelle notion occasionne souvent la peur de ne pas connaître des notions devant être acquises et la peur que les autres le découvrent. On peut alors rassurer les femmes et les filles quant aux notions préalables nécessaires et agir sur les mythes véhiculés à ce propos. Le dernier cours est trop souvent ressenti comme la fin d'un cauchemar. Il devrait plutôt servir à faire bilan ou à inciter à prendre d'autres cours de sciences ou à penser comment se servir des connaissances et habiletés acquises dans le quotidien ou le travail professionnel.

Pour outiller des intervenantes qui peuvent influencer les femmes et les filles dans leur choix de carrière ou de programme d'études, MOIFEM (Mouvement international pour les femmes et l'enseignement des mathématiques) réalise actuellement une série de séances de travail subventionnées par le ministère de l'enseignement supérieur et de la science (Québec) et par le Secrétariat d'État (Ottawa).

Le contenu des ces séances porte sur les trois dimensions décrites ci-dessus: attitudes des femmes et des filles à l'égard des mathématiques, contexte démythifiant et pédagogie féministe. Les personnes qui ont déjà été rejointes, tant dans le milieu scolaire que chez les groupes de femmes, se sont montrées fort intéressées : c'est ce que nous indique à la fois les réactions immédiates au cours d'ateliers, une première lecture des questionnaires d'évaluation et la forte demande pour organiser d'autres ateliers. Nous avons tout lieu de croire que notre type d'intervention qui est basé sur la description proposée ici se situe dans la bonne direction et que l'entreprise est appelée à prendre de l'ampleur.

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Science Through Her Looking Glass

by Heather Menzies

By the title of this article, I want to suggest a double meaning. Looking glass connotes not only a scientific instrument--a microscope or telescope--through which one looks to see things scientifically, it is also a mirror which reflects back the image and aspect of the viewer. This implies that what you see and discover through the looking glass of science is also a reflection of how you see the world, which depends on who and where you are.

What I want to suggest is that the science women have done is a reflection of women as a social group and of the social and historical circumstances of women's lives. No single woman constitutes a pattern, nor should we expect all women to fit a pattern. But we can learn a lot by contemplating the source of the reflective differences.

Women scientists tend to have atypical career paths and eclectic, often inter-disciplinary backgrounds. They might go into an applied science area where getting into science seems easier, and move laterally from there. They might interrupt careers to follow husbands, and take their science wherever they can find it. They might also interrupt their full-time career work to have children and stay home with them during their infancy, or juggle their work between lab, daycare centre and home. Or they might simply be less readily recognized for what they are doing and thus not drawn into the centers of scientific inquiry.

The science women have done is a reflection of women as a social group and of the social and historical circumstance of women's lives.

What does this imply in terms of the looking glass? That women bring to their work unique advantages because of their inter-disciplinary, inter-institutional social experience and even their tendency to be relegated to the margins of science. In a survey of Canadian women scientists and their work, Ann Innis Dagg and Rachelle Sender Beauchamp confirmed that a sizeable proportion--45%--of women natural scientists in Canada feel that being a woman affects the science they do (1). I'd like to suggest that women's eclectic background and often marginal position in science uniquely positions them to pursue their science less at the centre of organisms, for example, but more in the border regions between organisms and between individual organisms and their environment. Furthermore, this has led them to some important, path-breaking science.

Les sciences et les femmes

par Heather Menzies

Le genre de sciences que les femmes font reflète ce qu'elles sont en tant que groupe social ainsi que les circonstances sociales et historiques de leur existence. Chez les femmes, les scientifiques ont souvent une formation éclectique, interdisciplinaire. De plus, elles travaillent fréquemment à la périphérie du monde scientifique. Il est arrivé que cette situation entraîne des découvertes très prometteuses. Ainsi, les recherches du docteur Margaret McCully sur les liens existant entre les organismes et leur milieu ont provoqué une remise en question de la théorie de l'évolution de Darwin.

La science est également enchâssée dans des relations sociales qui ressemblent toujours pour les femmes à l'approche se fondant sur la coopération et la collaboration qui existait avant l'ère industrielle. Des études effectuées sur les femmes scientifiques indiquent qu'elles préfèrent faire part des méthodes qu'elles appliquent et se montrent souvent moquées devant l'esprit de clocher de leur confrères masculins.

Les sciences, telles que les femmes les conçoivent, mettent souvent l'accent sur l'importance qu'il y a de parler du sens de la vie et sur les efforts à déployer pour être des participantes respectueuses et observatrices. Il est possible que ce genre d'attitude permette quelque peu de libérer les sciences de leur état de dépendance vis-à-vis de la machine militaire et industrielle.

As an example of a woman who had done such breakthrough science, I'd like to cite Dr. Margaret McCully. She discovered, or rather rediscovered, something called soil sheaths, which are neither animate nor inanimate, organic nor inorganic, but a mixture of root cells, soil bacteria and soil particles held together by the equivalent of mucus secreted by the root (2). In these soil sheaths, Dr. McCully found an illustration of what is emerging as a crucial modification of Darwin's theories of evolution: namely, that organisms don't blindly adapt to their environments or die. Rather, organisms interact with the world outside them to create the environment they need for survival.



Dr. Margaret McCully and students

Dr. McCully discovered soil sheaths in the context of a regular farm field.

Equally significant are the circumstances under which Dr. McCully made this discovery. She was studying corn in the larger context of a regular farm field. Soil sheaths don't grow in the small seedling pots in which corn is grown in the lab, and if they do at all, they tend to be washed off as scientists follow lab procedure, rigorously separating research materials from their living context. Dr. McCully only discovered her "rediscovery" when she found a drawing dated 1882 demonstrating the existence of the sheaths. This knowledge had gotten lost in the move toward modern laboratory science.

Margaret McCully was doing field work in the first place partly because she grew up on a farm. Although a Ph.D. at Harvard trained her for a life of pure laboratory research, she found herself going against that training. She did this partly because her own farm background kept pulling her back to the larger context in which corn is grown. she told me: "I'd always wanted to go back and apply what I knew to the real thing, corn in the field."

What if the science of life in the border regions between individual organisms in their environment were taken as the root metaphor or model for life? The metaphor might then be of a dialogue between autonomous yet inter-connected and inter-dependent beings.

A second aspect of science through the looking glass is that science as a social process is embedded in personal social relationships. To illustrate this theme, I want to talk about Mileva Einstein Maric.

Mileva Einstein's story dramatically illustrates the liberal feminist theme of the exclusion of women from recognition as scientists. There is considerable evidence to indicate that she, Albert Einstein's first wife, was the co-author of a key paper which won Albert fame and the Nobel Prize for the theory of relativity. Although she was not honored by the Nobel committee, nor publicly recognized at the time by Albert himself, he sent her the entire Nobel Prize money, a promise he'd made at the time of divorcing her. This only came to light many years after Mileva died in poverty and obscurity (3).

What's more fascinating, however, is to look at Mileva Maric's story from what might be called a cultural-radical feminist perspective. Instead of seeing a woman stripped of recognition as a scientist, consider her as someone pursuing science on her own quite different terms. I think she succeeded on those terms, even though it meant being rendered invisible as a scientist in the terms that caused Albert to be so fulsomely honoured.

Mileva's sense of herself as a scientist was quite in keeping with the conception of science before the influences of industrialism, commoditizing commercialism, and atomistic individualism. Pre-modern science was very much a personal vocation. It was practiced in the domestic sphere, with the living room or "salon" as a major centre of scientific discourse, and with women as well as men acting as patrons of scientists (4).

Mileva broke off her own doctoral studies to work with Albert and be his patron. As she put it: "We are ein stein, one stone." Just because Albert Einstein demeaned, by taking advantage of the collaborative oneness he enjoyed with Mileva shouldn't cause us to devalue the cultural priorities with which Mileva shaped her life and pursued her science.

Vestiges of this pre-modern scientific culture survive today. A significant number of women scientists in Dagg and Beauchamp's study reported that their approach to research was more collaborative than their male colleagues, and that they paid more attention to relationships within their research group. One said: "I always share my methods and ideas, and am repeatedly shocked and surprised when a male colleague withholds or protects information."

Mileva Einstein's sense of herself as a scientist was quite in keeping with the conception of science of her time.

But why does this difference in doing science as social process and social relations persist, especially among women? It may be explained simply by the fact that when modern science followed modern economics out of the home into the "public" sphere of specialized institutions, women as a group were left behind. As long as women continue to do science in a way that reflects the orientations associated with household activities, they will also be preserving and applying the vestiges of a pre-modern scientific mindset.

This brings me to the third, and possibly the most subtle, of the looking-glass differences I want to discuss here: the orientation of the individual scientist in seeking to know the world scientifically.

Science in tribal society was embedded in the context of everyday life. It was the science of roots and the technology of digging sticks fire-hardened by women to get at those roots. It was the science of plants women cultivated from seeds they selected from the best they found in the wild. It was the science of knowing when to harvest the leaves, the roots or the seeds, how to treat these things to neutralize any poisons they contained and to release the nutrients into the human metabolism. As well, it was the science of herbal medicines to both prevent and to treat illness and disease (5).

We know from the annals of Jacques Cartier that in the winter of 1535 he asked the native people for help when his men were dying of scurvy. In his journal, he recorded watching two women bring ten or twelve branches of black spruce, strip the bark and leaves and prepare a tonic. After drinking this every other day for six days, Cartier's men recovered (6).

But to get a feel for these pre-literate people's scientific knowledge on their own terms, you have to listen to the stories that were passed down from generation to generation through their oral culture. As feminist science historian Autumn Stanley argues, you have to take seriously the ancient mythologies (7).

What you get in these old stories is not the definitive stuff of modern science under the bright lights of a laboratory, but almost the obverse of this: an indefinite but suggestive hurn in the twilight outside. It is knowledge left embedded in the process of life and living itself; where what's known is still, like the tip of the iceberg and the stalk of the corn plant, connected to all that lies unknown under the surface.



Mileva Einstein and her husband Albert, c.1905

For example, the tree is the symbol of native science. As Pam Colorado, a native woman teaching at the University of Calgary, writes, "To the Indian, the tree is the first person on earth. Indeed, the tree ... is the precursor to our human existence" (8). What is fascinating is how this truth, having been sensed and communicated by pre-literate science, is now being explicated through the instruments of modern science.

But to receive knowledge of this sort, to participate in this way of knowing, requires a certain posture on the part of the learner: a posture of attentive listening, and openness to what is being revealed, by the corn plant, by the animal, by the patterns of wind and weather.

Women have an inclination to pay attention to what is still unexplained, and to tolerate ambiguity more than most men.

What I also find fascinating is how you can find traces and echoes of this approach to science carrying on through history even into the present day. There are echoes of the accepting attitude toward the unknown in some of the differences which Dagg and Beauchamp discovered in their survey of Canadian women scientists. For example, in their inclination to go , back to square one, to pay attention to what is Instill unexplained, and to tolerate ambiguity .. "more than most men" (9).

This is what prompts scientist like Margaret McCulley to let research subjects speak (or reveal themselves) on their own terms. It is this spirit or scientific posture which makes for ethical, accountable, participatory research, instead of how-to manuals and ethics experts scripted from the same old mindset of authoritative final words from remote centres of control.

I don't want to do any major summing up but to suggest simply the centrality of relationships to what that life is about, and the striving to become a respectful, observant participant in that inter-dependent dialogue. I could say that I hope the ideas of this paper will help to set science free from its remote ivory tower perched atop the military industrial mountain (10). This way of knowing is central to Pam Colorado's account of native science and scientists.

Heather Menzies, is a writer and lecturer based "" in Ottawa. Her latest book is *Fast Forward and Out of Control*; others include *Women and the Chip*, *Computers on the Job*. This article is an abridged version of a paper given at Carlton University's Institute of Women's Studies', lecture series on women in science and technology.

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7. Autumn Stanley, "Daughters of Isis, Daughters of Demeter: When Women Sowed and Reaped," *Women Studies International Quarterly*, Vol. 4, no. 3, 1981.
8. Pam Colorado, "Bridging Native and Western Science," *Convergence*, Vol. XXI, No. 2/3, 1988.
9. Dagg and Beauchamp, p. 11.
10. Half the world's scientists are engaged in military research. In the U.S., one research institution alone is credited with having set and driven the arms-race research agenda for the past 40 years. This is the Lawrence Livermore Lab outside San Francisco. It occupies one square mile of land, employs 3,000 Ph.D. level scientists and has a budget of \$1 million a year. Source: "Civilizing Science," produced by journalist Stephen Dale on CBC Radio's "Ideas" Program January 17,1991.

At Odds with science?

by Gina Feldberg

Much has been done, during the past two decades, to improve women's representation in medicine, mathematics, science, engineering and the technologic trades--henceforth referred to simply as "science." Still, the perception that scientific work is not women's work persists. Study after study indicates that women remain a minority in the scientific

professions (1). And as the December 6, 1989 events at Montreal's École Polytechnique made clear, some Canadians remain hostile to women as engineers--or surgeons, or nuclear physicists...

The sources of North American discomfort with women scientists and physicians have been identified as threefold: historical definitions of appropriate women's work; economic and political barriers that enforce these definitions; and theories of biological nature invoked to justify a doctrine of separate spheres. More recently, the relation of Canadian women physicians and scientists to the wider women's movement has also affected patterns of women's representation in science.

This paper explores the impact that efforts to define a "feminized", "feminist," or "female" science have had on women's participation in these disciplines. The analysis is based on questionnaires completed by undergraduate students in an upper level science and gender course at two Canadian universities. Interviews with undergraduates and faculty in women's studies programs supplemented these data.

The relation of Canadian women physicians and scientists to the wider women's movement has affected the patterns of women's representation in science.

Feminist scholars have launched what can be seen as a two-pronged critique of science and gender. Informed by liberal principles of equity and equality, one line of research and activism has sought to increase women's participation in, and thus to "feminize," the scientific professions by both recognizing women's historic contributions and encouraging their further endeavours (2).

Another critical inquiry focuses on the content of science. Some scholars have systematically analyzed biases and flaws present in scientific statements about women (3). These insights provide the basis for a more systematic critique of the Western scientific enterprise, which exposes the patriarchal roots and practices of the Western Scientific tradition (4).

En désaccord avec les sciences?

par Gina Feldberg

Les efforts déployés pour définir une science "féminisée", "féministe" ou "féminine" ont eu des conséquences sur la participation des femmes dans les disciplines scientifiques. D'après des questionnaires qu'ont remplis 209 étudiantes du premier cycle universitaire qui suivaient des cours sur la condition féminine et des cours sur les sciences et les deux sexes dans deux universités canadiennes 50% de toutes les étudiantes et 66 % et 70 % des répondantes qui prenaient des cours sur les sciences et les deux sexes pensaient que les sciences étaient anti-féministes et anti-femmes. Le principe selon lequel les sciences sont réservées aux hommes a des conséquences sur les carrières que choisissent les femmes. Plus de 70 % des étudiantes interrogées n'avaient

jamais envisagé de faire une carrière scientifique ou affirmaient qu'elles ne l'envisageraient jamais.

Depuis vingt ans, les critiques féministes ont associé leur souhait de transformer les sciences à leur objectif d'accroître la participation des femmes dans le domaine scientifique. Il se peut que cela nous empêche de réaliser l'un et l'autre de ces objectifs. Les résultats de cette enquête suggèrent que les femmes qui veulent transformer les sciences s'intéressent peu aux sciences et que celles qui font des sciences ne voient pas la nécessité de transformer quoi que ce soit.

En revendiquant la féminisation des sciences, on veut que les femmes soient les porte-parole des changements et qu'elles prennent la responsabilité de créer des sciences plus humaines, moins hiérarchisées. Mais cela met au défi les femmes qui font des sciences (elles représentent déjà une minorité) de se montrer anti-conformistes.

In another branch of the critique, proponents argue that women engage in more contextual, integrated research and they challenge women to use this research to transform science (5).

Instead of charging that science is anti-feminine a new generation of women argue that science is anti-feminist.

By making us aware of the many problems that plague scientific research, and of the many ways in which medical and scientific pronouncements restrict women's roles, feminist critics of science have intended us to discredit the ideas that bound us. They have improved our understanding of barriers to women's entry into science. They have paved the way for better scientific studies of sex and gender, and they have exhorted women to engage in improved studies that challenge claims for women's biological limitations.

Inadvertently, however, this critique seems also to have contributed to the two-cultures divide that helps to keep women out of science. For many generations, young women believed themselves biologically, temperamentally and socially suited to the arts rather than to the sciences. Science, in short, was seen as anti-feminine. Now, instead of charging that science is anti-feminine, a new generation of young women has come to argue that science is anti-feminist. They use this charge to justify their isolation and disaffection from science and to create two cultures in which science and women must live apart.

For several years, I taught science and gender at North American universities. The courses aimed to introduce students to research on sex differences and sensitize them to the biases and flaws in that research. Enrolments hovered around 75, and the vast majority of students were women. However, few of those women had any background in the sciences. Many of them shared the history of a poor classroom experience which prompted them to either fear and hate science classes or avoid them entirely.

As I taught, however, another source of tension emerged. With increasing frequency,

students not only expressed an aversion to science but seemed also to dismiss altogether its legitimacy. Placing a new twist on the old argument that women couldn't do science, these students seemed to imply that women need not do science. Again and again, I heard them voice their frustration not with the typical "I hate science," or "I can't do science," but with the question, "Why do we need to know anything about science? Science is part of the male world." Adopting what they labelled a "feminist" stance, these young women wanted to dismiss science as patriarchal and "male stream"; women, they argued, spoke with a different voice.

More general reactions of teachers and peers supported the students' comments. An invitation to lecture on biology and gender came prefaced with the suggestion that the students be told how "biology was an oppressive, male tool." A group of women science students complained that they had been told that they were unwelcome at the University Women's Centre because they were "men in women's clothing." A young medical student lamented that when, as an undergraduate, she enrolled in a women's studies arts course she felt obliged to apologize for her career choice and that because she had chosen a scientific career, students and teachers challenged her commitment to feminism.

Preliminary statistical data suggest that these isolated anecdotes are representative of a wider, more systematic sentiment. The data come from a questionnaire distributed to undergraduate students in two classes on science, and gender. Some questions required yes/no. answers, others invited open-ended responses. If the students had not taken any science at the post-secondary level, they were asked to explain why not. They were asked if they had ever considered a scientific career, and why or why not. They were asked whether they thought that the content of science was anti-woman and whether the practice of science was anti-feminist.

Participation in the study was voluntary; 106 students responded. For purposes of control, the questionnaire was also distributed to students in an introductory women's studies course, of which 103 responded. Only 5.8% of the total sample, or 12 of 209 respondents, were; male. However, the proportion of males in the science and gender classes was larger; men represented 10% (or 5/50) and 7% (4/56) of these samples respectively. The respondents' ages ranged from 17 to 51 years; they represented all levels of university study though a majority were in their first or second years.

Most students had taken some science, especially biology, at the high school level, but only 35% had taken a course in biology or the hard sciences at the university level. The students provided standard justifications for avoiding science classes. Many cited bad experiences in high school. "The teacher, subject matter, approach, all were stifling" a twenty-year old woman wrote. More specific criticisms focused on the ways in which science had been taught. Complaints about "rote memorization" appeared frequently; high school classes, students reflected, were "boring and distant" and they "never seem to apply directly with personal/local experiences of the body and environment."

Other students expressed fears and insecurities of various kinds. They described science as "threatening and for the 'smart' people," or as "specialized and abstract" and

"technical." Many believed that science was too hard for them. Lack of knowledge and preparation combined with poor early experiences contribute to these fears. Severe limitations in the numbers and types of science courses required by the high-school and university curricula left some students feeling that they were ill-equipped to understand scientific arguments.

Equally often, however, students invoked the "two cultures" split. Some did so obliquely. "I decided courses in the social sciences were more geared to my future" one student wrote. "I disliked the sciences" others argued. But, like one 21-year-old woman, some spoke more explicitly. Asked why she had never taken biology at the university level, this student responded: "Fear! I'm an English Major, and actually wanted a Biology/English double major, however, I lacked the confidence having being [sic] stereotyped as artsie!" One could not, students suggested, do both arts and science, and more often than not, they found themselves drawn to the former.

*In the aftermath
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Students linked their arguments about the divide between science and the arts to the opinion that science formed part of a world that they neither belonged to nor valued. The frequency of observations that science courses seemed "distant," "abstracted" and "irrelevant" provided a general indication of alienation. Other answers indicated that students had set themselves apart from science, or saw themselves to be apart, for primarily political and ideological reasons: "science is a capitalist institution" they suggested; science is "institutionalized as a male dominant field"; "historically/traditionally science has been/is used as a tool of oppression"; "scientific thought is generally male created and misogynist in nature ... science can easily be used as a handy tool to subjugate [sic] women in our already oppressive society."

Qualitative data suggested a tension between current feminism and science; once again, quantitative data loosely support the trends. In response to the pointed questions, "Do you think that the content of science is anti-woman? Do you think that the method or enterprise of science is anti-feminist?," 50% of all 209 respondents, and 66% and 70% of the respondents in the two science and gender courses, answered positively.

The structure of the survey provided the opportunity to ask initial questions about the extent to which disaffection with science was based on experiences in the discipline. The data suggest that the apparent tension between science and feminism derives more from theoretical concerns than from actual time in the field. Those students who believed that science was anti-feminist were consistently those who had taken the least science. Only 28% of those who gave a definite yes answer had taken any biology beyond high school. In other words, 72% of those who believed that science was anti-feminist had taken no college science.

The divide works both ways. In the aftermath of the Montreal Massacre, women scientists' distance from feminism rang loud and clear. "Female engineers are pitching

hard to get young women into engineering, but don't feel they have to espouse feminism to do so," the Globe and Mail reported. "Feminism not prerequisite"; women should "think about the profession, not all the extraneous stuff," an eminent woman engineer advised (6).

Student reactions document this growing divide between women's studies and women scientists. Those respondents who had studied the most science least often identified it as containing any anti-woman or anti-feminist content. Seventy percent of the respondents who answered "no" to the questions "Do you think that the content of science is anti-woman?"

Do you think that the method or enterprise of science is anti-feminist?" had taken at least two university-level courses in lab science. "Not in my experience," they repeatedly answered. "I have found all my professors very helpful and the other students (male) were not biased or macho. I think women are generally accepted in the sciences. My brother says its mostly soft sciences that women are accepted and that women in his engineering class still have some problems, but I don't know whether this is true or not." Denial often gave way to open hostility.

"Your prejudice is showing" one student responded. Another quipped: "This is a stupid question. Women who feel that way are just feeling jealous of male successes. Men and women both have the same chances in the science field." In similar style, a third answered: "Only women who feel offended, intimidated by the male success would answer yes to this question. It's all in the mind."

Both quantitative and qualitative assessments suggest that students perceive women and science to be at odds.

Too much should not be drawn from a statistical or quantitative presentation of these findings. Much work remains to be done. Nonetheless, the implications are troubling. First both quantitative and qualitative assessments suggest that students perceive women and science to be at odds. This tension manifests itself in the assumption that science is "male stream." It manifests itself as well in women's career choices. Most of the students surveyed responded that they had never considered a career in science.

Some of their justifications had an almost nineteenth-century flavour to them. Women, they suggested, lacked a "natural inclination" for science; they preferred professions which required "personal" rather than "rational" skills. Perhaps most problematically, few of the students perceived science as a vehicle for change. "I think of science as being too static," one of my students surveyed responded. "Although with considerable effort women can change the face of modern science..." "Science does not provide opportunity for social change." And while the students who sought change seemed to abandon science, those who aspired to careers in science seemed to see little need for change, as the above quotes indicate.

These results also suggest that we need to rethink our pedagogical and conceptual approaches to problems of science and gender. Over the past twenty years, academics

have tied their desire to transform science to the goal of increasing women's participation in science, but our efforts to accomplish both at once appear less than successful. Women who share the transformative goal seem to have little interest in science, while those women who enter science seem to have little time to spend on transformation.

Their defensiveness is hardly surprising. Our calls for a "feminist" science have targeted women as the standard bearers of change and charged them with the responsibility of creating a more humanistic, more critical, more contextual, less hierarchical science. This places a further burden on the women who study science by challenging a group that is already a minority to also assume the stance of maverick.

Reflecting on the limited impact of a decade of activism, Marsha Hanen recently charged academics to consider why it is that we want more women in science anyway. The results of this survey raise the same question and indicate that the time has come for us to start disentangling our goals.

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1. For details see S. Beauchamp and G. Feldberg, *Girls and Women in Medicine, Mathematics, Engineering, Science and the Technological Trades*, Ontario Advisory Council on Women's Issues, Toronto: 1991.
2. Mary Roth Walsh, *Doctors Wanted: No Women Need Apply - Sexual Barriers in the Medical Profession* Yale University Press, New Haven: 1978; Margaret Rossiter, *American Women Scientists: Struggles and Strategies to the 1940s*. John Hopkins University Press, Baltimore: 1982. See also Rose Sheinin and Lykke De La Cour, "Canadian Women Medical Scientists of 1870-1911: A Made-Invisible Canadian Product," *The Crucible* (1987); Rose Sheinin, "Women in Science: Issues and Actions," *Canadian Women's Studies* (1984) 5: 70-77, and Marianne Ainley, *Despite the Odds*. Vehicule, Montreal: 1990.
3. One of the prototypes of this work was Hubbard, Ruth, Henifen, Mary Sue, and Reid, Barbara, eds. *Women Looking at Biology Looking at Women*. Schenkman, Cambridge, 1978. See also Ann Fausto Sterling, *Myths of Gender*. Basic Books, New York: 1985.
4. Bentson, Margaret. "Feminism and the Critique of Scientific Method" in Angela Miles and Geraldine Finn, eds. *Feminism in Canada: From Pressure to Politics*. Black Rose, Montreal: 1982; Belencky, Mary Field, et. al., *Women's Ways of Knowing* Basic Books, New York: 1986; Gilligan, Carol, *In a Different Voice* Harvard University Press, Cambridge: 1982.
5. An important critique of this process is provided by Ursula Franklin, "Will Women Change Technology, or Will Technology Change Women?" 1985.
6. "Female Engineers Seek New Recruits," *Globe and Mail* (Feb. 11, 1991) p. A6.

TINKER BELL AND ZEUS

(a cautionary tale for daughter and stepfather)

What is it that they hate in each other?
Submerged mostly.
She flairs around the house dramatically
dropping bits of ballet ribbon on a lamp
leaving books in shreds beside the door.

A careless prima donna of exists and entrances.

A man who needs numbers and order
he accepts this female fray and dazzle
because it is life, his own fluttering spirit.
begging for attention.

She endures his nuisance love
a concerned frown on flamboyance
from her mother's man of brutal vision
because it is real.

Sometimes though the pressure builds
to steamy blue reckoning
ransacked with mist and forming rain.
Clouds suck up the whole saltwater pond
and force it down on monster mountains.

The house becomes an ark
rocking and flooding behind me
pulsing with his Zeus, a thunder of indignation
shattered by her feline, frightened Tinker Bell
flashing out resentment, flying into corners of defense
darning at his eyes.

It's over so quickly for them.
A simple change in weather

barometric, physical.

I am the exile.
Humiliation sitting on my own front steps
banished from a war of love I started.

Smiling, they come out to rescue me.
Two white doves with olive branches, one apiece
purely to make promises on this fresh May day
veined green and flaming with birds.

Patricia Keeney
Ontario

Transforming Mathematics Pedagogy

By Pat Rogers

Listen to a woman groping for language in which to express what is on her mind, sensing that the terms of academic discourse are not her language, trying to cut down her thought to the dimensions of a discourse not intended for her. (1)



Pat Rogers

When the environment is genuinely open to and supportive of all students, women are just as successful at mathematics as men.

This paper is personal. It tells the story of my efforts to transform my teaching from practices which silenced and Rogers disempowered my students to a pedagogy aimed at engaging them actively in the production of mathematical knowledge.

Reflecting on my own experiences in undergraduate mathematics and on doing mathematical research has been a forceful impetus for changing my own practice. More recently, however, my efforts have gained momentum from research which shows that it is possible for women to excel in mathematics taught by male teachers without experiencing the negative consequences of learning in a patriarchal environment (2). It shows that, when the style of teaching is true to the nature of mathematical inquiry and the environment is genuinely open to and supportive of all students, women are attracted to mathematics and are just as successful as men.

When I first started teaching I reproduced those practices I had observed as a student: I lectured. Believing that teaching at the post-secondary level involved the transmission of knowledge and insight from me (the "expert") to the students (the "novices"), I saw my job as "exposing" the students to the

material of the course. I administered tests in order to measure achievement and to rank students in relation to their peers. Each class had a natural pattern: I introduced the topic, covered the blackboard with formulas and mathematical language, and worked a few problems. I asked some questions, and even elicited some answers (though usually from the same three or four--male--students) and assigned homework.

I was considered successful. In my course evaluations, students praised me for my enthusiasm, organization, the clarity of my exposition, my knowledge of the material and my accessibility. On the final examination many students failed or wrote such incomprehensible statements that I wondered if we had all been attending the same course. How could they do so badly when I had explained the material so well?

Transformer la pédagogie appliquée en mathématiques

par Pat Rogers

Des récentes recherche indiquent que lorsque le mode d'enseignement ne trahit pas la nature de la recherche scientifique et que les élèves bénéficient d'un milieu vraiment ouvert et encourageant, les femmes sont autant attirées par les mathématiques que les hommes et qu'elles y réussissent aussi bien.

Une pédagogie qui met l'accent sur la réponse juste empêche les élèves de mettre en pratique le processus selon lequel les idées se forment. Les élèves qui ne voient que le produit poli ont peut être l'impression qu'ils ne pourront jamais créer des résultats semblables. Des méthodes autoritaires, comme les cours magistraux, subordonnent les connaissances et l'intelligence des élèves à celles du professeur ou du manuel scolaire.

Depuis quelque années je m'efforce d'appliquer une pédagogie qui incite activement les élèves à créer des idées. Mon objectif se divise en trois catégories: le contenu (aider les élèves à élaborer leurs propres preuves et à les rédiger correctement); processus (prendre de bonnes habitudes et travailler de manière autonome); et aspect social (communiquer clairement et avec confiance).

J'espère que les méthodes pédagogiques que j'ai mises au point permettront de dispenser à tous les étudiants et étudiantes un enseignement plus adéquate et plus égalitarien.

Over the years I became increasingly concerned about the students (mainly female) who never spoke a word; the students who sorely needed individual attention yet never used my office hours; the students who were heading for certain failure but were lulled into thinking they might pass the course because, as they said, "It seems so easy when you do it on the board." I began to consider on my own experiences as a mathematics undergraduate at Oxford. It shocked me to realize how well I was reproducing the same

structures of power and domination which had so effectively silenced and disempowered me then.

Reflecting on the differences between what I was doing and what I believed needed to be done, I realized that the approach I sought is one that demystifies the "doing" of mathematics; that calls attention to its cultural construction and engages students in purposeful, meaningful activity. In other words, I needed to make visible the means by which mathematical ideas come into being, and the process by which they are polished for public consumption. At the same time, to deny the institutional authority and power I possess would be profoundly dishonest. In sum, I seek to open the gates to the mathematical community by teaching students the skills they need to join the club and to operate within it.

It shocked me to realize how well I was reproducing the same structures of power and domination which had so effectively silenced me.

Teaching Style

At the beginning of a course I discuss my goals with the students and make them available in written form. My main goals fall into three categories: content-specific, process, and social. Content-specific goals include helping students develop the skills necessary for constructing their own proofs of mathematical statements and writing them clearly and precisely in correct form. Process goals involve the development of independent working skills (so that they might eventually become free of the need for a teacher). Such skills include reading a mathematics text with understanding, finding, analyzing and correcting their own mistakes, and asking questions. Since mathematics is a cultural activity, social goals are also stressed. These include developing the ability to work with others by communicating ideas clearly and with confidence both orally and in writing, active listening, offering constructive criticism, and by asking and responding to questions.

I try to create a climate of safety and trust in my classroom so that risk-taking occurs; so that students are enabled to test their ideas and thoughts and so that fluency is developed in mathematical language. In other words, I build a community of mathematicians.

Following is a brief description of some of the teaching techniques I use most frequently.

Lecturing

Though I have not completely abandoned lectures, I use them sparingly: to introduce a new section of material; to tie new concepts in with previous material or to provide an overview of a particular topic; to conclude a topic and draw everything together; or to introduce a new concept and to motivate the assigned reading.

Think-write-pair-share

This idea is adapted from Davidson et al and is the most useful and most used of my current strategies (3). It is also the one most adaptable to classes of all sizes. Students are asked a question, or given a segment of the text to read. They work independently at first, putting their thoughts and ideas down in writing, and then form pairs to discuss. This

provides support for those students who are unsure of their ideas and also has the effect of increasing participation and involving all students in the affairs of the class. This activity may precede or be part of all of those which follow.

Full class dialogue

Like a lecture, full class dialogue is teacher-directed but student-centred. Dialogue usually follows assigned reading and think-write-pair-share activity, and operates through the medium of questioning. My questions are precise, and focused on process rather than memory recall. Good active listening skills on my part are essential: I constantly demand reasons for statements, and challenge students to formulate their ideas in their own words. This is important because students are often unable to "hear" their instructor, and so teaching students to listen to and learn from each other is empowering.

Board work

Students come to the board (individually or in small groups) to write up solutions for class discussion. Sometimes, several groups will work at the board on the same problem in order for me to demonstrate that there is no one right answer or approach to solving a problem. Students learn from each other's mistakes and learn presentation skills as well. At first, I do not require that students remain at the board to defend their solution but, as the classroom becomes more supportive, students gain confidence in their ability to discuss mathematical ideas.

Brainstorming

I give students about two to five minutes in pairs to write down everything they know about a given topic, after which I call on them randomly or in turn and generate a list on the blackboard. Discussion centers around evaluating and categorizing the items gathered. I use this technique most often for review or to begin an investigative class (see below).

The purpose of assignments is to allow students to practice with concepts and processes without being penalized.

Problem-posing

Students generate their own questions in a particular area. These are examined and the students are then asked to commit themselves to a particular conjecture, which then is added to a class list. Proving this conjecture becomes the focus of attention in the ensuing weeks.

Investigative class

The class examines patterns in concrete examples to uncover algebraic structure. It then makes generalizations, describes them in the form of a conjecture, and develops theory to prove or disprove the conjectures. For example, we generated all standard structure theorems for finite groups in this way.

Small group work

Students work together in small groups and I circulate. This provides me with information on student understanding and enables students to intervene in the pace and the development of the course. Even in one large class, where I could see only the work of the students at the ends of the rows, I gained immediate feedback on the students'

understanding of the concepts involved. Students in that class accused me of checking up on them. I asked whether they would prefer I waited for the test before I found out how much they understood and pointed out that a winning strategy would be always to sit near the aisle. This produced a very curious seating arrangement for the remainder of the course: the centre of the room was empty and all students were concentrated at the ends of the rows.

Proof generation

The forward-backward proof technique described by Solow in his book, *How to Read and Do Proofs*, is a very empowering strategy to teach students (4). The technique takes its name from the way mathematicians typically organize their thoughts when constructing a proof of a statement for the first time. It often eliminates students' complaints that they "don't know how to begin!"

Some students have difficulty adjusting to my teaching approaches and for this reason, ongoing classroom research is essential. For example, one student complained that my questioning techniques and practice of asking her to come to the board were intimidating and humiliating. On the other hand, she appreciated the opportunity to learn from other students. Through negotiation, we were able to arrive at a compromise which made her, and other students in the class, more comfortable about participating.

Evaluation of student learning

The student-centered techniques I employ provide immediate, frequent and regular feedback on students' understanding of the course content and processes. Following is a brief description of some of the more formal evaluation methods I employ.

Assignments

I assign homework regularly throughout the course and space the assignments so that, when combined with quizzes and examinations, students receive regular feedback on written work. I encourage students to collaborate on assignments but will accept only independent write-ups. I then comment on the homework but do not grade it. The purpose of these assignments is to allow students to practice with the concepts and processes of the course without being penalized for doing so.

Participation

Students earn participation credit in a variety of ways, allowing for their individual learning preferences. Some of these ways include: preparing for class by doing assigned reading and working problems from the text; participating during the class in assigned exercises; sharing ideas by coming to the blackboard to present a proof by asking questions, by offering explanations or by joining in discussions; visiting me for an office consultation.

Including participation credit in the final grade calculation is a matter of some concern to me. I have found it can foster competition regardless of the classroom climate. It may also disadvantage some students who are uncomfortable. For these reasons, I now use

participation, including observable improvement over time, to adjust grades upwards if a student's grade is borderline.

Quizzes

Regular in-class quizzes are given. For the first two, students are given the option of submitting an error analysis. This error analysis provides students with an opportunity to improve not only their grade but also their comprehension of the course material. The first grading is fast; I simply indicate where the student has made a mistake and award a mark, with no explanation. Grading on the error analysis is much more time-consuming; the importance of having students do the analysis far outweighs its value in increasing their grade. An early failure in a course can be very dispiriting. But also, a test should be a vehicle for learning, not solely an instrument of evaluation. Many students told me they appreciate the opportunity to learn from their mistakes without being penalized for making them.

Student participation in setting the final examination

I believe in formal examinations--a final performance, an opportunity for students to pull the course together, to see it as a whole and to demonstrate what they have learned. Last year, I experimented with making students responsible for setting 50% of the final examination. Time was devoted in class, about two weeks before the end of term, to reflect in small groups on the course content and brainstorm areas for examination.

Conclusion

For the past two years, I have been developing my approach to participatory teaching in a small third year Algebra course for majors. However, my first attempt at implementing these ideas was in a second year Finite Mathematics course for non-majors. It was a multi-section course; mine had sixty students enrolled and no attrition. The two other sections were slightly smaller and both instructors employed an exclusively lecture approach. My main objective was to prove to my colleagues that I could teach sixty students without lecturing and without consequently compromising standards or disadvantaging the students. Measured by a common final examination, the three sections of the course had almost identical class averages. However, students in my section obtained more A grades overall (27% compared with 22% and 19%) and only 15% of students in my section failed the examination where 24% and 30% failed in the other two sections. Covering the course content presented no difficulty for me or, judging by their examination success, for the students. Over two-thirds of them participated actively in the course in one way or another and only one student complained of discomfort.

One cannot conclude that the lecture method came out second best judging by the examination criteria alone; but it could be claimed that my "coaching" method held up well against the traditional approach. It is likely, however, that the impact of participatory, democratic teaching methods is not readily evaluated in the short-term nor by quantitative means.

In order to care for the growth and development of students, I must experience them

as having worth in their own right, as having the potential and the need to grow. As well, I must recognize that my students need me in order to grow.

However, that does not give me the right either to dominate or manipulate them. Rather than imposing my own direction, my responsibility is to follow their lead. To do this effectively, I must know the students' level of development. I must trust them to grow in their own time and in their own way, and be patient because I believe in their ability to grow, and that growing involves making mistakes and learning from them. Finally, I must actively promote and safeguard conditions that are favourable to my students' growth.

- adapted from Milton Mayeroff, *On Caring*.
New York: Harper & Row, 1971.

In fact, I was more interested in discovering whether I could teach this way and whether students would be responsive than I was in comparing these techniques with conventional methods or in trying to prove their superiority. I prefer teaching this way. I get to know the students and I am much more aware of how well they are comprehending the material. It feels much less secure than the lecture method: as a lecturer, I need not get to know the students at all, and consequently need never learn their despair.

By providing opportunities for students to hear and develop their own voices through engagement in authentic mathematical activity within the classroom, I seek to involve them in purposeful, meaningful academic discourse so that they might claim ownership of mathematics for themselves. In so doing, I believe I not only avoid discriminating against students who are currently denied access to mathematics, but I also provide a more meaningful and equal mathematics education for all students.

Pat Rogers lives in Toronto with her daughter Kate. Currently Director of York University's Centre for Support of Teaching, she has a joint appointment in the Faculties of Education and Mathematics. On Teaching and Learning, the journal of the Derek Bok Centre for Teaching and Learning, Harvard University, Cambridge, Mass.

1. Rich, Adrienne, *On Lies, secrets, and silence: Selected prose, 1966-1918*. New York: Norton, 1979.
2. I wish to fully acknowledge my indebtedness to the faculty and students of the Potsdam Mathematics Department for allowing me to observe them teaching and learning as well as to the Social Sciences and Humanities Research Council of Canada for the financial support of this study. Parts of this paper have already been published in different forms (Rogers 1988, 1990). My findings are not meant to most against affirmative action hiring procedures. But as most mathematics departments are dominated by male faculty, it is useful to learn of strategies which do not then inhibit the participation of women.

3. Davidson, N., Agreen, L., and Davis, C. "Small group learning in junior high school mathematics", *School Science and Mathematics*, 1986,23-30.
4. Solow, D. *How to Read and Do Proof: An Introduction to Mathematics Thought Processes*. New York: J. Wiley, 1982.

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BRIDGES to Equity

by Elizabeth Bohnen and Judy Klie

“It was wonderful. Something that I'll remember for the rest of my life. Before BRIDGES I was unsure of myself when others said my interest in non-trade was just a phase, I didn't know what to believe. Now I trust myself and am ready to commit to a TTO job for sure.”



- BRIDGES to Equity graduate

The BRIDGES to Equity training program (BRIDGES) is an effective employment equity measure developed by the City of Toronto. It is designed to help women employees move from their traditional jobs into trades, technology, or operations (TTO jobs) within their own organization.

The program is a combination of classroom sessions, shop training, and work placement. Employees retain their base job while receiving 34 days of training. After graduating from the program they return to their previous position better qualified and more confident, and compete as job openings arise.

BRIDGES has been successfully implemented in Ontario for women civic employees at the City of Toronto, as well as for those at the Municipality of Metropolitan Toronto, Consumers Gas, the Queen Elizabeth Hospital, Unite Communications, AT & T, and Rogers Cable systems. It has also been implemented in Alberta with employees of Syncrude Canada Limited, and the City of Vancouver in cooperation with the YWCA and Rogers Cable systems is currently developing a BRIDGES program. Private and public sector organizations in Ontario have offered BRIDGES programs on a cooperative and cost-sharing basis, joining together for the common core of the program and individually tailoring other components to meet their particular needs.

Programme de recyclage

Par Elizabeth Bohnen et July Klie

Le Programme de recyclage qu'a élaboré la municipalité de Toronto est une mesure

efficace en matière d'équité d'emploi. Il vise à aider des employées à passer dans leur organisme de leur emploi de nature traditionnelle à des emplois dans le secteur spécialisé ou technique ou dans celui des opérations. Le programme conjugue des cours en salle de classe, des ateliers de formation et le placement à un emploi. Les employées gardent leur emploi pendant le programme de formation (trente-quatre jours). Une fois le programme termine, elles reprennent leur poste, mais elles sont mieux qualifiées et plus confiantes pour poser leur candidature quand d'autres postes sont vacants.

Les femmes qui ont suivi ce programme ont quitté leur emploi de bureau ou de secrétaire et sont devenues réparatrices de parcomètres, installatrices d'équipement de communication, inspectrices des travaux publics, inspectrices d'oléoducs et préposées dans des parcs. Ces emplois donnent l'occasion aux femmes de travailler au grand air, de faire appel à leur force physique mais aussi à leur intellect, de travailler de façon plus autonome et d'être mieux rémunérées.

Le but de ce programme est de permettre aux femmes de faire des choix et de leur offrir une formation qui les aide à être plus concurrentielles et plus qualifiées pour changer de profession. Ce programme vise aussi à changer les organismes pour qu'ils appuient leur personnel et apprennent ce qu'est l'équité en matière d'emploi grâce à une méthode efficace.



Women have left clerical work to become repair technicians, pipeline inspectors, and park laborers.

BRIDGES is about giving women choices

Graduates of the program have left clerical and secretarial work to move into jobs such as parking meter repair technicians, communications equipment installers, public works inspectors, pipeline inspectors, and parks labourers. These jobs offer women an opportunity to move out from behind a desk to a more physically active setting. Often it is a job where they work outdoors, use their body strength as well as their intellect, work more autonomously, and earn more pay.

BRIDGES is about giving women employees choices, about providing catch-up training to help them be more competitive and more qualified for a career change. It is about organizations changing, supporting their own employees to move into jobs previously held only by men and learning about the actual process of employment equity through a special initiative.

Designing the Bridge

In August of 1979, City of Toronto, staff met to brainstorm ways to move more women into no jobs. They were concerned that the civic work force was almost totally sex segregated, with very little movement between traditional jobs and the so-called "non-traditional". Inspired by the Introduction to Non-Traditional Occupations programs

delivered through the community college system, BRIDGES training was developed and supported cooperatively by City departments across the corporation, the unions, and the funders (Employment and Immigration Canada, the Ontario Women's Directorate, and the City of Toronto).

The initial program was very successful and on the basis of this success, Employment and Immigration Canada encouraged the City of Toronto to sponsor additional BRIDGES Programs, to see if they would work in other public and private sector organizations. This revised BRIDGES program began in March of 1989, a decade after the first vision began to take life. It has been funded by Employment and Immigration Canada, the Ontario Ministries of Education and Municipal Affairs, the City of Toronto and participating companies.

The training focuses on empowering employees to make well-informed career decisions for themselves and to be successful in competing for and performing in the chosen job. The program has been designed to "bridge" gaps which prevent women from moving into no jobs in their own companies and on their own initiative. In the program planning, gaps were identified and modules designed to bridge them. Examples of the gaps and corresponding modules are given in a side-bar to this article.

Building Bridges in an Organization

When a new service or program is introduced to a community, it is important to follow certain strategic steps to maximize success. It is equally important to be strategic in implementing change in a workplace. In order for BRIDGES to be successful, the following steps should be taken:

Needs-assessment: Is there a match between the goals of the BRIDGES program and an organization? Women employees may be surveyed, or other more informal methods used to assess no jobs where women are under-represented and whether there is sufficient interest in this kind of career change.

Appointing a BRIDGES Coordinator: Ensure that a staff person will be designated to coordinate and champion the program.

Identifying stakeholders: Involving those who may be affected by the program in the assessment, development, and implementation is important.

A key to the success of BRIDGES is this collaborative process. It results in commitment to and ownership of the program from a wide range of players. Careful attention to potential resisters and to their motives will minimize opposition and develop wider ownership of the Program. At the City of Toronto, a BRIDGES Union-Management Advisory Committee was formed; there is also a national, Toronto-based BRIDGES Advisory Board for all interested in participating in the program.

Developing organization specific objectives: Which jobs will be targeted? How many participants? When will the program be offered?

Implementation

Acknowledge and credit each person's contribution/support of the program, from the chief executive, to managers, to co-workers. Take time to celebrate the successes, such as graduations and placements.

Ongoing Evaluation:

Include a feedback process for all those involved in the program: participants, trainers, managers, and work placement supervisors.

Observing women successfully complete a work placement promotes a change of attitude in male co-workers.

Crossing the Bridge

The BRIDGES Program brings about change within an organization on three levels: organizational, attitudinal, and individual. Organizationally, BRIDGES directly and indirectly helps an organization to become more aware of supportive policies and structures already in place and of systemic barriers to employment equity. For example, at the City of Toronto, the lack of City-wide seniority was identified as a systemic barrier for employees who wished to cross over from the "inside" workers' union local to the "outside" workers' bargaining unit.

Pockets of support and resistance also surface, identifying attitudinal barriers and giving the organization opportunity to deal with sexual harassment or more subtle forms of gender discrimination. Observing women employees successfully complete a no work placement promotes a change of attitude among male workers. After a City of Toronto BRIDGES participant completed a work placement on an asphalt paving crew, each male member of the crew individually suggested to the foreperson that she be hired on a permanent basis.

Individual women participants are empowered by learning new skills and by building self-confidence through each of the program components. Of the 92 BRIDGES graduates to date, 62% have moved to permanent or temporary no jobs in their own organizations or are involved in no continuing education programs related to specific jobs. Graduates have formed an independent, voluntary BRIDGES Alumna Association which has served as an advocacy and support group.

As Pam Napier, an employee of Consumers Gas and a class valedictorian, said: "We are closing the final stage of the BRIDGES Program and beginning a new stage of our work career. Wanting to work in a no job is one thing that each of the BRIDGES women share. But from each other we have learned so much.

"We came together from three different companies, each having our own knowledge and experiences, and now we leave here knowing so much more about not only no work, but of ourselves. We have had to go from saying 'I don't know if I can do that,' to 'Yes I can do that and I can do it well.'" Other women have offered short descriptions of what the

course meant to them: "I know too much now to stand back and pretend. To go after what I want because of my knowledge and skills, it is my right to have the job I want."

GAPS	MODULE
in information about the nature of the jobs, the requirements, the vocabulary used in job postings, the working conditions	tours of jobsites and presentations about the TTO jobs targeted for inclusion in BRIDGES
in confidence-apprehensions about the ability to perform certain jobs often	classroom sessions on confidence-building, transferable skills; shop sessions on mechanical reasoning, basic power and hand tools, and shop maneuvers
in skill- women informed or confident enough to apply for no jobs are frequently screened out for lack of necessary skills	shop sessions, as described above, and fitness focusing on building upper-body strength
in knowledge--apprehensions about working in a very different work site environment	classroom sessions on assertion-training, dealing with sexual harassment, learning from women role models A specially developed mechanical reasoning test is used before and after the program to demonstrate how the skills that are gained are not innate but

On the Other Side

BRIDGES is a powerful experience for participants, who often undergo a feeling of letdown and disappointment when the program ends if they are not able to move quickly into a TTO job. Even though it is explained that BRIDGES is not a "quick fix," graduates may find it difficult to return to their old jobs after experiencing the joy of their work placement. BRIDGES Coordinators try to stay in touch periodically, offering moral support, passing on information about job openings, and sponsoring reunions.

BRIDGES is a successful training program for individuals, and a powerful change agent for organizations.

The program is designed to bridge "gaps" that prevent women from competing for trades or technical work.

BRIDGES Coordinators in some organizations meet with graduates on a regular basis, along with women currently doing no work, to try to keep interest alive and spirits up. The Alumna Association is also an important resource for graduates, and the forty-two BRIDGES graduates currently working in no jobs attest that the career change is worth the wait.



BRIDGES is a successful training program for individual employees and a powerful change agent for the organization as a whole. To quote from another valedictory address, this time delivered by Bonnie Rice, an employee of the City of Toronto:

"The development of programs such as BRIDGES is an ever growing sign that it is not just a change of occupation and career that women are looking for, but a change in attitude that society has always held for us. There have always been obstacles to overcome, and there still are, but with every class that has graduated from this Program, the bridges that are built over those obstacles become larger and stronger."

Elizabeth Bohnen and **Judy Klie** are BRIDGES Program Managers at the City of Toronto.

Resources

1. BRIDGES to Equity Video (approximately 12 minutes). An excellent, short introduction to the why, what, and how of the program. be borrowed (\$10 preview fee) or purchased (\$25 purchase price).
2. The BRIDGES to Equity Program Manual and Trainers Guide developed by Elizabeth Bohnen and Judy Klie; with "Trainer's Guide" by Susan Booth (\$55.00 each), and Participant's Workbook by Susan Booth (\$45.00 each). A comprehensive guide to establishing your own in-house BRIDGES Program or for providing curriculum ideas women's training programs. Contains a newly developed and tested non-sexist mechanical reasoning assessment.

3. *Retention: Support Strategies for Women in Trades, Technology, and Operations Work* (booklet). Experienced guidance on developing a positive working environment for women in TTO jobs (\$5.00 plus shipping and handling).
4. *BRIDGES to Equity Program Evaluation Report* (\$4.00 plus shipping and handling). These resources can be obtained from: Elizabeth Bohnen/ Judy Klie, BRIDGES to Equity Program Managers, Management Services Department, Person Services Division, 2nd Floor, West Tower, Toronto, Ontario, M5H 2N2. Telephone (416) 392-7162, TDD Users . (416) 392-7354.

Sois mâle et tais-toi!

Par Karen Messing

Quand j'étudiais en biologie à McGill, j'ai affiché un jour sur le babillard du département un tableau avec les proportions de femmes et d'hommes selon le cycle universitaire ou la catégorie de professeurs. Forte de ma compétence en statistique et de mon féminisme--les deux tout neufs--j'ai montré que la proportion de femmes diminuait de façon très hautement significative quand on montait l'échelle. Aujourd'hui, 15 ans plus tard, à McGill comme ailleurs au Québec, les femmes sont tout autant mal réparties à travers les départements de science. Elles sont aussi tout autant absentes des prix Nobel en sciences en 1990 qu'en 1975. Et ce, malgré 15 ans de conscientisation, de recherches, voire de luttes féministes.

Doit-on en conclure que les femmes ne sont pas à leur place en science? Est-ce que la tentative de Marc Lépine en vue d'évacuer les femmes des postes non traditionnels en science a été superflue, puisque son but aurait été atteint par des forces naturelles?

Aujourd'hui, on fait face à un discours selon lequel il n'y aurait plus de problème pour les femmes en sciences, quand elles sont vraiment excellentes. Par contre, des études (et le simple fait d'ouvrir les yeux) montrent que les femmes sont sous-représentées, qu'elles publient moins, qu'elles ont moins bien percé dans les réseaux scientifiques internationaux que les hommes. Est-ce qu'on en conclut que les chercheuses sont en général moins excellentes que les chercheurs à cause d'un chromosome X en trop?

Est-ce que la tentative de Marc Lépine en vue d'évacuer les femmes des postes en science a été superflue?

En bonne généticienne, j'ai une hypothèse à proposer: une femme a tout autant de chances qu'un homme d'être considérée comme une excellente chercheuse, à deux seules conditions: ne pas avoir d'enfants et ne pas paraître femme. En février dernier, avec une collègue, je dînais avec le responsable d'un programme qui subventionne des travaux de notre équipe. Il nous conseillait de nous départir d'une collaboratrice parce qu'elle n'était pas "fiable", étant très en retard pour le dépôt d'un rapport.

Nous avons souligné en vain qu'elle avait accouché en décembre et qu'elle avait produit beaucoup de rapports pendant l'année, malgré l'existence de ses deux autres enfants, âgés de 4 et 5 ans. Nous avons été forcées d'admettre que non, elle ne retournait pas toujours les appels à temps. Non, elle n'avait pas publié d'articles dans des revues avec jury cette année. Non, elle n'était effectivement pas très fiable de ce temps-ci. Ce monsieur réitéra son conseil: ne travailler qu'avec des gens professionnels et fiables.

Be a man, or be quiet!

by Karen Messing

When I was studying Biology at McGill, I realized that the proportion of women in science decreased significantly the higher one looked up the academic hierarchy. Since things are much the same today, is it possible to conclude that women are just not as competent researchers as men as result of one chromosome X too many?

As, a geneticist, my hypothesis is that women can be considered equal scientists with men on two conditions: that they don't have any children and don't appear to be women.

For example, not long ago a position was filled in my department for whom the qualifications included a doctorate. Two candidates presented themselves: a woman who had a doctorate, a year of post-doctoral research, and several publication credits; a man who had not finished doctorate and had never been published. After several hours of discussion, the decision was finally made with reference to a clause in our collective agreement that, given "equal competence," the job should go to a woman.

But sexism is not always so subtle. There are professors who appear to take pleasure in humiliating the female students in their courses, like the one who told his class that women could not be industrial designers since they are incapable of seeing in three dimensions.

The solidarity of women working in science is imperative to give us the support not only to demonstrate our excellence, but also to identify the obstacles we face and call them by name.

Alors, je me suis rappelé que je n'étais pas très fiable non plus lorsque, chef de famille monoparentale, je jonglais avec mes études doctorales et mes petits. Ma réputation était faite au département la deuxième fois que j'ai oublié d'arrêter la colonne de Sephadex en partant à la hâte pour la garderie. On m'a expliqué également qu'il n'était pas approprié d'amener mes enfants d'âge préscolaire au laboratoire le samedi et, surtout, de les laisser jouer dans les couloirs. Pourtant, il n'y avait pas beaucoup d'autres possibilités: ma bourse d'étude ne me permettait pas de payer une gardienne le samedi et mes cultures mutantes ne savaient pas distinguer la fin de semaine des autres jours. Je passais donc un peu pour une fofolle, pas pour une vraie scientifique.

*On m'a expliqué
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approprié
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laboratoire le
samedi.*

Cela ne fait guère plus sérieux aujourd'hui quand j'explique à des collègues américains que nous n'avons pas encore publié l'article dont les résultats furent communiqués en 1988, parce que l'étudiante dont c'est le projet de maîtrise a accouché quelques mois après. Les collègues peuvent comprendre qu'on arrête quelques heures pour l'accouchement même, à la limite pendant quelques mois (bien que l'allaitement ne paraisse pas très professionnel), mais au-delà de cela, une excellente chercheuse devrait pouvoir "s'organiser".

Donc, sachant que l'opinion de nos départements est critique pour notre avenir en recherche, nous "organisons" les nuits blanches, les maladies d'enfants au moment des congrès, les grèves dans les garderies, et ce, malgré l'écoeurement de nos mères, ces gardiennes de derniers recours. Nous présentons au travail tous les matins et notre épuisement tant mental que physique passe pour de l'incompétence, du manque de sérieux ou de la paresse.

Bref, pendant quelques années de notre vie, il est difficile de montrer notre excellence. Si nous sommes particulièrement fécondes, notre avenir en recherche ne s'en remet jamais. Dans mon département, il y a peu de temps, nous devions combler un poste de professeur. Les deux candidats avaient commencé leurs études de troisième cycle dans le même laboratoire, en même temps. La femme avait un doctorat, une année postuniversitaire et plusieurs publications à son actif. L'homme n'avait pas fini son doctorat et n'avait pas publié.

Les exigences du poste affichées dans les journaux et consignées dans les règlements de l'université incluaient le doctorat. La discussion en assemblée départementale a pourtant duré plusieurs heures. Nous avons finalement engagé la candidate sur la foi d'une clause de convention collective voulant qu'à «compétence égale» (sic), on engage une femme! Je ne comprenais rien à la discussion jusqu'au moment où un de mes collègues m'a expliqué que, personnellement, il se sentait plus à l'aise et plus susceptible de pouvoir collaborer avec «Jean» qu'avec «Marie». «Quand je lui ai dit que sincèrement je me sentais mieux avec Marie», il s'est étonné.



Ce genre de différence de perception ne se limite pas à l'université. J'étais un jour dans un comité qui devait combler un poste de responsabilité en vulgarisation scientifique. Nous avons interviewé une candidate qui m'a beaucoup plu. Après l'entrevue, mes deux collègues (mâles) m'ont expliqué qu'ils n'étaient pas impressionnés parce que la candidate avait répondu à quelques questions en citant des paragraphes de documents qu'elle sortait de sa serviette. Je n'y voyais pas de mal, mais je me suis pliée rapidement à la majorité.

Lors d'une entrevue subséquente, un candidat pour le même poste a répondu à toutes les questions en citant des paragraphes de documents qu'il sortit lui aussi... de sa serviette.

Ayant bien appris ma leçon, j'étais certaine que le candidat s'était «calé» d'autant plus que, dans ce cas, les réponses me paraissaient vides. Quel ne fut pas mon étonnement devant l'unanimité de mes collègues qui voulaient l'engager immédiatement. La "technique de la serviette" ne leur avait pas sauté aux yeux, cette fois-là. Hommes et femmes se sont regardés avec une incompréhension totale. Il a fallu former un autre comité composé moitié-moitié d'hommes et de femmes pour décider.

Il est parfois difficile de comprendre que ce qui paraît constituer du sexisme acharné n'est rien de plus qu'une question de perception. Toutefois, dans un contexte où les décideurs et les modèles sont surtout des hommes, il est nécessaire de garantir un traitement équitable en se donnant des règles qui pallient les problèmes liés à la perception; par exemple, les règles d'action positive en vigueur à l'Université du Québec à Montréal. Cela ne mine pas l'excellence; cela garantit simplement qu'elle soit reconnue.

Il y a des directeurs de département qui jurent toujours qu'ils n'engageront jamais de professeures.

Mais le sexisme n'est pas toujours innocent ni inconscient: il existe aussi à l'état pur, dans les milieux de recherche comme ailleurs. Il y a des directeurs de département qui jurent toujours qu'ils n'engageront jamais de professeures. Il y a des professeurs qui prennent plaisir à humilier les femmes dans leurs cours, comme ce professeur de l'École polytechnique dont m'a parlé une de mes étudiantes, qui lui a expliqué que les femmes ne peuvent pas faire de design industriel puisqu'elles sont "incapables de voir en trois dimensions". De même, j'ai mis du temps à me remettre d'un congrès où un grand bonze m'avait flattée en m'engageant dans de longues conversations sur la génétique, pour m'abandonner brusquement quand j'ai repoussé ses avances sexuelles.

Certaines de mes étudiantes, qui croient mes idées dépassées, me diront qu'il existe des femmes sexistes. Mais la situation n'est pas symétrique actuellement puisqu'en science, il y a une probabilité beaucoup plus élevée qu'un sexiste détienne le pouvoir d'agir contre les femmes que l'inverse.

Comment garantir que l'excellence en recherche puisse survivre et se montrer chez les femmes? Il faut que les femmes travaillant en science soient solidaires. Nous constatons que l'appartenance à notre groupe de recherche, composé majoritairement de scientifiques féministes, nous apporte un soutien qui nous permet de viser l'excellence, en identifiant les obstacles à mesure et en les appelant par leur nom. Il n'est pas très scientifique de compter sur des contes de fée au sujet de l'égalité des chances, quand les données nous disent tout le contraire.

Karen Messing est professeur au Département de biologie de l'Université du Québec à Montréal. Cet article a été publié en septembre 1990 dans *Interface*, publication de L'Association canadienne française pour l'avancement des sciences.

Foreigners to the Culture: Women in Trades and Technologies

by Kate Braid

“Any woman who has moved from the playing field of male discourse into the realm where women are developing our own descriptions of the world know the extraordinary sense of shedding ... someone else's baggage, of ceasing to translate. It is not that thinking becomes easy, but that the difficulties are intrinsic to the work itself, rather than to the environment”(1).

Women make up about three percent of the apprenticeable trades today and slightly more of the technologies. This is barely more than the same number ten years ago. It seems that though there is an increase in the number of women entering the trades and technologies, many are not staying. The reason is not that they don't like the work, but because they can't stand the environment. This article hopes to name the differences between men and women that come clear when they meet in the context of a traditional male bastion of behaviour and language. It is dedicated to every woman who has e left, in recognition of the fact that you made it easier for those of us who came after. Thank you.

Women leave the trades and technologies not because they don't like the work, but because they can't stand the environment.

When I began to teach carpentry in 1989, I was amazed at the breadth of knowledge most male students had, at their ease with tinkering and the unconscious availability of options. "How did you know that?" I'd ask. Then I realized I had tinkered too. With my mum. If you asked me for a substitute for baking powder or five ways to get a stuck lid off a jar, no problem. But two ways to remove a broken screw?

Most women have very little hands-on experience with tinkering or mechanical problem-solving. It is a positive step that girls are now being allowed to take basic shop; in some grade eight classes it is even required. But when nothing's working out the way the book said it would and all the boys are looking like you're some kind of idiot, and that terrible little voice whispers, "See? You

can't do it," it takes great reserves of courage or just plain stubbornness to say, "I'm going to do it anyway." Most women more understandably quit.

Étrangères à la culture

par Kate Braid

Nombre de femmes qui se lancent dans un métier spécialisé ou technique l'abandonne rapidement. Car elles ne supportent pas le milieu de travail. Les différences de culture importantes existant entre les femmes et les hommes entrent en collision dans le bastion masculin qu'est l'industrie de la construction.

Les hommes ne parlent pas la même langue. Pour communiquer, ils jettent des bouts de phrases dans lesquels ne transparaît rien de sérieux, ni de personnel. Dans un milieu de travail stressant, un peu d'humour n'est pas déplacé, mais il se peut qu'il soit dirigé vers les plus faibles, qui en l'occurrence risquent d'être une femme si elle est nouvelle et insécure. Une femme se sentira peut-être aussi intimidée, voire humiliée, par la terminologie du métier qui est égrenée de mots sexistes.

Les femmes qui effectuent des travaux de force se trouvent souvent prises entre le marteau et l'enclume. Si elles demandent de l'aide (comme le ferait un homme), on en conclut que c'est parce qu'elles ne peuvent faire le travail. Si elles ne demandent rien, c'est parce qu'elles veulent en remontrer aux hommes. Certaines femmes ont affaire à un superviseur qui veut leur perte. Il les affecte à des tâches impossibles et les réprimande si le travail n'est pas effectué.

On ne s'étonne donc pas que les femmes se lassent et abandonnent leur emploi. Ce qu'il faut c'est procéder à un rapprochement des deux cultures pour provoquer des changements radicaux dans la façon dont les hommes travaillent depuis toujours.

Women also generally lack math experience. Those who are good at math as well as those having trouble are often counselled, "You won't need it." They drop it, or develop an anxiety that reinforces the stereotype that women can't do math, and are thus excluded from hundreds of career choices, including many of the trades and technologies.

The positive side to all this is that once a woman has come as far as the classroom door for a training course in trades or technologies, she has already shown an extra dose of commitment. She is a student who often excels, at least in the study of theory, because she knows she has to try harder and usually does. This also takes its toll, but that is another story.

Language

The common assumption that trades and technologies are "men's work" is more than confirmed the first day a woman walks into a schoolroom or an airplane hanger or onto a construction site and discovers that the same man she had a pleasant chat with in the supermarket the day before, is now talking a different language. For example, men in these groups generally talk in short expository statements. "Last night, eh?" one will jab the other in the ribs and set off a chorus of guffaws.

Most men operate, in these situations, by terse verbal codes that exclude any issue that is personal or serious. Subjects such as home, children, and even news events, are not acknowledged. Only "the wife" may occasionally be mentioned in the nature of an excuse. "Beer?" one will ask. "Nah. The wife," the other will reply.

In fact, over time, many of us working in trades and technologies come to learn and even appreciate this language. In work that requires constant movement and loud noise, being able to talk in short bursts accomplishes conversation without expending time or energy. A terse style of language works, but it is a language most women do not know and were never taught. Men and women speak differently in other ways that are exaggerated on the job.

Men in trades and technologies are notorious for bluffing. Ask almost any trade man if he knows how to do something you are sure he does not. "No problem," he'll probably beam back. He'll even give you directions (of a vague but assertive sort) if you press him. But ask a woman and she might say, "Well, not really. I mean, I took a course in it once but I've never done it exactly..." And the man gets the job.

In another situation, when the foreman yells at a man, it is usually taken as a criticism of what he has done. Most women, especially at first, consider it as criticism of themselves. The foreman, meanwhile, can't understand why she's upset. Talk is also competitive, a constant comparison of work skills. I never heard a foreman (except a female one) say,



Kate Braid

*Men in groups
will pick on the
weakest, who may
be the sole
woman.*

"Well done!"

Humour can be the grease that keeps it all going, when you're doing work that is routine beside men you wouldn't pick in a thousand years to spend eight hours a day with. But most women don't know that teasing and practical jokes on a construction site are embedded in a tradition of "picking on" the apprentice. Women can feel attacked by this humour and often our instinct is right--some of it is meant personally. Men in groups will pick on the weakest who may be the sole woman, especially if she is new and insecure.

A difference in language that become strikingly clear when men and women work together is that the terminology of the construction site has evolved in the absence of women. The trades are full of a sexual vocabulary that includes the fact that materials are "erected." electrical connections are male, female or even lesbian, concrete is "laid" with a long thin "vibrator," things are "screwed," insulation is "rigid," a door is "well hung," roofing includes "hot rubbers," concrete nails are calculated to their "depth of penetration" and so on. Once I was working on scaffolding above an electrician who called to his partner, "Bring me some nipples!" Numbed by then, I didn't pay any attention until the apprentice at his side gestured frantically in my direction. The man spotted me and said, "I'm sorry! I'm sorry! That's what they're called!"

A significant result of many of these factors is that the woman, who is usually alone in a class or on a crew of men, becomes acutely aware that she is "different". She is the immigrant. Research indicates that anyone in a token position reinforces the identity of the dominant group. The resulting isolation is devastating, even when the crew or class are supportive and accepting. Instructors report that this isolation is broken and women need less instructional support when they are hired or trained in groups of two or more.

Research indicates that anyone in a token position reinforces the identity of the dominant group.

Using our Bodies

Work in the trades and technologies is often the first time many of us have ever had to physically use our bodies. As "ladies" we are taught to keep our knees together, arms to our sides, eyes down. As little girls we learn it is OK to cry when something hurts, to take the hurt as a sign to stop. But in a physical job, if your muscles hurt or you hit your finger, you can't cry (or hide it if you do) and above all, you don't stop. You keep going, you get the work done.

This is one of the things women learn - from the men's culture, this focus on the job, this ability to willingly suspend concern with process and concentrate on getting the job done. We find ourselves stronger, more skilled, and less likely to hurt the next time.

When I first started working with another woman (in our own company) the work went well but occasionally it would slow down as we I got involved in some personal discussion. Then I one of us would say, "Act like a carpenter!" and we would go back to swinging hammers, knowing that after supper we would "act like women" and phone each other to talk in order to deal with process, the emotions of working. As carpenters, we

were combining the skills of both cultures.

Ways of learning

The learning styles of men and women are often also different. Most women have what is called a "relational" style of learning (2). Relational learners don't know what they know until they hear themselves say it, so they need to explain to each other and to use the vocabulary. They also need a personal connection with the teacher. One trades instructor felt angry and "used" by his first women students until someone explained that they lacked confidence and were asking for his constant reassurance and a feeling that he cares about their progress. It made a major difference to his teaching.

Double Standard

The presence of women on a construction site or in a technology class often makes double standards apparent. For example, the men might feel that when a "lady" comes on the job they should act as "gentlemen" and stop swearing. Then they resent the woman for making them change their language. If she starts swearing she is snubbed as "unladylike".

Another example is strength. Strength is the favourite of all possible topics when people (including women) discuss why women "cannot" do trades and technology work. Few of us are born strong. There are ways to carry things, tighten things and remove things that are easier, involving balance and leverage, that one learns over time. Kinesiologists generally agree that the differences in strength between individual men and women far outweigh the generalizations of strength between them. In other words, some women are very strong and some men are not.

It is interesting that out of the hundreds of women I have spoken to in the past fifteen years, none has met a physical demand she couldn't handle--if not always in the traditional ways. But again, she is placed a double bind. If there is a particularly heavy job, she can ask for help (as most men would) or not. If she asks for help, it's because she can't do the work. If she doesn't, she's trying to show up the men. If help is offered to her, she can either accept or reject. If she accepts, it proves she can't do the work. If she rejects it and does the job alone, she's being hostile.

All of which is contrary the way a construction site and many other jobs actually operate. Everyone has different skills. Some are strong. Others' small size makes them nimble and light and more suitable for jobs like rigging the crane. Some are better at fine work, some are best at the "quick and dirty" and so on. It is the skill of the supervisor to identify such strengths and use them to the best advantage of the employer.

Sexual Harassment

Many men are not so much hostile to women coming into a classroom or onto a job as they are uncomfortable with something new, with change. Often, when they see that a woman is doing her own share of the work, they leave her alone or even befriend her. Some men, however, have decided that a woman cannot, should not, and therefore will not do this work--and they take it upon themselves to assure her failure.

Harassment dramatically undermines a woman's job performance and further isolates her. In a workplace with a strong tradition of "joking around", there is a thin line between banter and harassment. Sexual harassment is not workplace romance or flirtation; it is not mutual behaviour between two consenting adults. It is an exhibition of power and as such it is inappropriate, unacceptable, and illegal.

It is time to stop assuming women will do all of the adapting and ask men to acknowledge and respect what women bring to a job.

Some of the more blatant sexual harassment is now giving way to gender harassment, which is more subtle and therefore harder to deal with. Gender harassment is not directly sexual but aims to humiliate or defeat someone because she is a woman. An apprentice machinist worked night-shift with a lead hand who repeatedly gave her jobs he knew she could not perform, then got angry that she couldn't do the work. One evening he asked her to machine a chrome diameter. Only later did another machinist tell her that you can't machine a chrome diameter--you can only grind it. After several months of such treatment, she dropped out of the trade.

Employment

Last but not least of the many factors acting against women in trades and technologies is that we have more difficulty than most men getting a job in our chosen field. Most employers assume that women are trouble. Will she need special bathroom facilities? Is she strong enough to do the work? Will the men have trouble adjusting? Easier to say no.

And besides all the barriers that women particularly face, the trades and technologies are not easy fields in which to work. Though many of us put effort into persuading other women to join us, we do not deny that our work is often physically heavy, uncomfortable, dirty, and often dangerous. Perhaps the danger is one of the things we like. After all, we are the stubborn ones. The work is also enormously rewarding. Not counting the excellent wages (which on union sites, so far, do not vary for men and women), it is deeply satisfying to build, repair, and create, to see your product at the end of the day and know it will last beyond your lifetime. You feel strong, healthy, fit and competent. There is a profound sense of independence that comes with having tried the hardest thing and succeeded in some way, if even at some cost.

But given the need to make all the cultural adjustments themselves, on top of the challenges of the work, is it any wonder that women grow tired and drop out? The fact

that the culture of women is clearly "different" from that of men does not mean "worse". It may, in fact, have something to offer. It is time to stop assuming women will do all of the adapting and to ask the dominant culture, the men, to acknowledge and respect what women bring to a job. Employers who worry that women will "change" a job are absolutely correct. One welder says that men have told her they go easier on each other when she's around, are more humane not just to her but to each other.

We need to work together, to educate each other, in order to ease both women and men through these radical changes in the traditional culture of men's work.

Kate Braid is a journey carpenter who has recently been appointed as Director of Labour Programs at Simon Fraser University. She has also published a book of poems about her work called *Covering Rough Ground* (Polestar Press).

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POETRY

NAMING

1

The window frames a blue pause
in the run of winter:
clear sky, the snow
embossed with faint outlines
(buried branches, rock tips)

Before your eyes, falling:
the domino line of centuries,
time sweeping backward
to the antediluvian world,
the cave in winter

Here, under your blanket
of tumultuous hair,
you are animal woman
urge incarnate

the child that gasps first breath
between your thighs
is unnamed and ageless,
body of your body

Already, death blooms within him
certain flower

Safety lies
in not knowing this

2

When you return from the edge of yourself to
your own time,
the warm woodglow of the sideboard,
the cats dreaming cat dreams,
your son, five months old,
is cooing his marvel at the plastic rabbit
in his hands

This is the familiar life,
the comfortable evolution

The lines around your eyes
grow stealthily more pronounced,
your hair grays

The days are more and more a recognition of
these and other things, all carefully sounded
like the child's proud verbal pointing:
apple bubble face

Names occupy the
world with the assurance of buddhas,
meaningful and placid,
each a soothing roundness
complete in itself,
each word a hologram, in each
the world recreated

You summon it now, your son's name, that
small melody

Brendan, you say,
and know that in the saying of a name
is born the first danger

Eva Tihanyi
Ontario

Jane Deer in Science: A Sample Case

by Anne Innis Dagg

When I was enrolled in the Honours Science program at the University of Toronto in the 1950s, my ambition to become a practicing biologist seemed to others rather quaint. There was little or no thought that the four "girls" in my year would ever become professional scientists. Three of us went on to graduate school, but despite our best efforts only one succeeded in having a paid career in science.

Today, girls have a far better chance of becoming scientists and engineers if that is their ambition. Indeed, the demand for professionals in these fields is soon expected to exceed by far the supply. Universities are now anxious to attract women students into science and engineering to help overcome the declining number of men (1).

If women are needed in science and are capable of achieving there, why is there a problem?

Despite widespread efforts, it is still sometimes implied that females can't do science and engineering as well as males. This isn't true, as many studies have shown. At the University of Alberta, an examination of many thousands of students' course marks over 12 years showed that women on average did better than men in both engineering and science courses, and that their performance remained high as the number of women taking such courses increased, indicating that it was not just the very best women who were outstanding (2). If women are needed in science and engineering, and if they are as intellectually capable as men in succeeding there, why is there a problem? Why are there relatively few women in these fields?

Let us look at the qualities a hypothetical A+ student, Jane Deer, must have to succeed at university. If Jane really wants to become a scientist or an engineer, she will have to be DETERMINED. In high school, when her counselors and friends and family may be telling her that it would be easier to be a teacher or a nurse (secretaries aren't much in vogue any more), and that women aren't readily accepted in science or anywhere else considered non-traditional for them, she will have to stand firm. She will have to think to herself that women can be successful at science--look at the many women who have won Nobel Prizes--and that science needs women to humanize it.

Jane Deer et les sciences: une étude de cas type

Par Anne Innis Dagg

Les qualités que doit avoir une excellente étudiante hypothétique, Jane Deer, pour faire des études scientifiques à l'université, sont les suivantes détermination, persévérance, dévouement, endurance à long terme, aptitude à travailler avec des hommes, avoir la peau dure, confiance en elle et créativité. Il faudra aussi qu'elle réfléchisse sérieusement à l'avenir et qu'elle se demande si elle veut fonder une famille ou pas.

Beaucoup d'étudiantes en sciences trouvent que les cours sont trop restreints et qu'ils ne leur donnent guère de possibilité d'envisager leurs études dans le contexte de toute la société. La façon dont les cours sont enseignés les irrite ou les dévalorise souvent. Les professeurs et les étudiants sont presque toujours des hommes; à l'université, une atmosphère dominée par les hommes sapent la confiance de presque toutes les étudiantes.

Pendant les cours, les étudiantes se heurtent à un sexisme flagrant et à l'impatience des étudiants lorsqu'elles posent des questions d'un intérêt tout féminin. Il se peut aussi qu'elles aient à faire face à des actes de harcèlement sexuel. Selon une étude, 50 % des étudiantes du premier cycle universitaire et 61 % des étudiantes des deuxième et troisième cycles y ont été sujettes.

Si Jane Deer veut réussir dans le domaine des sciences elle devra surmonter des obstacles que les hommes ne rencontrent jamais. Les universités qui veulent attirer et retenir des scientifiques en puissance doivent modifier en conséquence leurs structures et leurs programmes.

Jane's determination must turn into SINGLE-MINDLESSNESS when she begins to study science or engineering. She may find the program content too narrow and focused for her liking, with few chances to take elective courses in the arts. She may be so swamped by science and computer and mathematics courses that she has no time to consider her studies in the broad context of society.

Professors treat male students more seriously than female, asking them more questions and spending more time on their concerns.

Many women switch out of science because of this; those who do so tend to be top performers rather than average or poor students (3). One of my students was so appalled by the rigid curriculum of engineering that she turned against the whole profession, pronouncing it "very limited," full of technicians rather than thinking people, and with expertise greatly overvalued by society. She is now an A+ student of women's history.

Jane must be DEDICATED enough to master material taught in a way that may irritate or devalue her. At least some women are put off by an emphasis on problem-solving in physics and chemistry classes (4). These women want concepts to be discussed, and to know the relevancy to society of what they are learning. They want cooperation and interaction with others in their courses, and less competition.

In one relevant study, Sherry Turkle looked at the male-centered culture of computers. "dominated by images of competition, sports and violence" that dishearten many women (5). Women are more likely than men to view computers as "just a tool"; few girls become computer hacks who are completely absorbed in computer manipulations, often unable to cope with personal relationships or social niceties.

The actual teaching method in Jane's courses may also be a problem for her. Professors treat their male students more seriously than their female students, asking them more questions and spending more time on their answers and concerns (6). (Professors are often amazed, especially if they are women, when research in their classes demonstrates they really are doing this even though they believed their teaching to be gender unbiased.) (7).

Jane will need LONG-TERM PERSISTENCE, fully-trained scientist must have a Ph.D., and often postdoctoral experience as well. In biology and chemistry, where students without doctorates can likely find work as technicians and research assistants, many women decide not to enroll for a Ph.D., whereas in physics and geology women are more likely to earn their Ph.D.s. These fields have traditionally had relatively fewer women than have biology and chemistry, so perhaps those who enter them have more resolve-enough to carry them through graduate school (8).

In computer science, women are much more likely than men to drop out of graduate school (9). This is, at least in part, because of less financial support than men receive, decreased self-confidence, and roadblocks and pressures that men don't experience.

As a scientist, Jane will have to get used to **WORKING WITH MEN**. Almost all her professors will be men, as will most of her fellow students. She may not notice it, but the male-dominated atmosphere at university will undermine her self confidence.

When young women and men enter university, about one-fifth of each group describes itself as being "far above average" in intelligence (10). When these students are in their fourth year, the women (unlike the men) no longer describe themselves in such glowing terms. The self esteem of all the women, including the brightest, has been eroded. An astrophysics student writes "Sometimes I sense that my ideas strike certain men in the fields as not being serious about physics and that can be maddening and/or saddening". Jane will find that she may do excellent work, but will often have this work devalued because she is female.

Because of sexist attitudes, Jane will have to have a **THICK SKIN** when she goes to classes taught by sexist professors. These men may describe a bimodal graph as being like a woman's breasts, or refer to women students as "girls" even if they are in their thirties. If a student objects to a professor's sexist language, he may retaliate angrily "I will not be censored!" rather than try to understand her comments (11).

If a woman asks questions related to women's interests, the male students may soon become restless and urge the professor not to waste time with irrelevancies. Women in science, to a greater extent than men, value "personal relationships, caring for self and others, and working in a supportive environment--attributes often minimized in science and engineering (12). A fish endocrinology student says her feminist beliefs have "affected my desire to work in a male-dominated, sexist atmosphere. I am presently making plans to leave research and commit my time to teaching and a more activist career.

Many people assume that women students who have broken out of traditional roles for women enough to enter science or engineering faculties at university must be open feminists. Such was the assumption of Marc Lepine. This seems rarely to be the case for undergraduates. When women are greatly outnumbered by men students, they cope best if they go along with what the men say. When women engineering students were massacred in Montreal in December 1989, other women students in engineering were quick to disavow that they were feminists. Some students even implied that feminist "aggressiveness" was partly to blame for the killer's action (13).

In our study of women graduate students in science, engineering, computer science and mathematics at four Canadian university, Shelly Beauchamp and I have found that only 39 percent of 225 respondents to our questionnaire considered themselves feminists (14). Even non-feminists may be sensitive, though. One in molecular biology writes that "there are one or two scientists working in related fields to mine that I could not work with due to my perception of their attitudes towards women, especially women in science.

50% of undergraduate and 61% of graduate women say they have suffered incidents of sexual harassment.

Though Jane must have a thick skin to allow her to put up with insensitive attitudes towards women, she must also have an ASSERTIVENESS that allows her to cope with incidents of personal sexual harassment. In one Study, 50% of undergraduate women suffered such incidents, mostly from other students, while 61 % did so as graduate students, mostly from professors (15). Jane must be ready to refuse to tolerate sexual harassment, and to report it if necessary. assertiveness may also be a response to sexist behaviour in the classroom, though Jane will have to balance in her mind the gains from sticking up for her self and other women against the loss of her professor's goodwill.

If she undertakes research at university, Jane will be best served if she is CREATIVE. In our ongoing study of women scientists and research, Shelly Beauchamp and I find that graduate students may choose topics of especial interest to women, and carry them out in a way they feel is feminine--i.e. taking great care with their data, preferring to observe rather than manipulate experimental subjects, and trying to observe broad patterns, and patterns of interest to society, in their results. Their methods may go against the way research is usually done, so they may have to spend time hunting for a suitable supervisor or persuading a supervisor to see the research in a new way.

Finally, Jane should think seriously about her future as a scientist. Like many young women, scientists have to decide whether they will have children, and if they do, who will care for them on a daily basis. Men usually assume their wives will look after any children; the wives who accept this responsibility have to figure out how to make their commitment work. Many women engineering students feel that when the time comes they will work part-time or in the home while their children are young (16).

In reality, it is difficult to do this when it may jeopardize your career in science. If you are a professor, you may be able to work part-time and keep up with technology in your field, but this is more difficult if you work for a company or for the government. In fact, most scientists who have earned their doctorates have spent little or no time outside the work force, except perhaps for short maternity leaves or because they could not find a job (17).

One aquatic ecology student says that her graduate studies and career are affected in many indirect ways. "For example: choice of husband who is supportive of my career and shares equally in child care, association with friends and colleagues with similar interests and values." A wildlife ecology graduate student who has decided to leave academia writes "A person can't make it in the current system unless they give up all other aspects of their life

(besides research) or so it seems. And I am not willing to do that." More women than men, at least in engineering, have made a decision not to marry and not to have children (18).

If Jane is a high achiever in science and mathematics in high school, she is more likely than other women to enter such non-traditional disciplines at university. She is also more likely than men to switch out of them again (19). Such women perceive their education in these fields differently than do men and are more negatively affected by it, which is not surprising because traditional male fields were set up for men by men.

If Jane Deer is to succeed in science and engineering she must be prepared to overcome obstacles that are not present for men. Only she can decide if the effort is worth it. If universities want to attract and retain top potential scientists such as Jane Deer, they must modify their structure and programs accordingly.



Anne Innis Dagg

Anne Innis Dagg has a Ph.D in Animal Behaviour from the University of Waterloo where she is a part-time Academic Advisor. Her research centers on large mammals, sexual bias, and women and science.

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In Their Own Words: Stories by women engineers about themselves

by Jeanne Inch and Monique Frize

Since its formation in February 1990, the Canadian Committee on Women in Engineering (CCWE) has held cross-Canada consultations to find out why so few women study engineering and work as engineers in Canada.

The consultative process included six regional public forums that became platforms for dozens of women to tell about their personal experiences as engineering students and Engineers. To these stories told in public have been added over forty private briefs sent in confidence to Dr. Monique Frize, CCWE Chair.

The stories illustrate some of the problems facing women engineers in Canada, and will be an integral part--along with research and statistics--of the report the CCWE is now preparing for release in 1992. The report will contain recommendations, strategies, indicators of success and mechanisms for monitoring change. It will be directed at parents, primary and secondary school educators, educators and employers of engineers, and engineers themselves.

*At public forums
across Canada,
most women
engineers spoke
with confidence.
A few
courageously
spoke in despair.*

At public forums across Canada, most of the women engineers spoke with confidence and determination. Some told their stories with humour. A few courageously spoke in despair.

Some said they left the engineering profession because of discrimination; others reported they had encountered no problems either in university or the workplace. Still others, fearful of backlash, wrote privately about their experiences.

By sharing their stories, women engineers lessened the isolation felt by women who represent 14% of engineering students and less than 4% of registered professional engineers in Canada. Hearing the stories, other women realized that they are not alone, that others have felt discouraged because they are a minority in a male-dominated profession.

Following the West coast forum, a woman mining engineer wrote: "Events such as this forum are like a saviour to me. It feels so good to meet and be around other female engineers. It was inspiring."

Des femmes ingénieurs se racontent

par Jeanne Inch et Monique Frize

Le Comité canadien des femmes en ingénierie a organisé six tribunes publiques dans tout le Canada pour entendre l'histoire de celles qui représentent 15 % de l'effectif des étudiants en sciences et moins de 4 % des ingénieures agréées du Canada.

Les femmes ont mentionné les résistances auxquelles elles se sont heurtées lorsqu'elles ont émis le désir de faire des études d'ingénierie, en particulier de la part des conseillers pédagogiques qui prétendaient que la physique serait trop difficile pour elles. D'autres ont parlé des salles de classe qui sont conçues pour les hommes : tabourets de laboratoire trop bas, étagères trop hautes, écrans d'ordinateurs mal orientés.

Une des participantes a évoqué le sentiment d'isolement que les femmes ressentent en tant que minorité, tandis qu'une autre a dit que la camaraderie existant entre les étudiants : faisait partie de ses meilleurs souvenirs. Une diplômée de 1990 a affirmé que la faculté d'ingénierie s'était améliorée en raison de la présence des femmes.

Certaines femmes ont décrit leurs hésitations et leur manque de confiance dans les laboratoires, et ont insisté sur l'importance qu'il y a à comprendre le bien fondé de ces compétences dans leur existence. Beaucoup de femmes pensent aussi que la présence de modèles à imiter dans les écoles et les universités permettraient aux jeunes filles et aux femmes de mieux se voir en tant qu'ingénieures. Comme l'a fait remarquer une professeure, il est aussi essentiel en ingénierie que les étudiants aient des modèles à imiter masculins qui ne soient pas sexistes.

At every forum, the Committee heard that attracting women to engineering must begin very early and that parents play a crucial role: *My mother is a very capable lady who at an early stage showed me that women are able to do what they set their mind to. If we needed a garden table, she would simply make one. And if a receptacle needed to be repaired she would do so. My father quietly encouraged me. I have fond memories of doing everything from chemical experiments to chopping wood together with my father.*

If young women in secondary schools are not encouraged to study mathematics and science and do not discover the link with engineering, they are potentially lost to the profession. Some women who eventually became engineers were discouraged from pursuing mathematics and physics. *Although I had always chosen academic electives such as sciences and foreign languages, and was one of the top two or three students in my class, my counsellor (a woman) told me that physics was too hard for me and that I should consider taking home economics instead. I ignored her and registered for Physics 12 anyway, where I was one of two girls in a*

“Being a woman engineering student I never felt like I really belonged, no matter how hard I tried.”

class of eighteen.

On the other hand, others spoke of teachers who were responsible for their choice of engineering: "I did not consider engineering as a career until I was in Grade 12. My high school physics teacher was a marvelous teacher who was himself an engineer. He suggested that I should consider engineering as a career."

In its recommendations the CCWE encourages educators to provide equal and unbiased career information, especially information about women's increasing participation in engineering, to both young men and women, and to bring women engineers into the classroom as role models. Recommendations regarding science curriculum include imbedding applied science topics in the curriculum, making references to the scientific and mathematical achievements of women, and increasing the emphasis on science at the elementary school level. Other recommendations deal with training mathematics and science teachers and providing courses on gender equity in teacher education programs.

At the forums, the CCWE heard of dozens of initiatives now underway by engineering faculties to attract and retain women engineering students. Engineering deans, faculty and students are working hard to create more welcoming environments for women. Even so, some women students still face difficulties. Even the physical environment can say to women students: you don't belong here. At the West coast Forum, a 1991 engineering graduate spoke of her experiences:

I sat in a classroom for three years where the table tops came up to my chest. I often ended up taking notes in a book on my lap. And all the women in my class were smaller than the majority of male students. Learning is not facilitated by equipment that is uncomfortable: lab stools too short, shelves too high, screens at the wrong angles.

Another woman described what it is like to be a minority:

What I found about being a woman engineering student was never feeling like I really belonged; no matter how hard I tried; because the attitudes and actions of the engineering student body (that is the group rather than the individuals) were shaped and dominated by men as they have been since time immemorial.

Still others, like this young woman from British Columbia, had more pleasant memories: *The best part about being in engineering was, for me, the sense of camaraderie between classmates. I found that the guys were very supportive of their female peers. And the engineering undergraduate society, despite some of their more notorious events, never made me feel like a second-class citizen. Some of the best friendships I have now were made with the men I went through engineering with.*

A 1990 woman graduate from a Maritime university noted changes in the faculty because of the presence of women students:

I had the sense that students as well as professors enjoyed having men and women in the classrooms. It is my understanding that in the past the school newspaper used to publish jokes that were degrading to women. While I was there, these types of articles were not

tolerated. So perhaps having women enter the school of engineering has helped tone down the macho crude image it once had.

Because many women are unfamiliar with the tools and equipment their male counterparts grew up handling, women engineering students can have difficulties:

I did reasonably well in academic courses, but initially the labs were very intimidating. I did not feel comfortable around electrical power and wires, oscilloscopes and tools. At first, I was able to avoid the problem as my male lab partners were more than willing to do it for me. However, this lowered my self-confidence and made me apprehensive of my ability to become an engineer.

Fortunately, for this young woman, her school had a co-op program:

After a summer spent working around high voltage switching equipment where I was forced to figure things out by myself, I came to realize that I actually could do these things. My summer jobs progressed to the point that I spent my last summer working as an electrician in a remote underground mine in the High Arctic. This experience increased my self-confidence immensely and made the academic work far more rewarding and relevant.

CCWE recommendations to engineering faculties include increased efforts to attract and retain women graduate students who could be both role models for undergraduate women and potential engineering faculty members. Retention initiatives include the establishment of voluntary mentorship programs for men and women students, appointment of an advisor to the dean on issues of concern to women students, and comprehensive social and academic adjustment and support programs for all students. Addressing the environment in engineering faculties, the CCWE recommended a code of behaviour be adopted for all students, and gender-sensitivity programs be provided for all faculty, students and administrative staff.

"I would really have liked to have had a female engineering professor in university."

Perhaps the most isolated of all are women graduate students who represented only 10% of Master's students and 6.1 % of Doctoral student in engineering in 1990. In a private brief, a woman reported that she experienced support through her undergraduate studies, but that graduate school was quite a different story:

Power and domination became such an issue in one working relationship that I changed supervisors. I experienced for the first time, systemic discrimination. The situation brought me to the point of withdrawing from graduate school which would almost certainly have happened without the intervention of my present supervisor and a very supportive family.

Role models can play a critical role in supporting women in non-traditional fields. At the Prairie Region Forum, one woman described how she felt:

I didn't even meet a woman engineer until the end of my final term at university. A female mentor or role model during grade school would have helped me battle my insecurities.

She also could have satisfied my pre-teen curiosity, like "Do women engineers wear skirts or do they dress like guys?" I had to wait until I started work to discover the answer to that one.

More women faculty would ensure both men and women students had women role models and would alleviate the tremendous burden on female professors who are often the only female in a faculty.

I would really have liked to have had a female engineering professor in university. Somehow there is a big difference between knowing that it is possible (to become an engineer) and seeing that someone has really done it. I get the same hunger for a real role model from my female undergraduates today.

The CCWE recommends proactive recruitment of women faculty and redesign of tenure and promotion criteria to take into account the impact of family responsibilities on career progression. An action plan to increase the number of women faculty would include financial incentives, a mentoring system, and part-time faculty positions.

One woman professor suggested that the men students need role models too:
The young men in the (engineering) program need to see their role models (male) behaving in a non-sexist fashion, by the use of appropriate language and even changes in the curriculum (what kinds of examples are used in the classroom). If the young men perceive that it is acceptable for the concept of the non-sexist male to be an engineering role mode, the ideas of stupid jokes or outright harassment disappears.

The CCWE is grateful to dozens of women who have told their stories. They have brought to life the dilemma of women who have chosen engineering, and there is a pioneer spirit in their storytelling.

At the Montreal forum, a young engineering student spontaneously told her story before delivering her written brief. She began by saying that she was the only female among 20 engineering students who participated in a tour of an electronics company. After the tour, the students were addressed by a company official.

An older gentleman came in to tell us what his company was looking for in its new employees. He said they were looking for bright, young, innovative minds, people who could come up with creative solutions to problems. But there was something more. His company was looking for people with social skills, people who could interact well with others, people who one day would make good managers.

Then he turned to me and said "You may be pleased to find out that most of the women we interview are better at these social skills than men are. So don't feel too bad, dear, if they beat you at math because your heads above them in social skills.

I said, "I can beat them in math too. "

Jeanne Inch is Project Coordinator for the Canadian Committee on Women in Engineering. **Dr. Monique Frize** chairs the Canadian Committee on Women in Engineering. At the University of New Brunswick, she is a professor of electrical engineering and holds the Northern Telecom-NSERC Women in Engineering Chair.

POETRY

FOR MRS NORRIS AGED 91

Who Defied Her Family,
Blew All Her Money on a Sea-Cruise to Hawaii,
and Died After Partying Non-Stop The First Night Out

Here's to Mrs. Norris!
The ink on plans and charts still wet with anticipation,
a hornpipe of exotic place names dancing on her tongue,
and a few salty asides scouring the frowns of younger relatives,
pursed lips buttoned about doubt and disapproval,
their scheme for the nursing home,
the sexless nightie and the carpet slippers
wrecked on the rocks of her elderly intransigence.
No barnacles on that old lady!
All such sea wrack left behind,
she rollicked up the gangplank of her own craftiness,
a Mickey of bad scotch stuck into her bar,
wearing loud shorts and cheap jewellery that clunked,
bellowing a rude song about sailors and loose women,
and planning to blow her pension on bingo ...
Mrs. Norris, leaving on an oceanic sky
and a fleet of stars
with the tide high
and her spirit high
breaking up and out
of outworn flesh and rising
like a lean, clean, silver fish,
to seize the dragonfly
of a new morning.

Jancis Andrews
British Columbia

Despite the Odds: Essays on Canadian Women and Science

Review by Beverly Boutilier

Marianne Gosztonyi Ainley, ed.
Montreal, Vehicule Press, 1990

The relationship of women to science and technology is a relatively uncharted territory within feminist historical and pedagogical scholarship in Canada. The publication of *Despite the Odds: Essays on Canadian Women and Science* is thus a welcome addition to Canadian women's history and the history of science alike.

While the book's subtitle promises a wider range of concerns, the majority of essayists in this volume confine their attention to either the personal and professional constraints imposed upon women in science or the relationship of women to science as the consumers and users of technologies such as photography, household electricity, and computers, during the nineteenth and twentieth centuries.

A sense of innovation and discovery pervades this anthology. Although the volume was originally conceived as an antidote for the lack of published reading materials for post-secondary courses about women, science and technology, its significance extends beyond its utility as a text. As editor Ainley notes, "publications on Canadian women in science and technology have been scarce, widely dispersed, and often published in obscure, hard-to-obtain, specialist journals" (p.18).

The danger of such scholarly isolation, as generation of "exceptional women" have understood, is that the experiences of individual women become particularized. As a result, women's collective achievement within non-traditional fields and the systemic patterns of discrimination confronted by them remain obscure. The collective and individual portraits of women in science assembled here by Ainley will help Canadian scholars compare and assess the experiences of Canadian women in science as a group.

Ainley divides the twenty-four papers that make up the collection into three sections: historical studies, biographical studies, and contemporary concerns. Although methodologically distinct, the essays in each section reveal a common concern with women elites within the Anglophone scientific community of central Canada, the career patterns of these women scientists, the impact of the institutionalization of science and technology on them (and, to a lesser extent, on Canadian women generally), and the generational experiences of women in science. Although the latter is only an implicit concern of this anthology, read as a whole the essays in *Despite the Odds* constitute a useful study of how, since the early nineteenth century when elite British women naturalists pursued their inquiries alongside equally untrained elite men, successive

generations of Canadian women have faced and sometimes overcome the recurring problem of sexual discrimination within scientific institutions.

As might be expected, this survey of generations is both empowering and frustrating. The historical and biographical essays show that while some women have successfully scaled the scientific hierarchy to claim a place for their sex in science, the persistent designation of science as "male" and "unfeminine" continues to undermine the professional and pedagogical footing of contemporary women contemplating or pursuing careers in science. The prevalence of what Betty Collis describes as the "We can, I can't" attitude among young women towards their technological and scientific abilities is particularly disheartening (pp.280-82).

The historical studies and biographical sketches of the first two sections of the book examine the careers of women in fields as various as the natural and physical sciences, pharmacy, sociology, psychology, medicine, advertising, household science, and photography.

REVIEWS

Here the central concern is Canadian women's collective and individual contribution to scientific inquiry and their response to technological innovation. In her own contribution to the collection, Ainley elaborates a temporal framework for understanding the impact of professionalization on women who aspired to a life of science. Despite the new educational opportunities opening to women after 1870, Ainley argues that the segmentation of the natural sciences into increasingly specialized, university-based disciplines at the end of the nineteenth century effectively excluded women from

positions of power within the profession as a whole. Her argument is persuasive.



*Harriet Brooks,
Canada's first Woman
Nuclear Physicist
(1898)*

But Ainley does not attempt to explain how gender constructs informed the process by which science was professionalized and institutionalized at the turn of the century; how certain forms of knowledge were defined as inherently masculine or feminine; or how scientific constructions of gender were evoked to legitimate the exclusion of women from positions of power within the profession.

Virtually all of the contributors to *Despite the Odds* assume that women's marginalization in science is, as Ainley notes in her brief introduction, "the result of complicated historical processes," but only a few of the essays in the anthology attempt to examine science and technology as gendered constructs (p.18). Historians Diana Pederson and Martha Phemister, for example, trace the relationship of gender and sex role stereotypes to the dissemination of photographic technology among Ontario women between 1839 and 1929.

Their conclusion, that "contemporary sex role stereotypes combined with the nature of the technology to limit women's active participation as photographers, and encouraged a more passive, "feminine" role as consumers of the products of photography, "suggests how women's cultural alienation from science and technology has been effected and perpetuated. Similarly, Pederson and Phemister's assertion that "the successful achievements of the few did not in any way challenge the widely-held view that women were technological incompetents" could serve as the collective thesis of the essays in this anthology (pp.88-89).

How the odds in favour of women's growing participation in science can be improved is the subject of the contemporary essays in part three. Among the issues discussed are how educators can help girls overcome many of the self-imposed and structural barriers to computer usage; how the widespread designation of science as "masculine" often alienates many of the brightest female; and how female has begun to inform both the subject of scientific research and the ways it is conducted. A warning of the potentially dire ramifications of the continued socialization of women and girls as scientific outsiders, and the consequences for society of the perpetual under-utilization of women's scientific

abilities, is a fitting conclusion to a text that so compellingly demonstrates the significance of women's contribution to the development of science in Canada.

Being itself a pioneering effort in the history of Canadian women and science, *Despite the Odds* of necessity has a limited scope and purpose. Perhaps its most important contribution to Canadian scholarship in general is its reclamation of the experiences of yet another sorely neglected group of middle-class professional women. But, as Wendy Mitchinson's recent work on the Victorian medical profession's view of female sexuality suggests, how we regard the experience of women in science must be delimited by our understanding of how women and their social roles have been defined and validated by practitioners and disseminators of scientific inquiry.

REVIEWS

Similarly, we may wish to ask what is and is not science. The masculine identity of "hard" science has been rigorously maintained by designating female-dominated occupations like nursing, whose practitioners claim scientific expertise as the basis of their collective professional identity, as "soft" forms of pseudo-Science.

By organizing our discussion of women and science around an uncritical acceptance of the male discourse of professionalization, we risk the perpetuation of women's status as other within science in particular and, as in the case of nursing, within society as a whole. Nevertheless, as points of departure for discussion and research, both in the classroom and among scholars, the essays collected by Ainley in *Despite the Odds*: should fulfill their role eminently.

Bev Boutilier is currently pursuing her Ph.D. in History at Carleton University in Ottawa. Her thesis focuses on the work of the Victorian Order of Nurses.



Alice Wilson and Jocelyn Legault examine a fossil imprint (1962).

They're not Dumb, They're different: Stalking the Second Tier

Review by **Rachelle Sender Beauchamp**

“I was certainly not given the belief that I could give something to science and that it could give something back to me.”

Student quoted by Sheila Tobias
in *They're Not Dumb, They're Different* (1).

by Sheila Tobias Tucson, Arizona; Research Corporation, 1990 How to attract more students to study science? In this fascinating study, Tobias arranged for a group of very bright non-science graduate students to audit introductory university chemistry and physics courses and to keep journals chronicling their reactions to the work, the teaching styles and the other students.

Most report negative reactions: as compared with arts courses, they find their fellow students extremely competitive (interested only in the marks of others). Faculty pays little or no attention to the larger significance of the material studied, focusing almost exclusively on the nitty-gritty of problem solving.

Although this book does not specifically address gender issues in science teaching, many of the points made have also been raised by advocates of feminist pedagogy. Tobias provides many concrete suggestions for ways to improve science teaching, including smaller classes, ongoing support to science students by trained "science advisors"; exit interviews with science dropouts; and changes in grading practices (i.e., elimination of 'curved' grading schemes).

Rachelle Sender Beauchamp is a Guest Editor of this issue of *Women's Education des femmes*.

RESOURCES/RESSOURCES

CALLS FOR SUBMISSIONS

Royal Commission on New Reproductive Technologies

The Commission has been given an Additional year to carry out its mandate before reporting to the federal government in October 1992. While the Commission would like to receive information as soon as possible, all material received until April 20, 1992 will be reviewed. Any written or audio-visual information, research material and or recommendations should be sent to Royal Commission on New Reproductive Technologies, Box 1566, Station B, Ottawa, Ontario, K1P 5R5, (613) 954-9999. Toll free number is 1-800-668-7060.

Mujer a Mujer /Woman to Woman
Correspondencia

Mujer a Mujer/Woman to Woman is a program in Mexico City dedicated to examining the Free Trade Agreement and its implications for Mexican women. Correspondencia is the program's quarterly bilingual newsletter that prints interviews and analysis by women active in unions, feminist organizations, women working for their own survival, etc. Submissions to this newsletter--article, interviews, stories--are welcome in order to share and learn from each other's strategies. Please contact Mujer a Mujer, Apdo. Postal 24-553, Colonia Roma, 06700 Mexico D.F., Mexico.

Canadian Association for Distance Education

Annual Conference

"New Alliances" is the theme for CADE's 8th annual conference in Ottawa, May 12-15, 1992. Sub-theme include: the clients who are making new alliances, the policy issues of new alliances, and the new alliances that have been developed by Canadian distance educators with counterparts in other countries. Proposals will be accepted until November 29, 1991. Contact Dr. J. McDonnell, Continuing Education, University of Ottawa, 139 Louis Pasteur, Ottawa, Ontario, K1N 6N5, (613) 564- 3468, fax (613) 564-3956.

Canadian Association for University Continuing Education

Annual Conference

"The Continuing Educator: Entrepreneur or Social Activist?" is the theme for CAUCE's annual conference at the University of Regina, June 10-13,1992. Submissions of papers and presentations are welcome on this topic. Submissions are due December 1, 1991. For guidelines contact: CAUCE '92 Proposal Committee, University Extension, University of Regina, Regina, Sask, S4S 0A2, (306) 779-4815, fax (306)779-4825.

SOUSSIONS DE TEXTES

Commission royale sur les nouvelles techniques de reproduction

Son mandat ayant été prolongé d'un an, la Commission remettra son rapport au gouvernement fédéral en octobre 1992. Les membres de la Commission aimeraient recevoir le plus tôt possible les documents annoncés, mais elle tiendra compte au cours de ses délibérations de tous ceux qui lui parviendront avant le 30 avril 1992. Tous les documents écrits ou audiovisuels, qu'il s'agisse d'informations, de rapports de recherches ou de recommandations, doivent être envoyés à : Commission royale sur les nouvelles techniques de reproduction, C.P. 1566, Succursale B, Ottawa (Ontario), K1P 5R5 Tel: 1-800-668-9781.

Le Conseil consultatif de l'Ontario sur la condition féminine

Le Conseil est à la recherche de femmes qui ont de l'expérience en recherches et en rédaction selon une optique féministe. Le Conseil a souvent recours aux services de chercheuses et de rédactrices indépendantes qu'il engage à contrat pour préparer divers rapports, mémoires au gouvernement et documents d'information. Contactez Le : CCOCF, 880 rue Bay, 5e. étage, Toronto (Ontario), M7A 1N3 Télécopieur: (416) 326- 1836.

GRANTS/SCHOLARSHIP

National Research Council of Canada Science and Engineering Scholarships for Women

NRC has created a three year program for women enrolled in undergraduate studies in science and engineering at Canadian university. Selected candidates will receive \$10,000 the first year, \$12,000 in the second and \$15,000 in the third and will be employed by NRC for work in the summers or during cooperative terms. The call for 1991/92 nomination will go out to university and CEGEPs in December 1991. Students should apply through their university during the first year of undergraduate studies (or last year of CEGEP). Results will be announced in May of 1992. For more information, contact Jean-Guy Soulière, Special Human Resources Management Adviser, Personal Branch, NRC, Ottawa, Ontario, K1A 0R6, (613) 993-5921.

American Association of University Women Educational Foundation

International Fellowships

AAUW annually awards international fellowships for women who are not citizens or permanent residents of the United States. The fellowships are for one year of graduate study or research in the U.S. and carry a stipend of \$13,000 (U.S.). Following their studies, recipients must return to their home countries to pursue a career; preference is given to applicants who can verify a definite position to which they will return. Complete application must be postmarked by December 1, 1991. Contact AAUW Educational Foundation, 1111 Sixteenth Street, N.W., Washington, D.C, 20036, (202) 785-7700; Fax (202) 872-1425, TDD (202) 785-7777.

SUBVENTIONS**Conseil national de recherches Canada**

Le Conseil a lancé un nouveau programme de trois ans destiné aux étudiants du premier cycle en sciences ou en génie des universités canadiennes. Le programme offre une aide financière et une formation préparatoire à une carrière. Les participantes recevront une aide financière de 10 000 \$ et plus chaque année, et seront embauchées par le CNRC pour la durée du programme. Les étudiants devront soumettre leur candidature par le biais de leur université, durant la première année du cours, universitaire ou la dernière année du cycle collégial au Québec. Pour de plus renseignements, veuillez communiquer avec: Jean-Guy Soulière, Conseiller spécial en gestion des ressources humaines, Direction du personnel, Conseil national de recherches Canada, Ottawa (Ontario) KIA OR6 Tél: (613) 993-5921.

Fédération nationale des femmes canadiennes-françaises

Bourse Amanda Walker Marchand

Cette bourse de 1000 \$, en hommage à celle qui a fondé la FNFCF, permettra à une femme francophone résidente en milieu minoritaire au Canada de poursuivre ou de reprendre des études en français. Sa formation devrait de préférence contribuer à l'amélioration des conditions de vie des femmes ou de la communauté francophone hors Québec. Veuillez contacter: FNFCF, 525-325, rue Dalhousie, Ottawa (Ontario), K1N 7G2 Tel: (613) 232-5791 Télécopieur: (613) 232-6679.

Le Centre de Toronto pour les études sur les lesbiennes et les gais

Le Centre présente tous les ans quatre prix de 200 \$ pour honorer certaines personnes et certains groupes qui contribuent activement au développement des études lesbiennes et gaies au Canada. Veuillez contacter : Toronto Centre for Lesbian and Gay Studies, 2, rue Bloor ouest, bureau 100-129, Toronto (Ontario) M4W 3E2.

FILM/VIDEO**Women in Science**

Magic Lantern Communications Ltd
775 Pacific Rd., Unit 38
Oakville, Ontario L6L 6M4
1-800-263-1717 Fax (416) 827-1154

This is a six-part video series on women who have chosen careers in science. They discuss the nature of their work, how they chose their specialty, and the challenge of being a woman in the field. Videos are approximately 20 minutes each and can be purchased for \$99 each, or \$249 for the series.

What About You?

Women's Bureau
Labour Canada
Ottawa, Ontario
(819) 953-0055
Fax (819) 997-1664

This 19 minute video profiles women who work in a number of non-traditional occupations: a pilot, a research scientist, an aerospace systems engineer, an electronic technician, etc. A User's Guide is available for workshop leaders, facilitators, career counselors, etc., to provide background information.

No Time to Stop: Stories of Visible and Immigrant Minority Women

National Film Board
(Contact your local office)

This film portrays the lives of three Women a sewing machine operator, a domestic worker, and a garment worker--and the barriers they face in Canadian society. The film addresses how racism and lack of access to good language and skill training are major obstacles.

Words: Four Stories About Becoming Literate

Asterisk Film & Videotape
Productions Ltd
#703,110 Spadina Avenue
Toronto, Ontario M5V 2K4
(416) 868-1175
Fax (416) 868-1176

This 28 minute video presents stories of four adult literacy learners who recount, in their own words, what it is like to lack the reading and writing skills so often taken for granted.

Beyond the Image

National Film Board
(Contact your local office)

Beyond the Image is a resource catalogue of 250 films and videos about women's cultures, politics, and values. They can be previewed, rented or purchased directly through NFB offices listed in the catalogue. NFB video prices were recently reduced to encourage individual and institutional video libraries.

FILM/VIDÉO

A toi de choisir!
Bureau des femmes

Ottawa (Ontario) KIA OJ2
Tel: (819) 953-0055
Télécopieur: (819) 997-1664

Ce film de vingt et une minutes présente des femmes qui occupent un certain nombre de métiers de nature non traditionnelle : une pilote, une chercheuse scientifique, une ingénieure spatiale, une technicienne en électronique, etc. Un guide est disponible pour les personnes qui dirigent des ateliers, les animateurs et animatrices et les conseillers et conseillers professionnels, etc.

RESSOURCES/RESSOURCES

Pas le temps d'arrêter!

Office national du film
(Contactez votre bureau local)

Ce film présente trois femmes, soit une opératrice de machine à coudre, une travailleuse domestique et une travailleuse de l'industrie du vêtement et les obstacles auxquels elles se heurtent dans la société canadienne, en particulier le racisme et le manque d'accès à de bons programmes de formation linguistique et professionnelle.

Clippe, mais clippe égal

Direction des communications
Ministère de l'éducation
1035, rue de la Chevrotière
11^e étage
Quebec (Quebec) G 1R 5A5

Ce film vidéo est entrecoupé de dessins animés et de témoignages de vedette sur le thème du sexisme et de la violence dans les vidéo-clips. Un guide d'animation accompagne le film.

Société royale du Canada

C.P. 9734
Ottawa (Ontario)
K1 G 5J4
Tél: (613) 992-3468

Le Comité de promotion de la femme dans les arts, les lettres et les sciences a produit un film vidéo à partir de la table ronde organisée à la mémoire des quatorze femmes assassinées à l'École polytechnique de Montréal. Sept spécialistes appartenant à diverses disciplines présentent leurs points de vue et formulent des recommandations pour contrecarrer les "réactions brutales". Vidéo et transcription: 50 \$ + 2,50 \$ de frais de manutention et d'expédition; transcription uniquement: 10 \$. En anglais et en français sans traduction.

BOOK/PUBLICATIONS

Surviving and Thriving

Kootenay Women in Trade and
Technology

RR#1

Winlaw, B.C VOG 2JO

(604) 226-7621

Available for \$15 (plus GSI), this is a collection of the edited transcripts of the most interesting and timely workshops from the Women in Trades and Technology conference in 1988. The text is useful for pre-trade and technology courses, and provides essential background and practical approaches for instructors, employment, employment equity practitioners, and other.

Claiming the Future

The Royal Society of Canada

P.O. Box 9734 Ottawa, Ontario

K1 G 5J4

(613) 992-3468

Fax (613) 992-5021

The booklet is designed to encourage young women to obtain undergraduate and graduate degrees in science, engineering, the humanities or social sciences. Twelve Canadian women scholars are portrayed, including Monique Frize, Lorna Marsden, Sylvia Fedoruk and Geraldine Kenney-Wallace. Price \$10/each plus GST and postage and handling.

Searching for Subjectivity in the World of the Sciences

CRIAW Paper No. 25

408, 151 Slater Street

Ottawa, Ontario

K1P 5HZ

(613) 563-0681

Fax (613) 563-0682

This feminist paper, written by Roberta Mura, argues that any science should be open to examination for the imprints that its creators, usually men, have left upon it. Paper are \$4 + \$1 postage and handling (20% on orders of 10 or more of the same title).

Women in Science and Engineering Industry, Science and Technology Canada

235 Queen Street

Ottawa, Ontario K1A OH5

(613) 998-0484

IST Canada is producing three bilingual statistical profiles on women in science and technology. The first, which looks at women's enrolment, degree attainment and faculty

membership in Canadian universities, has been published. The second, to look at the same issues in community colleges, and the third, on labour force participation, will be out next year.

The land that we Dream Of

OISE Publishing
252 Bloor Street W.
Toronto, Ontario M5S 1V5
(416) 926-4723
Fax (416) 926-4725

This participatory study of community- based literacy explores the practice and theory through an in-depth look at three programs---their mandates, physical environment, and day-to-day operations.

Canadian Feminist Periodical Index,

1972-1985

and

Canadian Feminist Thesaurus

OISE Publishing
(as above)

The Index includes 15 English and French periodicals published between 1972 and 1985, with 14,000 records and access by subject, author, and title. The Thesaurus features over 6,000 items to help find and organize written materials about Canadian women and the women's movement. Both are bilingual.

Faces of Feminism

Second Story Press
760 Bathurst Street
Toronto, Ontario
M5S 2R6
Tel/Fax (416) 537-7850

RESOURCES/RESSOURCES

Faces is a series of 75 photographs by Pamela Harris and text documenting the Canadian women's movement in its diversity and grass-roots energy. To publish the collection in book form Second Story Press is soliciting pre-orders for an autographed, hardback edition due out in the fall of '92. Price \$50/each.

Aquelarre

Latin American Women's Magazine
P.O. Box 65535
Station F
Vancouver, B.C. V5N 5K6

\$12/year individual; \$ 17/year institution

Aquelarre is an exciting, bilingual (Spanish/ English) feminist magazine by Latin American women with content from Canada, Latin America, and the Caribbean.

Coming Out of My Shell

Educational Planning and Design
Associates
18 Leslie Street
St. John's. Nfld. A1E 2V6
(709) 753-2017

This autobiography of a participant in a community-based literacy program is a unique contribution to the literature on violence against women and children. \$5.95/each + \$1 postage and handling + 7% GST. 20% discount on orders of five or more.

Sauti Ya Siti

Tanzania Media Women's Association
c/o Friends of TAMWA
L. Bragg, CUSO
135 Rideau Street, 3rd Flr
Ottawa, Ontario K1 N 9K7

This quarterly publication serves as a forum to discuss issues of importance to Tanzanian women, with issues in both Swahili and English. Subscriptions are \$30/year.

Community Development with Immigrant Women

Cross Cultural Communication Centre
2909 Dundas Street West
Toronto, Ontario M6P 1Z1
(416) 760-7855
Fax (416) 767-4342

This resource kit for community education and organizing is a course model for community workers in the immigrant women's community. \$12/ copy + 15% postage and handling + 7% GST. 20% discount on orders of 10 or more.

LIVRES/ PUBLICATION

Les femmes en sciences et en génie Industrie, Sciences et Technologie Canada

Secteur des sciences
235, rue Queens

Tel: (613) 998-0484

IST Canada prépare une série de trois profils statistiques sur les femmes en sciences et en génie. La première, déjà disponible, présente un profil des femmes dans les universités, et sera suivi d'au moins deux autres publications consacrées d'une part aux femmes qui poursuivent des cours au niveau collégial et d'autre part à celles qui sont membres de la population active dans d'autres secteurs du monde du travail.

Se bâtir un avenir

Société royale du Canada

C.P.9734

Ottawa (Ontario) K1G 5J4

Tel: (613) 992-3468

Télécopieur: (613) 992-5021

Cette brochure vise à encourager les jeunes femmes à poursuivre leurs études jusqu'à l'obtention de diplômes dans des domaines relatifs aux sciences, génie, sciences humaines et sciences sociales. On y décrit la vie et les réalisations scientifiques de douze Canadiennes versées dans diverses disciplines. 10 \$ l'exemplaire + 7 % TPS + 2,50 \$ frais d'expédition et de manutention.

La violence faite aux femmes

Communiqué

Union culturelle des Franco-Ontariennes

50, rue Vaughan

Local 3

Ottawa (Ontario) K1M 1X1

Tel: (613) 741-1334

L'UCFO a consacré un numéro (volume 6, numéro 4) de son «Communiqué» à la violence faite aux femmes.

Femmes et santé: aspects psychosociaux

Gaétan Morin, éditeur

C.P. 180

Boucherville (Québec) J4B 5E6

Tél: (514) 449-2369

Télécopieur: (514) 449-1096

Cet ouvrage collectif porte sur la santé physique et mentale des femmes en fonction de leur habitudes de vie et ce dans une perspective tant écologique que féministe. 15 \$ + 10 % frais d'expédition et de manutention + 7 % TPS.

Les maladies transmissibles sexuellement

Les presses de la santé inc.

C.P. 1 000

Succursale Place du Parc
Montréal (Quebec) H2W 2N1
Tél: (514) 282-1171

Ce guide traite du diagnostic et du traitement de chaque maladie, et donne des renseignements plus généraux sur les soins de santé. Y sont examinés également certains aspects politiques et sociaux. Prix: 4 \$.

AGENDA

Still struggling for Better Child Care

Ontario Coalition for Better Child Care
November 29-December 2 Toronto, Ontario

Ten years ago day care advocates presented the Ontario government with the document Day Care Deadline: 1990. This conference will assess the current crisis in child care and discuss ways to move toward an accessible, subsidized, high quality, non-profit system. For registration information contact Ontario Coalition for Better Child Care, 500A Bloor Street, 2nd Floor, Toronto, Ontario M5S 1Y8, (416) 538-0628, Fax: (416) 538-6737.

Reporting Classroom Based Research in Ontario

Ontario Educational Research Council
December 6-7 Toronto, Ontario

This conference includes sessions on gender differences in mathematics learning, gender differences in occupational and educational plans, learning disabled students, adult female students and their experiences with violence, etc. For information contact OERC, 979 Finlay Avenue, Ajax, Ontario, L1S 3V5 (416) 428-6622, Fax: (416) 686-9231. .

Men Organizing Against Pornography

Brother Peace
December 5-8 Ottawa, Ontario

This first North American conference, co-sponsored by the New York based National Organization for Men Against Sexism and BrotherPeace, will foster and fortify men to speak out and oppose pornographers who claim to speak for men. In Canada, contact: BrotherPeace Ottawa, P.O. Box 4465, Station E, Ottawa, Ontario, K1S 5B4.

Challenges in Child Care

The Child Care Connection-Nova Scotia
January 31-February 1 Halifax, N.S.

The 3rd annual Administration Connection conference and Trade Show will provide opportunity for child care administrators, board members, and directors to exchange information with child care professionals from the Atlantic provinces, other parts of

Canada, and the eastern United States.

Justice: Extending the Vision

Canadian Organization for Victim
Assistance
March 2-5, 1992 Victoria, B.C.

Workshop themes include: family and sexual violence, victims as witnesses, victim offender continuum, research, skills for service providers, caring for ourselves, and program management. For information contact: Shelley Rivkin, Justice Institute of B.C., 4180 West 4th Avenue, Vancouver, B.C., V6R4J5, (604) 222-7251.

Women in Engineering, Science, and Technology

Canadian Association for Women in
Science/Women in Science and
Engineering
August 14-15, 1992 Toronto, Ontario

This conference will discuss educational and training needs and workplace barriers, and will produce a report on recommendations for change. For information contact Evelyn Vingilis, c/o Addiction Research Foundation, 33 Russell Street, 4th Tower, Toronto, Ontario, M5S 2S1, (416) 595-6017.

7th International Congress on Mathematical Education

International Commission on
Mathematical Instruction
August 17-23, 1992 Quebec City, Quebec

A look at mathematics education in most parts of the world, at the responsibilities and achievements in the field, at problems to be identified, and at innovative strategies. For more information contact: 7 Congress, Université Laval, Quebec, QC, G1K 7P4, (418) 656-7592, Fax: (418) 656- 2000.

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(G.S.T. included)

Membership in CCLOW is open to individuals, organizations, or agencies.

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<input type="checkbox"/> Sustaining Member	\$250.70
<input type="checkbox"/> Organization with an annual budget up to \$100,000	\$48.25
<input type="checkbox"/> Organization with an annual budget \$100,000 to \$500,000	\$80.25
<input type="checkbox"/> Organization with an annual budget over \$500,000	\$133.75

Associate Member (receives *Women's Education des femmes* only)

<input type="checkbox"/> Individual	\$18.19
<input type="checkbox"/> Organization	\$32.10

A \$20.00 income tax receipt will be issued.
A \$240.00 income tax receipt will be issued.

Additional donations will be receipted for income tax purposes.

Enclosed, payable to CCLOW, is my cheque for:

Membership	\$ _____
Additional Donation	\$ _____
TOTAL	\$ _____

Please return form and payment to CCLOW,
47 Main Street, Toronto, Ontario, M4E 2V6.

Name _____
Address _____

Postal Code _____
Telephone: (Home) _____

Business) _____
Occupation _____
Area of Interest _____

[] I do not give CCLOW permission to trade, or sell my name and address to other like-minded social action groups for the purpose of fundraising or as a means of networking.

INSCRIPTION

(T.P.S. inclusé)

L'inscription au CCPEF est ouverte aux particuliers et aux organismes ou associations.

DROITS D'ADHÉSION

<input type="checkbox"/> Étudiante/sans emploi/ Retraitée	10,70 \$
<input type="checkbox"/> Inscription personnelle	30,70 \$
<input type="checkbox"/> Membre commanditaire	250,70 \$
<input type="checkbox"/> Organisation: budget annuel inférieur ou égal a 100 000 \$	48,25 \$
<input type="checkbox"/> Organisation: budget annuel entre 100 000\$ et 500 000 \$	80,25 \$
<input type="checkbox"/> Organisation: budget annuel supérieur a 500 000 \$	133,75 \$

Abonnement seulement
Women's Education des femmes

<input type="checkbox"/> Particulier	018,19 \$
<input type="checkbox"/> Organisation	32,10 \$

Un reçu de 20,00 \$ aux fins de l'impôt sera remis.
Un reçu de 240,00 \$ aux fins de l'impôt sera remis.

Les dons supplémentaires feront l'objet d'un reçu aux fins de l'impôt.

Veillez trouver ci-joint un cheque payable au
CCPEF d'un montant de:

Adhésion ou abonnement

\$ _____

Dontation

\$ _____

TOTAL

\$ _____

Veillez renvoyer le formulaire et le paiement au
CCPEF, 47 rue Main, Toronto (Ontario), M4E 2V6.

Nom _____

Adresse _____

Code

postal _____

Téléphone:

_____ (Res)

_____ (Bur)

Profession _____

Intérêts _____

Je N' AUTORISE PAS le CCPEF a échanger,
prêter ou vendre mon nom ou mon adresse a
d'autres groupes d'action sociale aux fins d'une
campagne de souscription ou a des objectifs de
réseau.



The Canadian Congress for Learning Opportunities for Women (CCLOW) were founded in 1979 and are a national, voluntary, feminist organization with networks in every province and territory. CCLOW advocates equality between women and men by promoting equal participation in our educational, political, economic, legal, social and cultural systems. To overcome discrimination based on gender, age, race, class ethnicity, and sexual orientation, CCLOW focuses on improving educational and learning systems. Our work and research includes maintaining a Women's Learning Resource Centre, publishing a quarterly magazine (*Women's Education des femmes*), advocacy, program development in local areas and involvement in educational related activities and events.

Le Congrès canadien pour la promotion des études chez la femme (CCPEF) a été fondé en 1979. C'est un organisme national, bénévole et féministe qui a des réseaux dans chaque province et territoire. Le CCPEF prône l'égalité entre les femmes et les hommes en promouvant une participation égale de tous et de toutes à notre système éducatif politique, économique, judiciaire, social et culturel. Pour surmonter la discrimination qui se fonde sur le sexe, l'âge, la race, la classe sociale, les caractères ethniques et l'orientation sexuelle, le CCPEF s'attache à perfectionner le système éducatif et celui de l'apprentissage des femmes, publie une revue trimestrielle *Women's Education des femmes*, se fait le défenseur des femmes, s'occupe d'élaborer des programmes dans différentes régions du pays et participe à des activités et à des manifestations dans le domaine de l'éducation.