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THE UNIVERSITY OF BRITISH COLUMBIA

NSERC Chair for Women in Science & Engineering, BC and Yukon Region

SECOND 24-MONTH PROGRESS REPORT

(Months 24-48)

September 5, 2014

Chairholder Information:

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Chair for Women in
Science and Engineering
BC and Yukon Region



Lead Sponsors:



Teck



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Westcoast Women in
Engineering, Science
& Technology

Communities Impacted
September 2012 - August 2014

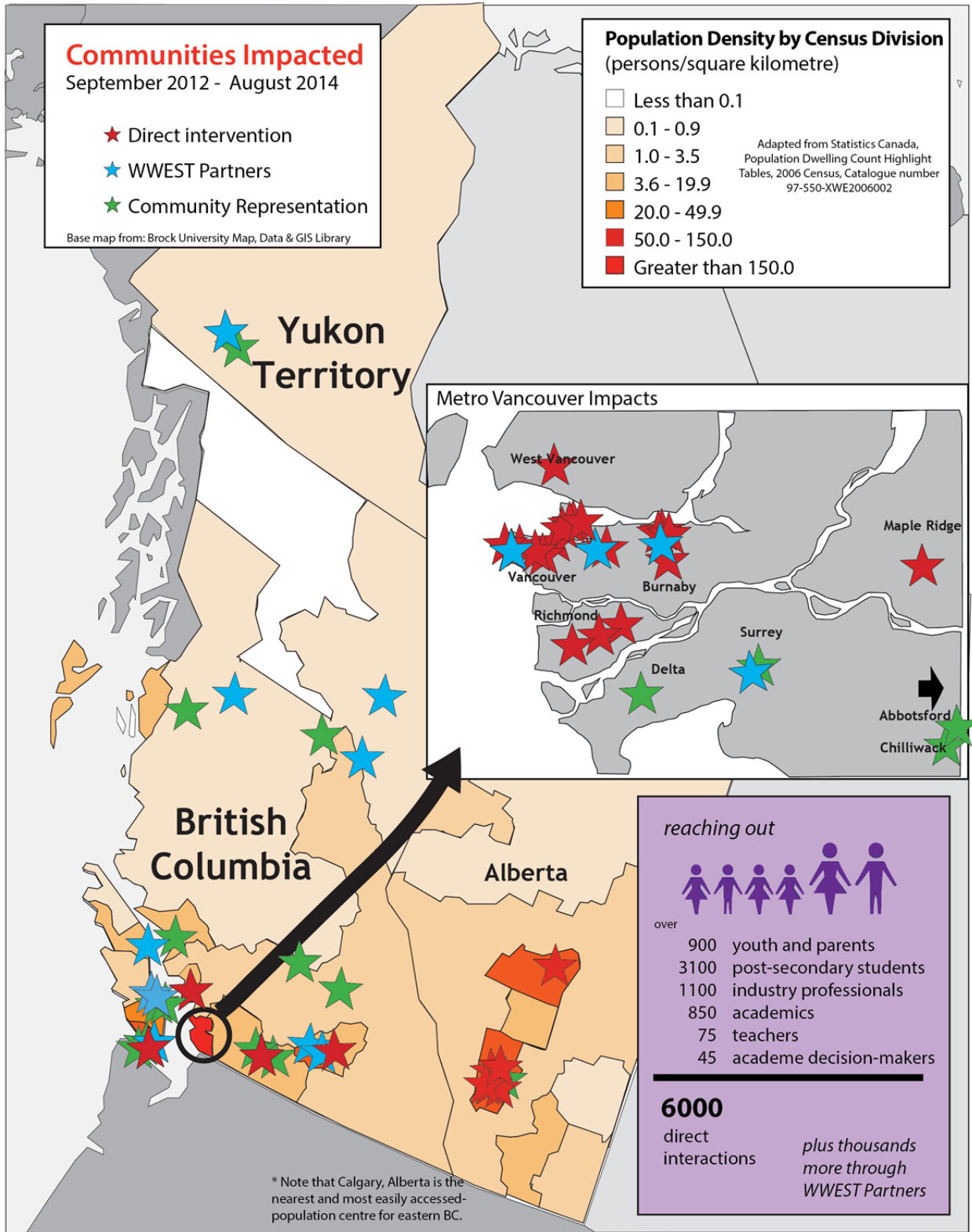
- ★ Direct intervention
- ★ WWEST Partners
- ★ Community Representation

Base map from: Brock University Map, Data & GIS Library

Population Density by Census Division
(persons/square kilometre)

- Less than 0.1
- 0.1 - 0.9
- 1.0 - 3.5
- 3.6 - 19.9
- 20.0 - 49.9
- 50.0 - 150.0
- Greater than 150.0

Adapted from Statistics Canada,
Population Dwelling Count Highlight
Tables, 2006 Census, Catalogue number
97-550-XWE2006002



Yukon Territory

British Columbia

Alberta

Metro Vancouver Impacts



reaching out



- 900 youth and parents
- 3100 post-secondary students
- 1100 industry professionals
- 850 academics
- 75 teachers
- 45 academe decision-makers

6000
direct interactions

plus thousands more through WWEST Partners

* Note that Calgary, Alberta is the nearest and most easily accessed-population centre for eastern BC.

Executive Summary

Over the past two years, the NSERC Chair for Women in Science and Engineering for the BC and Yukon Region (CWSE BC/Yukon), operating as WWEST (Westcoast Women in Engineering, Science, and Technology) has reached over six thousand people through direct interactions, and made an impact on thousands more by leveraging local, community-based leaders and non-profit organizations through the WWEST Partners program and community representatives. The majority of the proposed chair objectives have been achieved, and effort is now focused on sustaining these results and transferring them to other stakeholder groups for continuation beyond the Chair term.

An outstanding example of the impact the CWSE (BC/Yukon) over the past four years is illustrated through the percentage of women entering first year engineering at UBC Vancouver. When the Chair began in 2010, 19.7% of the first year class was women. This fall, 29.0% of the class will be women – a gain of almost 50%.

Chairholder Elizabeth Croft and the WWEST Program are recognized region-wide as champions for, and experts on, the full inclusion of women in science, technology, engineering and math fields. Dr. Croft was recognized as a 2013 YWCA Women of Distinction, was featured in the media thirty-two times over the past two years, and has been invited to give talks at eleven different events, including serving as the closing keynote speaker at the International STEM Conference 2014. She was named Associate Dean, Education and Professional Development, for the UBC Faculty of Applied Science in November 2014, and was recently appointed Chair of the Task Force on Engineering Culture formed by the National Council of Deans of Engineering and Applied Science.

WWEST hosted the Creating Connections 2013 Regional Conference, attracting 300 women and men from throughout the region. The conference achieved both of its major objectives: participants in the conference showed an immediate, statistically significant positive increase in their awareness of the value of gender diversity ($P < 0.001$), which was sustained at a six month interval ($P < 0.05$). Participants also showed an immediate, statistically significant positive increase in their occupational self-efficacy ($P < 0.001$), a construct that predicts career persistence.

A key communication project of the past twenty-four months has been WWEST's Gender Diversity 101 infographic fact sheets. Each sheet addresses one topic that is frequently discussed, and provides fully-cited, credible information and statistics addressing common questions or misconceptions about gender diversity. The infographics were released to strong reception, and co-branding and/or distribution agreements are in place with six non-profit, professional, and educational groups, ensuring the information is shared as widely as possible.

Engineering workplace best practices were identified as another area of particular concern. Dr. Croft (Principal Investigator) and interdisciplinary colleagues across Canada were awarded a Partnership Development Grant from the Social Sciences and Humanities Research Council of Canada for *Engendering Engineering Success*, which aims to identify which organizational practices best predict an inclusive and supportive workplace culture that maximizes organizational commitment and productivity. The total value of the grant and associated industry contributions is \$305,432.

In academe, Dr. Croft was the Chair of the UBC Faculty of Applied Science (Vancouver Campus) Climate Committee, charged with identifying potential gaps and best practices to advance equity, diversity, and working climate. The findings identified a gender-based time-to-promotion delay, among other concerns. Dr. Croft continues to work with senior administration to implement the report recommendations.

Recognizing the outcomes and impact of the CWSE (BC/Yukon), Goldcorp donated \$500,000 to UBC in 2014, creating the Goldcorp Professorship for Women in Engineering at UBC. The Professorship will sustain three of the large-scale outreach events currently supported by WWEST, in addition to several other initiatives, ensuring continuity beyond the end of the Chair.

1 Progress to Date

Over the past two years, the NSERC Chair for Women in Science and Engineering for the BC and Yukon region has expanded its impact throughout the region, across sectors, and across age groups. The majority of the proposed chair objectives have been achieved and effort is now focused on sustaining these results. Participation of women, particularly in engineering, shows significant growth, and collaborative efforts, catalyzed by the chair, have strengthened the overall capacity of the many regional groups working towards gender diversity in STEM. The profile of the Chair at UBC, and also at a national and regional level, has been raised as Dr. Croft has taken up the role as Associate Dean, Education and Professional Development within the Faculty of Applied Science at UBC, effective November 2013.

The following abbreviations and terms are used in this document:

- APEGBC: Association of Professional Engineers and Geoscientists of British Columbia
- CWSE: Chair for Women in Science and Engineering
- CWSE Program: The NSERC program that sets out the objectives and priorities for the CWSEs
- CWSE (BC/Yukon): Dr. Elizabeth Croft's NSERC Chair for Women in Science and Engineering for the BC and Yukon regions
- DAWEG: Division for the Advancement of Women in Engineering and Geoscience, a division of APEGBC
- SFU: Simon Fraser University
- STEM: science, technology, engineering and mathematics
- UBC: University of British Columbia
- UVic: University of Victoria
- WWEST: Westcoast Women in Engineering, Science, and Technology; the operating name for the CWSE (BC/Yukon)
- WWEST Partners: A cornerstone program of WWEST that supports (financial, training, resources) locally-relevant non-profit organizations that recruit, retain, or develop women in STEM.

1.1 Objectives, Activities, Impacts, Collaboration, and Sustainability

The original proposal for the NSERC Chair for Women in Science and Engineering for the BC and Yukon regions outlined three objectives: awareness and outreach, recruitment, and retention and industry support. Each objective plays an important role in supporting the pipeline bringing women into science and engineering professions, and significant contributions have been made in each area over the past two years.

1.1.1 Awareness and Outreach

The CWSE (BC/Yukon) awareness and outreach objective focused on improving the capacity for awareness and outreach activities throughout the region, primarily through collaborations and creating a network. Additional awareness and outreach objectives are set through CWSE program, including developing, implementing, and communicating strategies to raise the level of participation, and providing accomplished female role models.

1.1.1.1 Creating Capacity for Ongoing Change

Investing in existing regional resources, and creating the conditions that make new resources possible, ensures WWEST's contributions will have a sustained impact beyond the end of the NSERC CWSE (BC/Yukon).

Activity: Creating the Goldcorp Professorship for Women in Engineering at UBC

Impact: Recognizing the strong impact that Dr. Croft's efforts through WWEST has made on gender diversity in STEM in BC/Yukon, particularly around supporting women in engineering,

Goldcorp has donated \$500,000 to UBC to ensure outreach efforts to bring more young women into STEM continue beyond the Chair. Although the Professorship is based at UBC and will be running the first year pilots out of the UBC Vancouver campus, the Professorship is committed to collaborating with other institutions to run identical concurrent sessions throughout BC in 2015/16 and beyond.

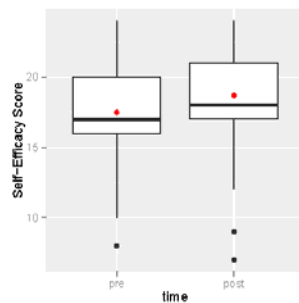
Collaborators: Goldcorp, UBC Engineering, Dr. Sheryl Staub-French (Professorship holder). Discussions for cooperation begun with Dr. Yvonne Coady (UVic), Dr. Lesley Shannon (SFU), Renee Leboe (UBC Okanagan).

Sustainability: This Professorship will actively sustain three of the large-scale outreach events currently supported by WWEST, and extend the initiatives to new audiences.

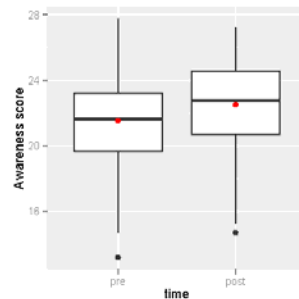
Activity: Creating Connections Regional Conference

Impact: Creating Connections 2013 brought together 300 women and men from throughout the region (including Metro Vancouver, Vancouver Island, Vancouver Coast and Mountains, Thompson Okanagan, and the Yukon; travel subsidies were available). The objectives for the conference were to increase awareness of the benefits of gender diversity in STEM, and to encourage women in STEM to persist in their career paths. Conference highlights included Dr. Roberta Bondar, the first Canadian woman astronaut; Dr. Amiee Chan, CEO of Norsat; Anna Tudela (VP at Goldcorp); and a media panel including Carin Bondar (Discovery network), Bob McDonald (CBC Radio One *Quirks and Quarks*), Cam Cronin (H.R. MacMillan Space Centre) and moderated by Dr. Jennifer Gardy (*Daily Planet*).

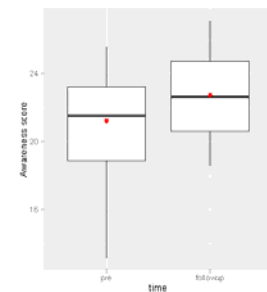
As shown on the boxplots below, two validated psychometric instruments were used to assess the change in participants' awareness of the benefits of gender diversity and their change in occupational self-efficacy (a proxy outcome to predict career persistence).



The Self-Efficacy Survey is scored out of 24 points.
Pre-event average: 17.5
Average increase: +1.27 CI: (1, 1.54)
Statistically significant? Yes, $P < 0.001$



The Awareness Survey is scored out of 30 points.
Pre-event average: 21.5
Average increase: +0.97 CI: (0.47, 1.47)
Statistically significant? Yes, $P < 0.001$



The Awareness Survey is scored out of 30 points.
Pre-event average: 21.5
Follow-up average increase: +1.46 CI: (0.23, 2.69)
Statistically significant? Yes, $P < 0.05$

Participants in Creating Connections 2013 showed an immediate, statistically significant positive increase in their awareness of the benefits of gender diversity ($P < 0.001$), an immediate, statistically significant positive increase in their occupational self-efficacy ($P < 0.001$). The awareness effects were sustained at a six month interval ($P < 0.05$).

Collaborators: The Creating Connections planning team included representatives from UBC, SFU, UVic, DAWEG, Women in Engineering Vancouver Region (an industry group), the Mining Industry Human Resources Council, and the private sector. Broad support for the conference was demonstrated through donations totaling \$57,000, contributed by: Hatch, Vivien M. Srivastava Memorial Endowment Fund, Seastar Solutions, Goldcorp, Genome British Columbia, APEGBC, TRIUMF, the Langley Concrete Group, the Applied Science Technologists and Technicians of British Columbia, SFU Faculty of Applied Sciences, UBC Okanagan School of Engineering, UBC Vancouver: Faculty of Applied Science, Faculty of Science, Alumni Office, Institute of Computing, Information and Cognitive Systems,

WWEST Partners 2012-2014

Outreach Partners

- Girls Exploring Physics (SFU)
- GIRLsmarts (Computer Science outreach, UBC Vancouver)
- GEERing Up! UBC Engineering Science for Kids
 - Metro Vancouver
 - Northern BC
 - Okanagan
 - Vancouver Island
- Science Adventures (Yukon)

Post-Secondary Partners

- Women in Science and Engineering (UBC Okanagan)
- Women in Engineering (UBC Vancouver)
- Women in Science and Engineering (UBC Vancouver)
- Leadership Through Diversity (UVic)
- Women in Engineering Group and Women in Computing Science (SFU)
- Association of BC Women in Engineering (southern BC inter-university network)

Industry Partners

- Women in Engineering, Vancouver Region
- Society for Canadian Women in Science and Technology

Conferences

- Women in Physics Canada Conference
- Canadian Undergraduate Math Conference Women in Mathematics Dinner
- Symposium for Women Entering Ecology and Evolution Today
- Pacific Institute for the Mathematical Sciences Young Researchers Conference
- National Conference on Women in Engineering (Canadian Federation of Engineering Students)

Departments of Mechanical Engineering, Chemical and Biological Engineering, Physics and Astronomy, and Statistics.

Sustainability: The 2013 conference included considerable effort into ensuring that the Creating Connections event was perceived as a regional event, not tied to a single organization or person. The sense of collective ownership is visible in the very large number of collaborators and sponsors. The sustainability of this conference – and the impact it makes in our region – is very high: Creating Connections 2015 will be hosted by Simon Fraser University. SFU's commitment to the conference objectives is illustrated by the \$20,000 they have already committed to the event.

Activity: WWEST Partners Program

Impact: The WWEST Partners Program brings together new and existing not-for-profit organizations from throughout the region that have a focus on promoting women in STEM. Beyond a funding program, WWEST Partners are expected to collaborate and share best practices, and adds additional value through face-to-face networking opportunities for non-profit leaders and targeted training, including event management and measuring efficacy. WWEST Partners programs target all levels of outreach, and all areas of the region, providing broader, sustained, and community-based impact (see impact map). In addition to the outstanding impacts individual partners have produced (example report in Appendix 1; full reporting will be available on www.wwest.ca as projects complete), we have seen region-wide benefits. Partners who were previously separated by geographic constraints are now sharing resources and mentoring each other in program development, allowing new programs to flourish much more quickly. Groups that previously had relatively small regular audiences are working together to co-present events, broadening their impact. Recently, two WWEST Partners that typically reached less than twenty participants each partnered with a group which had not previously offered women in STEM programming, selling out an evening talk with one hundred participants.

Sustainability: The WWEST Partners program was designed as a sustainable funding model. Funding structure was based on the needs of the group, but most partners signed multi-year funding agreements, providing a reliable base of support on which to grow, with values that diminished over time, forcing partners to pursue other sources of funding before the WWEST Partners agreement was complete.

The WWEST Partners model has been recognized by non-profits and by local industry as being an effective way of encouraging grassroots engagement. In recognition of this, the program will continue under the UBC Engineering Eng-Cite program, ideally in cooperation with the next Chairholder.

1.1.1.2 Serving as a Role Model and Regional Champion

As the CWSE (BC/Yukon), Dr. Croft has made a substantial impact on regional and national awareness as both a role model and a champion.

This was evident in the citation read as she was announced as the 2013 YWCA Women of Distinction (Education, Training and Development): “For more than 18 years, Elizabeth has been at the forefront of the campaign to increase the number of women engineering graduates. A dedicated engineer and professor of mechanical engineering at UBC, she is a passionate advocate for increased participation and retention of women in the engineering profession... and has also worked on national initiatives to help ensure that closing the gender gap becomes a national priority at universities across Canada.” (YWCA Metro Vancouver)

Activity: Providing hands-on research tours to youth

Impact: Over the past twenty-four months, Dr. Croft has personally provided hands-on research tour and robotics information sessions for over 500 young women.

Collaborators: GEERing Up! UBC Engineering & Science for Kids (an Actua organization), the Canadian Association of Girls in Science, UBC Institute of Aboriginal Health Summer Science program, UBC Engineering.

Sustainability: In addition to the personal participation of Dr. Croft, every tour included grad student and other faculty mentors, building connections between the partnering organizations and a broader set of available mentors.

Activity: Media appearances

Impact: Dr. Croft has had an exceptionally high level of media engagement over the past twenty-four months, with thirty-two appearances - from national publications to local profiles - highlighting both her research and her work to advance women in STEM fields. Highlights include five appearances in *The Globe and Mail*, and research features in *The Economist* and in *The New York Times Magazine*. A complete list of appearances is available in Appendix 2.

Activity: Invited talks

Impact: Over the past twenty four months, Dr. Croft has given eleven invited talks, ranging from speaking to youth at the HR MacMillan Space Centre, to addressing the Aviation Leadership Forum, a regional industry leadership organization, to serving as the closing keynote speaker at the International STEM Conference 2014. These invited talks directly illustrate Dr. Croft’s position as a regional champion with national presence. A complete list of talks is available in Appendix 3.

1.1.1.3 Building Regional Role Models

Every activity WWEST undertakes includes identifying and building regional role models as a key objective. Local women in STEM from all experience levels are invited to share their experiences, from high school robotics students acting as mentors at an event at HR MacMillan Space Centre, to university students running activities for high school students, to professionals mentoring university students, speaking at conferences, or working with their peers.

The WWEST Partners program, as previously discussed, also serves as a way to identify and support regional role models and leaders.

“The WWEST program has had a significant impact on my professional life by helping me to connect with a community of female academics and industry professionals, by providing me with opportunities to develop my leadership skills, and by facilitating the creation of the Goldcorp Professorship in Women in Engineering that I am honored and excited to hold. “

- Dr. Sheryl Staub-French
Associate Professor, UBC

In addition, WWEST has successfully nominated six outstanding women for prestigious awards over the last twenty four months, including a Vanier Canada Graduate Scholarship, the Engineers Canada Award for the Support of Women in Engineering, and two Canadian Engineering Memorial Foundation scholarships.

An excellent example of the development of regional role models is Dr. Sheryl Staub-French, an Associate Professor at UBC. Dr. Staub-French had expressed interest in increasing her involvement with women in STEM activities, and began to regularly participate in WWEST activities as a volunteer. This later developed into a position as a WWEST Faculty Associate, before being named the inaugural Goldcorp Professor for Women in Engineering at UBC. In the past twelve months, Sheryl has been featured in three media articles, including in the *Vancouver Sun*, and been invited to speak at four separate events.

1.1.1.4 *Creating Comprehensive Communication Strategies*

Activity: Social Media

Impact: When WWEST began, the BC/Yukon region had a large number of unconnected and uncoordinated women in STEM organizations and a strong body of leaders. It was immediately clear that one pressing need was for organization, coordination, and cross-marketing. A social media strategy was developed that was centered around highlighting the activities already taking place in the region, in addition to WWEST's own activities. Highlights from WWEST Partners and articles of interest were later added. Information is now pushed through 175 Facebook Likes (followers), 219 Twitter followers, a blog with RSS, and 313 subscribers to our semi-monthly digest. One of the most visible impacts this strategy has made is in event date coordination – it was previously not uncommon to have women in STEM events scheduled on the same day, but the increased visibility of events has prevented duplication.

Collaborators: WWEST Partners, other local non-profit organizations, post-secondary institutions, national non-profit organizations, other CWSEs.

Sustainability: WWEST has begun discussions to have the social media activities adopted by another organization after the end of the CWSE (BC/Yukon) term.

Activity: Infographic Fact Sheets: Gender Diversity 101

Impact: When interacting with business leaders and professionals, it was evident that clear, concise fact sheets backed up with full citations would lend much more credibility to our efforts. Seven topics have been created to date: Unconscious Bias, Mentoring Works, Stereotype Threat, The Business Case for Gender Diversity, Gendered Language Stereotype Awareness for Hiring Committees, Understanding Workplace Diversity, and What is Engineering? The infographics were released to strong reception, and we have excellent feedback from industry, regulatory organizations, and non-profits. A co-branding initiative was started to provide organizations with a vested interest in sharing the infographic content. Based on the success of the project, we are now reworking the print materials to a Pinterest-friendly format to access new audiences.

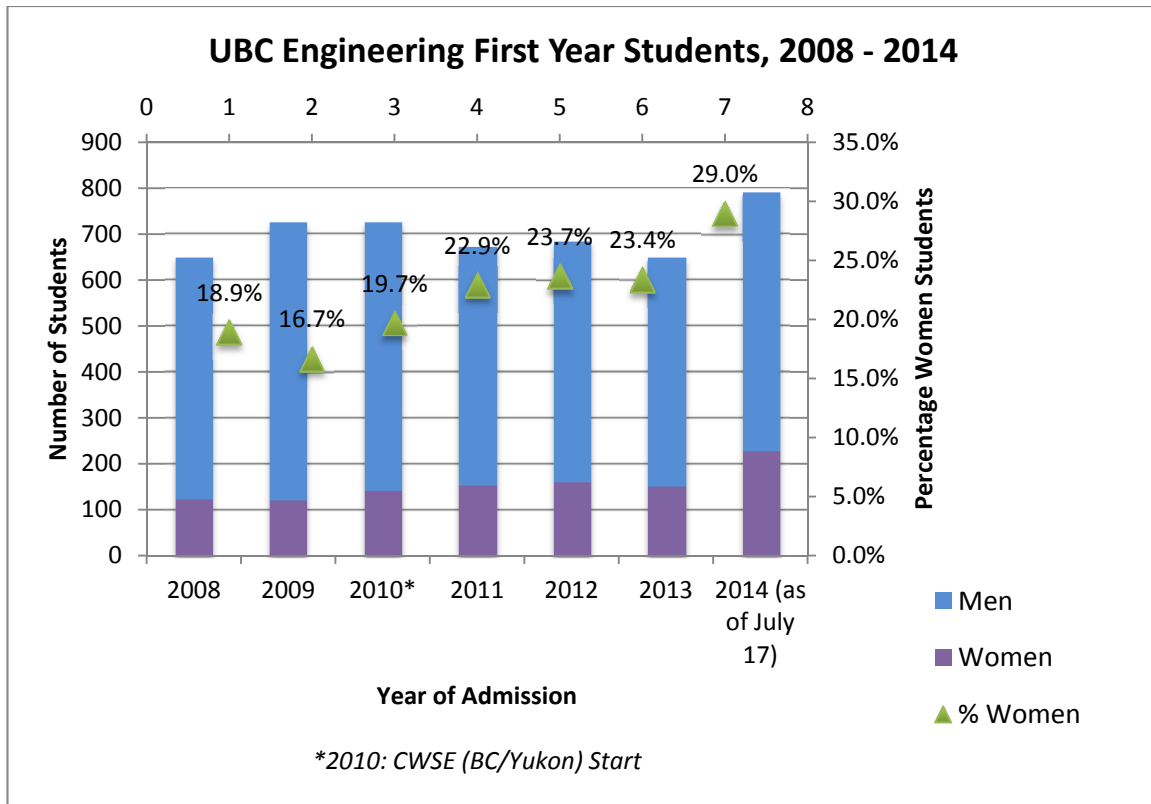
Collaborators: Confirmed co-branding partners include: UBC Engineering, the Engineering Leadership Council (professional group), APEGBC (limited topics), Society for Canadian Women in Science and Technology, and the Ontario Network of Women in Engineering. A distribution agreement, without co-branding, has also been set with the Mining Industry Human Resources Council.

Sustainability: Co-branding agreements are in perpetuity – partners have the ability to continue to distribute, print, use, and promote the fact sheets after the end of the CWSE (BC/Yukon).

1.1.2 Recruitment

The CWSE (BC/Yukon) recruitment objective focused on publically promoting the range of opportunities in STEM careers, the collaborative nature of the professions, and the ability for STEM professionals to create positive change in local and global communities. It aligns with the overall NSERC CWSE objectives to encourage young women to consider STEM careers and to increase the enrolment of women in STEM programs at universities, and to eliminate existing barriers.

Combining recruitment efforts with climate improvements have yielded a strong upward trend in the percentage of women entering UBC Engineering first year, as shown below.



1.1.2.1 Direct Outreach

Activity: Youth Outreach Events

Impact: In addition to the broad outreach undertaken through the WWEST Partners program, WWEST was directly involved in two signature events for young women in high school. Steveston-London Secondary School Introduce a Girl to Engineering Day (for Grade 8) was run in conjunction with School District 38, consisting of a keynote speech and three hands-on, engineering student- and alumni-led activities that exposed a broad range of engineering professions. One student comment forwarded to us from the teacher-organizer stated: *"I learned what engineering is and my interest for it also grew 😊. All volunteers were very friendly and answered my general questions about universities."* The second signature event, Engineering PowerUp!, was held at UBC Vancouver for grade 10 girls. On the post-evaluation, responding to a question about what engineers do, one participant wrote: *"Engineers work in all areas, because engineers have their part to play in the world. Everything we do/have relates to engineering, from the cell phones we use, to the water bottles on our tables, to the equipment used in hospitals. Innovative, collaboration, teamwork, problem solving, communication, thinking outside the box."* She later commented that the day *"...opened my eyes about engineering as a possible career."*

Collaborators: Steveston-London Secondary School, School District 38, DAWEG, WiE (UBC Vancouver), Engineers Without Borders, UBC Engineering

Sustainability: Both of these events have been incorporated into the work plan of the Goldcorp Professorship for Women in Engineering at UBC, and will be taken over after the CWSE (BC/Yukon) ends.

Activity: Post-Secondary Workshops

Impact: Bringing women into the STEM pipeline is only part of the challenge – the other half is keeping them there. WWEST was invited to provide workshops to current post-secondary students at the University of Victoria (Vancouver Island) and at the National Conference for Women in Engineering (run by the Canadian Federation of Engineering Students). Workshops were customized for each request, and focused on workplace diversity and leadership for students and junior employees, empowering participants to work together to find solutions to problems they identified. The National Conference for Women in Engineering consented to run the same survey set WWEST ran at the Creating Connections Event, and achieved similar results (NCWiE 2013 delegates had a statistically significant increase in occupational self-efficacy (a predictor of career persistence) and awareness of the benefits of gender diversity. Study conducted with WWEST; measures by Rigotti et al (2008) and Meng et al (2013)).

Collaborators: Leadership through Diversity, UVic, National Conference for Women in Engineering, UBC Engineering Undergraduate Society

Sustainability: WWEST will continue to accept workshop requests in the upcoming year. Outlines, slides, and other supporting documentation for all workshops have been shared in their entirety with the CWSE / CFSG Réseau National Network to allow for replication or modification beyond the end of the CWSE (BC/Yukon).

1.1.2.2 *Highlighting a Climate of Inclusion and Supporting Change*

Activity: Engineering Inclusion Initiative

Impact: The UBC Engineering Inclusion Initiative was launched in the spring of 2014, capitalizing on the culture changes started by WWEST and catalyzed by Dr. Croft and student leaders who have worked with WWEST. This project is making recommendations for and concrete changes to curriculum, faculty awareness, and student life to ensure an inclusive and supportive environment for all students. Plans are already in place (see 1.1.3.3) to share the resulting best practices with engineering schools across BC and Canada.

Collaborators: UBC Engineering, UBC Engineering Undergraduate Society, UBC Access and Diversity

Sustainability: This initiative is being championed by the Dean of Applied Science at UBC and is part of the strategic plan.

“WWEST has been an amazing resource and support system for me as a female student leader in UBC Engineering. When I was Chair of the National Conference on Women in Engineering 2013, WWEST gave me support with everything from operating resources to amazing mentorship and leadership from Jennifer Pelletier and Elizabeth Croft. As well, as a UBC Engineering student, WWEST has introduced to an amazing network of mentors and events that help improve my leadership and love for Engineering. In the past few years, the culture at UBC Engineering, especially within students, has changed to be more inclusive, welcoming and to have a stronger female presence. In my opinion, this change can largely be attributed to having this Chair at UBC. I will be sad to see this Chair come to an end, however, I know the programs they started and the culture shift they created will continue on for many years to come.”

- [Veronica Knott](#)
[UBC Vancouver Engineering Undergraduate Society President](#)

Activity: Supporting student leader-initiated change

Impact: In addition to working with the Engineering Inclusion Initiative, the Engineering Undergraduate Society at UBC Vancouver specifically approached WWEST for assistance in evaluating their historical events and activities for diversity, inclusion, and other measures. Jennifer Pelletier assisted the students with rubric design and facilitated an evaluation and selection session at their Strategic Planning Meeting. This invitation from student society leaders strongly illustrates the relationships and trust WWEST has built, and the significant changes in climate that have resulted from the first four years of the CWSE (BC/Yukon).

Collaborators: UBC Vancouver Engineering Undergraduate Society, UBC Vancouver Engineering Departmental Clubs

Sustainability: The materials from this session, including the rubric, have become part of the Engineering Undergraduate Society President's Transition Manual.

1.1.2.3 *Change through Curriculum*

Activity: Community-based experiential learning

Impact: A major focus of the first twenty four months of the CWSE (BC/Yukon) were three Community Service Learning pilot programs: (1) broad implementation in the UBC Mech 2 program, with short interventions for a large number of students, (2) a targeted upper-year elective course in Global Engineering Leadership featuring guest speakers and a local project, and (3) an international service learning placement with hands-on engineering experience. All three courses have been well-received, resulting in each one of them becoming a permanent part of the UBC Vancouver curriculum, ensuring that students have the opportunity to link their classroom knowledge to community concerns, increasing relevance and engagement. The Mech 2 implementation is now part of Mech 224, and must be completed to pass the course. The upper year courses now have permanent course numbers, and are elective options in most engineering programs.

Collaborators: UBC Engineering, UBC Community Based Experiential Learning, Tsomanotik (Chiapas, Mexico)

Sustainability: These pilots are now part of the curriculum, and are therefore unlikely to change. Best practices from these pilots have been shared at engineering education conferences.

Activity: UBC Vancouver First Year Engineering Curriculum Reform

Impact: Anecdotally, one often-cited reason for attrition in first year engineering at UBC Vancouver is the lack of immediate relevance of the content (mostly pure math and science) to engineering or helping the community. Championed by Dr. Croft and supported by the success of community-based experiential learning pilots in upper year classes, UBC Vancouver is re-evaluating the first year curriculum to focus on the integration of design, problem-solving, and social contexts – aspects of engineering that are particularly attractive to female students.

Sustainability: UBC Engineering has created the position of First Year Chair to champion the reform. This is a new, permanent administrative role for a faculty member.

1.1.3 *Retention and Industry Support*

The third CWSE (BC/Yukon) recruitment objective was to compile best practices for retaining women in SET careers. This aligns with NSERC CWSE objectives to eliminate barriers for women who wish to pursue careers in science and engineering, increase the retention rate of women in STEM.

1.1.3.1 Engendering Engineering Success – a SSHRC PDG Project

Impact: Engendering Engineering Success is a Partnership Development Grant, awarded by the Social Sciences and Humanities Research Council of Canada. It aims to identify which organizational practices best predict an inclusive and supportive workplace culture that maximizes organizational commitment and productivity for both men and women. Bringing together non-profits, academe from several disciplines, and industry, Engendering Engineering Success significantly extends our ability to analyze workplaces and communicate best practices to industry. The grant is worth \$193,372, combined with industry support of \$112,060, for a total of \$305,432 in funding.

Collaborators: Dr. Croft is the Principal Investigator of the grant. Co-Principal Investigators are Dr. Michelle Inness, University of Alberta School of Business; Dr. Toni Schmader, University of British Columbia Department of Psychology and Canada Research Chair in Social Psychology; and Dr. Valerie Davidson, University of Guelph Professor Emerita School of Engineering. Our work is supported by: Engineers Canada, CWSE National Network, Canadian Centre for Women in Science, Engineering Trades and Technology, Mining Industry Human Resources Council, Enbridge Pipelines Inc., WorleyParsons Canada. Additional industry partners are corporate participants in the studies, but cannot be named.

Sustainability: This grant extends beyond the CWSE (BC/Yukon) and work will continue through it. There are plans to continue to a full Partnership Grant application.

1.1.3.2 Building Industrial Awareness of the Value of Gender Diversity and Encouraging Persistence for Women in the Pipeline

In addition to building awareness through the Creating Connections Conference and National Conference on Women in Engineering, as previously discussed, WWEST has also reached out to industry through a number of industry-focused workshops.

Activity: Industry Workshops

Impact: To maximize both exposure and access, WWEST has focused on delivering workshops in conjunction with or through existing industry group meetings and events. Four workshops were delivered over the past twenty-four months, focusing on building leadership diversity and mentoring.

Collaborators: APEGBC, Association of Professional Engineers and Geoscientists of Alberta.

Sustainability: Materials from these workshops are being archived and shared, per 1.1.2.1.

“WWEST has provided fantastic opportunities to meet women and network with other women in STEM careers in the lower mainland, providing mentorship opportunities that would likely have been otherwise impossible.”

- Dr. Lesley Shannon, Associate Professor, SFU

1.1.3.3 Creating Change Through Governance, Professional Associations, and University Leadership

Dr. Croft and WWEST have been recognized as experts in diversity and change creation through invitations to serve on senior committees and consultation requests. An outstanding example at the national level is the appointment of Dr. Croft as the Chair of the Task Force on Engineering Culture, formed by the National Council of Deans of Engineering and Applied Science. The task force will work with engineering students, the academic community, and the professional community to reshape and

refocus the culture of Canadian engineering programs and student societies to promote respectful behaviour, inclusivity and ethical conduct for engineering students.

At a grassroots level, Dr. Croft was also the Chair of the UBC Faculty of Applied Science (Vancouver Campus) Climate Committee. In 2012/2013, the Faculties of Applied Science and Science jointly assessed the working climate and status of equity and diversity for their faculty members in the Science and Engineering departments and affiliated major research centres. The overall goal of this study was to identify potential gaps and best practices to develop recommendations for the Faculties' efforts to advance equity, diversity and working climate for faculty in alignment with UBC's employment equity and respectful working environment goals. Six main findings were identified, including that "averaged over the current cohort and adjusted for leaves, women engineering faculty achieve tenure more than one half year later than men faculty. As well, on average women faculty remain in the associate professor rank prior to promotion over two years longer than men faculty." Dr. Croft continues to work with senior administration to implement the recommendations of the report

Over the past twenty four months, Dr. Croft has also served on the Engineers Canada Women in Engineering Advisory Group, the UBC Dean of Applied Science Search Committee, and the APEGBC Council Subcommittee Task Force on Women in Engineering. Dr. Croft and WWEST were also asked to consult with APEGBC on career awareness outreach and mentoring, and with the Association of Canadian Chairs of Chemical Engineering on recruiting and retaining women students and faculty.

1.1.4 Academic Contributions

Gender diversity-related academic contributions by Dr. Croft and the WWEST team include:

- Major Tri-Council Grant (see 1.1.3.1): SSHRC PDG Engendering Engineering Success - \$193,372
- Gender Summit – North America Conference, Washington DC: panelist and rapporteur
- CCWESTT 2014 Policy Forum Keynote: How Much Are You Worth?
- CCWESTT 2014 sessions:
 - Call to Action (Farenhorst, Croft, Franz-Odendaal, Mavriplis)
 - Designing Evaluations (Meng, Pelletier, Croft)
 - Engendering Engineering Success (Croft, Davidson, Inness, Schmader)
 - Starting Conversations: A National Conference on Women in Engineering (Knott, Dozzi, Li, Palmer, Meng, Pelletier)
- Society for Personality and Social Psychology Annual Meeting, New Orleans, LA, USA, p. B93. Engineering Equality: How Negative Interactions Undermine the Health and Well-Being of Male and Female Engineers.
- Proc. 2013 Canadian Engineering Education Association (CEEA13) Conf. Paper 123, Montreal, QC; June 17-20, 2013. Research publication: Design for Inclusion
- Proc. 2013 Canadian Engineering Education Association (CEEA13) Conf. Paper 001, Montreal, QC; June 17-20, 2013. Research publication: Global Engineering Leadership
- Proc. 2013 Canadian Engineering Education Association (CEEA13) Conf. Paper 137, Montreal, QC; June 17-20, 2013. Research publication: Leadership Development Programs for Women in Engineering Industry

1.2 Team Members

The CWSE (BC/Yukon) is supported by a team that includes staff, student staff, and researchers. Team members are listed in Appendix 4.

1.3 Research Activities of the Chairholder

Dr. Croft is Director of the Collaborative Advanced Robotics and Intelligent Systems (CARIS) lab at UBC. This. She is primary supervisor for one postdoctoral fellow, one research engineer, five Ph.D. candidates, and four MASc candidates and co-supervisor for a further two Ph.D. candidates and two

Masters students also working in the CARIS lab. In the two years, Dr. Croft has published 13 articles and 12 abstracts on her research in Human Robot Interaction in peer reviewed international journals and conferences. Her research program is funded by General Motors, Hyundai Heavy Industries, CFI and NSERC and attracts approximately \$400,000 of research funding per year (excluding graduate student scholarships and CWSE program funding and industry donations). Her work has been featured in the New York Times, The Economist, The National Post, CBC, among others. She has been profiled as one of the “25 women in robotics you need to know about” on the International site “Robohub” and on the 2014 “Wiles Hot List”

As NSERC Chair and PI of the SSHRC Partnership Development grant, Dr. Croft has expanded her research profile and published a number of articles related to the impact of interventions, particularly workshops and conferences for women in STEM, on self efficacy and gender awareness (see 1.1.4).

1.4 Obstacles

No major obstacles have been encountered. While the new role of Associate Dean does create a significant challenge in balancing all of the needed activities as a chair, researcher and academic, some important strategies have been put in place. Dr. Croft has been allotted full teaching relief to allow her to focus on her roles as Associate Dean and CWSE (BC/Yukon). Professor Sheryl Staub-French was appointed as, first, WWEST Faculty Associate and, now, Goldcorp Chair has allowed a team approach to handling the many outreach activities. Most importantly, the greater profile and administrative responsibility of the Chairholder has allowed many of the activities of the chair to be more easily moved into mainstream programs and projects.

One unique feature of the BC/Yukon region is that most of the area is sparsely populated – less than one person per square kilometer. Seventy three percent of the overall regional population is concentrated in Metro Vancouver and on Vancouver Island. Many professionals outside this area travel into Metro Vancouver for business on a regular basis. Accordingly, WWEST has found that the most effective way to reach our demographic is by hosting events in this area and providing free or subsidized travel for those in other parts of the region. In addition, we use the WWEST Partners program and community representatives to engage local champions and extend our programs in community-focused, locally-appropriate ways throughout the region.

2 Proposed Action for the Remainder of Term

2.1 Objectives and Expected Impacts

The main objective of the remaining year of the CWSE (BC/Yukon) is to successfully transition our established programs to other groups, as described under sustainability in each section. For most projects, transitions will begin in fall 2014 to ensure there is one year of support available for the new project leaders. WWEST is also committed to creating resource packages from the materials developed over the past forty eight months, and sharing them with the CWSE / CFSG Réseau National Network, WWEST Partners and other local organizations, and ideally the next CWSE (BC/Yukon) to ensure they remain useful and accessible beyond the end of the Chair.

Working with the CWSE / CFSG Réseau National Network and the UBC Provost Office, we will also be hosting an Academic Advancement workshop for Associate Professors, open to women faculty across Canada. The Engendering Engineering Success project will continue.

2.2 Team Members and Timeline

It is expected that the team structure will remain stable over the next twelve months. The Academic Advancement workshop is currently planned for May 2015, to coincide with the transitioned Creating Connections 2014. Transitions will be ongoing throughout the period, with some dependency on the announcement date for the next CWSE (BC/Yukon).