ARE WE THERE YET?
15 YEARS AFTER THE 5TH CCWEST REPORT ON BARRIERS TO WOMEN IN ESTT AND RECOMMENDATIONS TO OVERCOME THE BARRIERS

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ABSTRACT

The Executive Summary of the Report of the Fifth Canadian Conference of Women in Engineering, Science and Technology, held at Glendon College, York University in 1992 stated: “The purpose of the 5th Canadian Conference of Women in Engineering, Science and Technology was to provide a forum for women to identify barriers they still face as students, scientists, engineers, technologists and trades people and to make recommendations to government, business and the education community to eliminate those barriers. The conference was organized to permit speakers and panelists to discuss issues in the morning sessions while afternoons were devoted to workshops in which participants discussed barriers and possible solutions.”

The report identified major barriers in education and the workplace, and numerous recommendations to ameliorate those barriers were importantly presented. The report concluded with: “Implicit in these recommendations was the suggestion that all of the major stakeholders must become active and vocal in encouraging women to enter the fields of science, engineering, trades and technology.”

Now nearly fifteen years after this report was written and disseminated, it may be very interesting to review the barriers and recommendations of 1992 and determine: 1) if any progress has been made, 2) what barriers and solutions are no longer relevant and 3) what barriers and solutions are still challenges. This presentation will present the key barriers and recommendations of the 5th CCWEST conference which will hopefully engender interesting reflection and discussion from the audience.
INTRODUCTION

Donna Brown, chair of the 5th Canadian Conference of Women in Engineering Science and Technology (CCWEST), entitled Breaking the Barriers, wrote in the program introduction August 14, 1992:

There is a major challenge facing Canada today. Our future depends on our ability to educate our people in the science and technology which will be the basis for our economic future as a country. Women need to play a major role in this future. However, despite nearly fifteen years of advocacy on the part of women’s groups, they are still playing a minor role in this most important part of our economy. We hope during this conference to try to identify causes and solutions to this problem.

Our intent is to provide a forum for women in a wide variety of science, engineering and technology related professions to discuss both perceptions of and possible solutions to the barriers they face, in education and the workplace.

As much as possible we have tried to design the conference program to provide information about the current status of women in the science-related professions and to give ample opportunity to you as participants to discuss your own experiences and provide input into recommendations which we will be making in the report of our proceedings.

The purpose of this paper is to present the recommendations made at the 5th CCWEST and to assess fifteen years later “if we there yet”. The various quotes, barriers and recommendations below are excerpted from the Report of the 5th CCWEST (1992).

EDUCATION AND WOMEN IN ENGINEERING, SCIENCE AND TECHNOLOGY

“We must ensure that students know that science is not necessarily hostile, nor is it more difficult than other subjects...that science can be fun and girls can do science” (Dr. Marianne Ainley, Principal, Simone De Beauvoir Institute, Concordia University.)

1. New Approaches at the Pre-school and Elementary Levels

Barrier I: Children’s attitudes of themselves and each other and what constitutes suitable female play/work activities are shaped during early stages of development by cultural and familial stereotyping.

Recommendation
1. Parents must become aware of their role and responsibility in helping their children develop during the early states to better prepare them in making career choices in the future.

Barrier II: In the early grades, the importance of science is rarely made clear either to the child or to her parents.

Recommendations
1. It is in the best interests of all the stakeholders (educators, industry, professional associations) to become involved in changing the stereotypical images of science, trades, technology and engineering.
2. Establish outreach programs – such as fairs, exhibits and demonstration projects – together with professional associations and industry groups to help raise the profile of science and technology schools.
3. Encourage the media (both television and the printed media) to showcase science in a less stereotypical and even more “entertaining” manner.

Barrier III: Young children in the classroom are often directed into gender stereotyped activities by their teacher.

Recommendations
1. To become more aware of gender stereotyping, corporations, advocacy groups, and professional associations should educate parents, teachers and boards of education about the suitability of science for girls through organized workshops at schools.
2. The participation of young children in all class activities should be encouraged rather than allowing free choice.
3. Computers should be introduced at a younger age with equal access for boys and girls.
4. In-service training should be provided for teachers to help them plan gender-neutral programs.

Barrier IV: Elementary teachers (who are predominantly female) frequently demonstrate a phobia or bias against science-related activities.

Recommendations
1. Each school should appoint a central contact person with a science-based background to assist other teachers. Schools should also be aware of the educational backgrounds and personal interests of their teaching staff.
2. Explore more ways to help teachers keep in touch with technological and scientific change and broaden their own personal backgrounds through more frequent upgrading sessions.

3. Take a serious look at teacher training courses provided through the Faculty of Education with a view to expanding both course content and the training period.

4. Men should be encouraged to apply for teaching positions at the elementary level.

Barrier V: The curriculum at the elementary level does not include enough science.

Recommendations
1. Increase the length of the school day at the elementary level in order to allow for more mathematics and science content.
2. Target more funds towards the teaching of science and technology at the elementary level. There should, in fact, be a more equitable distribution of funding the secondary and elementary panels.
3. Provide more administrative support for science and technology at the elementary level. This support should go primarily to the classroom teachers in the development of techniques and curriculum. Pilot projects should be encouraged.
4. Provide an exposure to the scientific workplace, even at the elementary level.

2. New Approaches at the Secondary Level

“We need to look at our faculties of education and the way in which they select students. It appears to me that there is a bias in those selection procedures that produces people who can teach but (who are) not terribly interested in science math and technology. Teachers are the key to increasing the participation of females in science technology and engineering.” (John Pettit, Coordinator of Science and Outdoor Education, Halton Board of Education)

Barrier I: A weak background in science and technology is a serious problem for the majority of teachers in secondary schools.

Recommendations
1. Take immediate steps to increase the number of mathematics and science students entering the Faculties of Education and Teachers’ Colleges.
2. Revise criteria for admittance to Faculties of Education to acknowledge the discrepancy in marks between scientific disciplines and arts disciplines.
3. Make it a requirement that all applicants have acquired some math and science prerequisites.
4. Encourage the enrollment of women with math and science backgrounds through affirmative action programs.
5. Insist that at least one additional science, trade or technology subject should be a requirement in the high school curriculum.
6. Create more material for use by teachers of science.

Barrier II: Too many studies of both sexes are dropping mathematics and the sciences at the high school level as soon as it is permissible to do so. This is particularly true for female students who appear to regard these subjects as too hard-edged, too complex, not people oriented.

Recommendations
1. To attract female students in particular, more emphasis should be placed on the practical aspects of mathematics and the sciences and their impact at-large (such as the environment). Discussions involving ethics and values should also be included.
2. Partnerships and exchanges with industry should be encouraged. While teachers gain practical experience in the workplace, individuals from the workplace would teach a module showing how industry and business applies science and mathematics. Such exchanges would help to make the study of these subjects more relevant for both the students and teachers.
3. Co-operative training programs should be developed by scientific and technical industries to provide opportunities for high school students to develop a practical understanding of science.
4. Mentoring and role modeling can create a greater awareness of the benefits of an education in the sciences. Providing more opportunities for high school students to “job shadow” engineers, scientists and others in non-traditional jobs would also be helpful.

Barrier III: Traditional role models of women in the home do not support the entry of girls into science, engineering and technology. The traditional role models are reinforced by the media influencing girls at a susceptible age.

Recommendations
1. Media role models are needed to show women active in scientific, engineering and technological professions.
2. Both guidance counsellors and parents need information to assist high school girls to understand the career opportunities in the scientific based professions.
3. The stereotypical images about science and engineering (work in dirty pants, need for physical strength, etc.,) need to be overcome to encourage young women to consider these professions.
4. Professional organizations should promote entrance to the profession at the school level with positive role models of women in the profession.

3. New Approaches at College and University Levels

“Generally there’s been a tendency to discredit and undervalue the educational opportunities offered in the Community College system...apprenticeship, the domain of the traditional blue collar trades, still ranks far behind...the professions” (Hilde Zimmer, Coordinator, Women in Trades and Technology, George Brown College)

a) The Colleges

Barrier I: The public image of a college education versus a university education is not a positive one.

Recommendations
1. Inform the public about the important role of colleges in the re-education and training of people.
2. Help the public to recognize the role and importance of technologists and “blue collar” workers in the work force.
3. Encourage mutual respect between groups representing technologists and technological trades and groups representing engineers and scientists.

Barrier II: A too rigid institutional approach to evaluating applicants restricts access to a college education for women re-entering school.

Recommendations
1. Encourage professional associations, unions and industry management to make re-entry courses at colleges more accessible by: supporting recognition of skills gained through non-formal training; working with the colleges to create job-enrichment programs for those already in the workplace.
2. Colleges should provide mathematics and science refresher courses for all re-entry students.

Barrier III: The women re-entering school experiences a feeling of being isolated and without familiar support systems. This is particularly true of women enrolled in male-dominated science-based programs and leads to a higher attrition rate for women than for men.

Recommendations
1. Support services, such as childcare centres and/or referral services, must be made available at the community colleges and universities. Women should be encouraged to make use of these as well as the many other women’s networks providing special assistance for female students.
2. Science-based programs at both colleges and universities should include courses that discuss specific coping strategies for women working in these fields.
3. Create a data bank of key women as candidates for instructing in these programs.

b) The Universities

Barrier I: Too often female high school students receive little and/or erroneous counselling about post-secondary programs in the sciences and engineering. There is, in general, little family/societal/peer support for females.

Recommendation
1. There must be improved counselling in high schools for all students, but for female students in particular, about possibilities of engineering and science careers.

Barrier II: There are few female role models at university level in the sciences or engineering, particularly at the post-graduate level.

Recommendation
1. Incentives (tied to funding perhaps) should be given for attracting women into post-graduate work and faculty positions.

Barrier III: Expectations are intensified for women in university science and engineering to excel. Yet, the learning environment and curriculum is almost formidably male in tone and content.

Recommendation
1. Universities should sponsor training sessions to improve teaching ability of faculty.

Barrier IV: Sexual harassment on campus and a sexist attitude held generally by faculty continues to be a problem for female students, particularly in engineering.

Recommendations
1. A sexism rating system or sexism audit should be developed and administered to engineering schools.
2. Stricter rules of conduct should be drawn up and more effective punishment applied by university authorities to discourage sexist attitudes on campus.
3. Group sessions involving both male and female students and their professions would help to clarify issues of concern to female students and bring them out in the open for rational discussion.
c) Science-based Apprenticeship Programs

**Barrier I:** There is a bias among the public-at-large and educators in particular with respect to “blue-collar” jobs and apprenticeship training. The bias against women participating in these programs is particularly strong.

**Recommendations**
1. Market the value of skilled trades and apprenticeship training generally to women, counsellors, students and educators. The Ministry of Skills Development should be encouraged to educate and work with school boards, vocational teachers and counsellors in promoting apprenticeship training for women.
2. Schools and colleges should be encouraged to have women teaching non-traditional subjects (like shop).

**Barrier II:** Hiring criteria makes it difficult to find suitable training places for women.

**Recommendations**
1. Ensure that correct information is provided regarding the physical demands of the job. Strength is not necessarily a prerequisite.
2. Encourage employers to take women in bridging programs or work placements.
3. Provide financial incentives for employers who hire women in apprenticeship programs.

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**THE WORKPLACE AND WOMEN IN ENGINEERING, SCIENCE AND TECHNOLOGY**

1. **Building a Career through Gaining Access to the Workplace**

**Barrier I:** Weak or non-existent cultural, parental and peer support prevents many women from pursuing studies and careers in engineering, science and technology.

**Recommendations**
1. Women themselves must not maintain stereotypical attitudes. They must learn to respect women working in both traditional and non-traditional fields.
2. Women must be encouraged to look at a broad range of occupations and not only those which they have traditionally filled.

**Barrier II:** For women considering a career in non-traditional fields, there is a scarcity of both helpful information and female role models.

**Recommendation**
1. Women’s organizations in the sciences, engineering, trades and technology must work together in promoting the viability of careers in these fields for women. Establishing and maintaining strong and positive links with universities and colleges, professional associations and unions is vital.

**Barrier III:** Apart from outright discrimination, gender insensitivity and a general lack of awareness on the part of both management and unions create barriers for many women at the hiring stage.

**Recommendations**
1. When positions are advertised, employers must ensure that only credentials absolutely needed for the job are listed.
2. Employers must eliminate testing procedures that have not been validated and that may be gender-biased.
3. When evaluating an applicant’s skills, employers should measure performance skills in other areas too, such as communication, collaboration, etc..
4. Women’s organizations in the areas of science, engineering, trades and technology should recognize and bestow honours on those companies and organizations which demonstrate real progress in their hiring and employment practices with regarding to women.

**Barrier IV:** There is a general distrust of foreign education and experience in hiring practices. This makes gaining access to professional accreditation difficult at best.

**Recommendations**
1. Professional associations should: educate prior experience gained abroad more equitably; educate the general public and employers in the worth of foreign-based education and experience; establish a board within the industry/professions/occupation involving both women and women to assist immigrant professional; establish liaisons with other industry/trade organizations to obtain funding for these endeavours.
2. Education systems within Canada should move towards the standardization of education credits gained abroad.

**Barrier V:** Access to a career in a new country frequently requires educational upgrading. In some cases, government barriers and immigration policies make it impossible for immigrant women to participate in these programs.

**Recommendation**
1. Government should: encourage women’s ministries to promote the interests of minority and immigrant women; present the hiring of minority and immigrant women as an economic benefit for the country; provide more
information for minority women on educational opportunities; provide potential immigrants with more realistic
information on employment opportunities in Canada.

Barrier VI: Biases held by and about some minority cultures present a formidable barrier for minority culture
women trying to gain access to the workplace.

Recommendation
1. The government and women’s support groups must work together to ensure that minority women understand their
basic human rights as residents of Canada and what support services/groups are available to them.

2. Building a Career through Succeeding in the Workplace

Barrier I: Limited access to further training makes opportunities for self-advancement and promotion difficult if not
impossible for some women in the workforce.

Recommendations:
1. Employers and employees together must make a greater commitment to and promotion of life-long learning,
retraining and upgrading.
2. Employers must periodically conduct “training audits” to ensure that there are no systemic barriers to women
participating in such programs.
3. At some point in the educational/training process, women must try to develop entrepreneurial skills. It would
enable them to become self-employed during the years they are raising children and may be out of the traditional
work place.

Barrier II: Women in non-traditional occupations often feel isolated in a mostly male environment, especially there
support systems are weak or non-existent.

Recommendations:
1. Women must find allies within the work force by networking with other women and men. Establishing a
mentoring relationship with a senior colleague could be immensely helpful.
2. Women must develop and find funding for effective support groups and networks. The agenda for these groups
should be focused on the development of mentoring, communicating, safety and education.
3. These groups/networks must be proactive in establishing frameworks, policies and guidelines with their
employers and unions and government that encourage, support and protect women when that required.
4. Women must themselves take steps to become more involved in decision-making by serving on committees and
boards of industry-based organizations.

Barrier III: Out-dated management styles based exclusively on the hierarchical system of management have not kept
pace with the rapid rate of technological change. There is widespread reluctance to move towards “team-
management”, for example, a management strategy that must be employed in dealing with part-time, job sharing or
at-home working arrangements favoured by working women with young children.

Recommendation:
1. Management personnel should be encouraged to explore the many benefits of a team approach to task
management. When properly implemented it provides: flexibility for both employer and employee; increased
productivity on the part of more contented employees; lower costs for office space; a higher retention rate of trained
employees.

Barrier IV: Occupation groups dominated by women often do not command the respect given similar occupational
groups dominated by men.

Recommendations:
1. Lobby for policies which permit a broader range of occupations (such as nurses, technologists) a greater role in
decision-making.
2. Encourage work organizations which permit shared responsibility and decision-making (e.g. team management).
3. Educate the public about the evolving role of the traditional female professions such as nurse practitioner.

3. Building a Career through Remaining in the Workplace

Barrier I: Sexist attitudes remain a major problem, particularly with respect to the engineering profession.

Recommendations:
1. Employers must make it clear to their workforce that sexist behaviour will not be tolerated by establishing clear-
cut policies and putting effective training programs in place.
2. Employers must also establish effective complaints procedures.
3. Managers must be trained in bias-free hiring and promotion strategies.
4. Professional associations and unions must be involved in promoting and enforcing equity issues.
5. Elimination of sexual harassment and discrimination should be made a component of the ethical codes of
engineering, scientific and technical professions and sanctions should be applied to offenders.
Barrier II: Maintaining a healthy balance between workplace and home continues to be a real challenge for both men and women. Yet few companies have established formal, standard, equitable policies for new work arrangements. This is partly because: there are initial complications in setting up these programs, managing them and creating new union agreements; child care is regarded as a “women’s” issue, not a business issue.

Recommendations:
1. Employers should encourage both male and female employees to lead a balanced career/family life.
2. For women with children, employers should be open to providing new work arrangements including work from home, flexible (including part-time) hours and job-sharing.
3. Where possible, employers should provide on-site child care. Where this is not possible, employees should have easy access to information and advice about appropriate child care facilities.
4. Business should become more pro-active in resolving some critical and outstanding child care issues. These include: funding — who subsidizes, government or business, and are tax incentives feasible; standards of care — what quality of child care is required?
5. Legislation should be passed to increase parental leave and to ensure the coordination of benefits and leave periods across Canada.
6. Employees, human resources personnel, unions and management must work together to draft well-defined policies (with well-defined expectations) on these new work arrangements.

DISCUSSION

So, are we there yet? A quick review of the Canadian context of whether any of these recommendations have been realized in the last fifteen years indicates that some initiatives have developed. Indeed many of the education recommendations are also reflected in various teacher and parent guides, such as the Strategies for Attaining Gender Equity (2005) and The Math Forum (Maraffi, 2006). Moreover, a number of outreach initiatives, such as CCWEST, CAGIS, CAWIS, Actua, Let’s Talk Science, WISE, WITT, etc., have provided girls, parents, teachers, governments and the public with educational and training opportunities in science, technology, trades, engineering, mathematics (STTEM), female STTEM role models, STTEM career information, etc. Additionally, during the past decade Canadian provinces have undergone curriculum renewals. For example, the Pan-Canadian Protocol for Collaborative School Curriculum, Common Framework of Science Learning Outcomes (Council of Ministers and Educators, Canada) sets out a vision and foundation statements for science literacy, “regardless of gender or cultural background”, that is “an evolving combination of the science-related attitudes, skills and knowledge students need to develop inquiry, problem-solving, and decision-making abilities to become lifelong learners, and to maintain a sense of wonder about the world around them”. Specifically, as per CCWEST’s recommendations, the Framework states that science education aims to encourage an applied, problem-solving focus to improve the quality of people’s lives, to address science-related societal, economic, ethical and environmental issues, to prepare students to pursue higher levels of study, science-related occupations and hobbies, and to develop knowledge of a wide variety of careers related to science, technology and the environment (Council of Ministers and Educators, Canada). However, despite the fact that the curriculum aims are congruent with CCWEST’s recommendations, the question is if the science education aims are actually being realized in the classrooms.

The 1990s ushered in an era of cost-cutting and efficiency in provincial Ministries of Education. Some efficiencies have lead to provincial collaborations in curriculum development but others have lead to the reduction of services and staff (Council of Ministers of Education, 1996). Thus, fewer people are expected to do more, and education support, planning and design can deteriorate (Council of Ministers of Education, 1996). Additionally, with ‘last in, first out’ contract bumping guidelines, there may not be a good infusion of new teachers with more innovative approaches and awareness of gender issues in STTEM. Generally, there are no provincial mandatory requirements for in-service professional development across Canada, except Ontario with the College of Teachers, and local school boards or schools through professional development (PD) days in relation to provincial or board priorities (Council of Ministers of Education, 1996). That said, it is important to recognize that Canadian students score reasonably well on various international tests. For example, the Programme for International Student Assessment assesses mathematics, reading and science literacy among 15 year olds within 41 countries (Council of Ministers of Education, 2006). In 2003, only 2 countries, Hong Kong-China and Finland, outperformed Canada in Mathematics (Council of Ministers of Education, 2006). Boys performed significantly better than girls on the combined mathematics scale in 27 countries, including Canada; however, the size of gender differences was small with Canadian boys outperforming girls by an average of 11 points, which is about one-sixth of a proficiency level (Council of Ministers of Education, 2006). No gender differences were found in 12 countries, while in Iceland girls significantly outperformed boys. Gender differences were found for Newfoundland-Labrador, Nova Scotia, New
reform…Many institutions and organizations are both part of the problem and need to be part of the solution."

In summary, we can say that we are not there yet, although we have made some progress. However, improving the situation for women in engineering, science, trades and technology, as Wharton (2001) suggests, is “long-term societal change process that ultimately requires not only initiative and programs but also structural reform…Many institutions and organizations are both part of the problem and need to be part of the solution.”
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