The Jade Bridges Project and Network

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Abstract. In light of the continuing low participation of women in engineering and some fields of science, two major challenges for our fields are to create a positive image of career paths in the physical sciences and engineering and to provide a supportive environment for women who choose to pursue an education in these fields. An initiative of the NSERC/General Motors Canada Chair for Women in Science and Engineering, the Jade Bridges Project has helped fund several initiatives in British Columbia and the Yukon that address these challenges. One key component of the Jade Bridges approach is to support committed individuals who are taking the lead in developing effective initiatives. The second key component is to increase the overall level of engagement at colleges and universities in advancing such efforts. Jade Bridges has created and sustained a network of academic leaders who are knowledgeable about good practices for addressing the problems and can effect longer-term institutional change, and project leaders are starting to have influence on larger-scale institutional engagement. Here, we describe the ingredients that have made Jade Bridges effective and discuss how its successes might be leveraged into bigger gains in the future.

1. Introduction

Women continue to be severely under-represented in the sciences and engineering (S&E) at both student and faculty levels. In 2006, while women made up 47% of the Canadian workforce, they comprised just 22% of professionals in the natural sciences, engineering and mathematics [1]. The percentage of female students in Canadian S&E programs at colleges and universities is also very low, being 25.3% in mathematics, computer and information sciences and 21.2% in architecture, engineering and related technologies in 2004-05 [2]. Moreover, a 2008 study of science and engineering graduate students at Canadian universities found that female graduate students in engineering perceived their environments as significantly less congenial than did their male counterparts; the study also reported significant differences between women's and men's feelings of self-efficacy, importantly associated with success [3]. Even in fields where women are well represented at the undergraduate levels, there is a persistent leak in the pipeline of women who progress to graduate degrees and on to careers in academia or at research institutions. For example, in the physical and life sciences, the percentage of female FTE enrolments in Canadian colleges and universities has been well over 50% and growing since 1995, yet the percentage of female FTE enrolments in doctoral programs had risen to just 40.6% by 2003 [4].

These problems are of significant concern to faculty and administrators at colleges and universities. While some individuals at academic institutions are proactive in developing new ways to recruit and support women in their programs, overall there is still limited engagement by departments and academic units in grappling with the complex underlying issues and in finding effective solutions. Often, those individuals who do engage get poor support or recognition from

their institutions for their efforts, risk compromising their own career success, and have difficulty sustaining their initiatives.

Funded through the NSERC/General Motors Canada Chair for Women in Science and Engineering, the Jade Bridges Project aims to address these challenges. Here, we describe lessons learned from our experiences in the first three years of the Jade Bridges Project. In Section 2, we describe some organizations that work to interest women in science and engineering careers and to support those in the pipeline. We emphasize organizations in the B.C. and the Yukon region, but mention also a few U.S. programs that inspired the Jade Bridges approach. We then describe the Jade Bridges Project in Section 3, comparing its goals and structure with those of organizations described in Section 2. In Section 4, we provide perspective on the progress of Jade Bridges in achieving its goals, informed by results of a survey of project leaders and institutional representatives. We conclude with suggestions on ways that the collective experiences of the network of Jade Bridges leaders may leveraged, as we tackle the larger challenge of fostering broader, and deeper, institutional engagement in advancing the participation and success of women in science and engineering.

2. Shoring up the Leaky Pipeline

Here, we review just a few of many ongoing efforts to expand the pipeline of women in science and engineering and to stem the leak from this pipeline. We emphasize efforts that have influenced the Jade Bridges model, both in B.C. and the Yukon, and across North America.

- **Regional Professional Organizations.** The **Society for Canadian Women in Science and Technology (SCWIST)** has created a strong network of Canadian women scientists and engineers, using email, web and newsletter media and through networking events. SCWIST also offers conferences for girls in B.C. and Yukon secondary schools and supports professional women who are immigrating to Canada. Similarly, the **Division for the Advancement of Women in Engineering (DAWEG)** runs several initiatives to increase the number of women working in engineering and geoscience in British Columbia.

- **National Organizations.** Focusing on locally delivered programs throughout Canada with an emphasis on reaching traditionally underserved communities, **Actua** employs college students to inspire children and youth to learn about science and technology, and reaches tens of thousands of girls annually. The **Canadian Coalition of Women in Engineering, Science, Trades and Technology (CCWESTT)** draws its members from academic institutions, NGOs, corporations and individuals. Their Women in Science, Engineering, Trades, and Technology (WinSETT) project, led by Hiromi Matsui and Margaret-Ann Armour, focuses on federal policies and resources that support the recruitment, retention and promotion of Canadian women in SETT careers. Project leaders are piloting workshops with industry and have proposed the creation of a national centre for the Advancement of Women in SETT

- **Discipline-Specific Organizations.** Many initiatives, particularly at the national and international levels, are organized along disciplinary lines. One organization that has influenced our approach is the Computing Research Association (CRA), which represents

academic computer science departments across North America. **CRA's Committee on Women (CRA-W)** focuses its efforts on expanding the pipeline of women in computing research, both in Canada and the U.S.

While all of these organizations have strong ties with academic institutions, through, for example, partnerships on projects or through their academic members, they do not have institutional transformation as a primary goal. Since institutional engagement is a goal of the Jade Bridges project, we next take a brief look at some national programs in the U.S. that do aim to engage academic faculty and department heads in working toward institutional change.

- The **National Center for Women in Information Technology (NCWIT)** is a major initiative with a broad agenda and a strong focus on institutional change. Membership is composed primarily of academic department heads and other institutional leaders across the country. One example program is its "effective practices" campaign, wherein effective practices for recruiting and retaining women in IT careers, and which have undergone substantive evaluation, are collected, analyzed, codified, piloted, and adopted at other institutions. The U.S. National Science Foundation (NSF)'s **Broadening Participation in Computing Program (BCP)** funds computer science departments and other organizations that work to recruit women and members of other underrepresented groups to the field of computer science. Finally, **NSF's ADVANCE program** provides significant funding for initiatives housed at academic institutions that aim to transform the academic environment for women faculty.

We close this section by describing programs initiated by members of academic institutions in B.C. and the Yukon that are both supported by those institutions independent of the Jade Bridges Project and which have an explicit focus on women.

- The **Women in Engineering and Computer Science (WECS) at the University of Victoria** (UVic) initiative [5], with a full-time coordinator, Anissa St. Pierre, and funded by the Faculty of Engineering, "strives to make changes to the established culture and teaching methods of the Faculty of Engineering and Computer Science to make it more attractive to women." In 2007 the initiatives of Anissa St. Pierre and her colleagues reached approximately 900 students from middle and high schools throughout British Columbia. **SFU's Faculty of Applied Science** has a full-time **Director of Diversity and Recruitment**, Hiromi Matsui, who has worked to develop policies and provide support for female faculty and students in computer science and engineering, including groups such as **WICS@SFU** [6], and also to advocate for resources and policy change at the national level. The **University of British Columbia (UBC) BCS (ICS)** program is a 2-year degree program that offers students with degrees from any field the opportunity to obtain a computer science degree. Roughly 40% of BCS graduates are women. UBC also sponsors **Tri-Mentoring Projects** [7] in several of its departments in which upper-level students are paired with professionals in their fields for ongoing mentoring and professional development. In computer science alone, roughly 40% of tri-mentoring students are women. UBC CS also has a **Focus on Women in CS** committee that organizes events supportive of women in the department and conducts outreach to girls in the community.

3. The Jade Bridges Project

Created in 2004, the Jade Bridges Project [8] is one of four components of the NSERC/General Motors Canada Jade Project. Jade Bridges aims to build institutional links between the Jade Project, located at UBC's Department of Computer Science, and individuals at other colleges and universities in British Columbia and the Yukon who are working on recruiting and supporting women in science and engineering.

Much of the inspiration for the Jade Bridges model derived from CRA's Committee on Women (CRA-W), of which the NSERC/General Motors Canada Chair, Anne Condon, was a member. CRA-W takes an activist approach, in which committee members, all of whom are leading researchers or educators, take responsibility for major projects. The time and energy devoted to projects by all committee members, together with the support of the CRA, sends a strong message that the work at hand is important. Finally, there is strong camaraderie and valuable networking among women in the group, experiences that are often missing in their own sub-disciplinary research communities.

Like CRA-W, Jade Bridges aims to bring together individuals who wish to lead a project and to provide a strong networking and support structure for those individuals. However, Jade Bridges differs in significant ways from the CRA-W model. Because of the mandate of the NSERC Chairs program, Jade Bridges has regional scope but encompasses many disciplines. It does not focus solely on encouraging women researchers; rather, its projects span everything from K-12 outreach efforts to support for graduate students, and they involve community colleges and universities as well as academic research institutions. Anyone at a college or university can apply for Jade Bridges funding, unlike the CRA-W model in which committee membership is by invitation only. In these ways, the project resembles more closely—and on a much smaller scale—the NSF Broadening Participation in Computing program. Also, unlike CRA-W's model, Jade Bridges has an emphasis on projects that not only aim to increase the participation and success of women in science and engineering, but which have a chance to foster institutional engagement as well. However, the amount of funding per Jade Bridges is not suitable for major institutional initiatives such as those funded through NSF's BPC or ADVANCE programs.

Would a regional approach with broad scope and a small amount of funding per project achieve anything of significance? Would people participate in a network that is not affiliated with a major professional organization and is not closely aligned with any particular institution? Would individual project leaders want to network with people in other disciplines and across institution types? The answers to these questions were not clear when Jade Bridges got underway. Before we address them, we first describe elements of the Jade Bridges Project in greater detail.

Project Mechanics: Proposals are submitted one time per year. The applicant, any co-applicant(s), and authorized department representative are identified in the proposal. The application process is fairly lightweight. Applicants describe the project they wish to work on (in three pages or less), give a proposed budget, and describe how they will evaluate the success of the project in meeting its goals. Upon completion of the project, leaders submit a final report, summarizing the project outcome, the number of female participants, and the results of the evaluation. Project leaders maintain a web page, which is updated as the project progresses.

Project proposals are reviewed by the Jade NSERC/General Motors Canada Chair (Anne Condon) and the Jade Project Coordinator (Michele Ng). Often, an email exchange with applicants helps clarify details or guide efforts before final decisions are made.

Scope of Projects: Since 2005, 31 projects have received funding. A total of 530 girls were reached through the 2005 and 2006 projects (figures on the number of girls served in the 2007 projects are not yet available). Feedback from participating students, both in the form of surveys and student testimonials, was overwhelmingly positive.

Examples of some of these projects are included here. The **Jade Bridges Workshop at UBC Okanagan** provided women interested in science careers the opportunity to meet female scientists and to learn more about effective communication skills. The **Women in Engineering Program at UBC** seeks to build student networks of women in engineering, together with industry and professional partners. Sponsored by UBC's Department of Biological and Chemical Engineering, the **Sustainability, Science and Engineering North of 60°** initiative in the Yukon encourages girls to become involved in science careers, particularly as they pertain to sustainability, environmental engineering, and sanitation technology for remote communities. Co-sponsored by SFU and SCWIST, the 4-part workshop series **Tools for Transition: Navigating Change and Making Life-Shaping Decisions** offers graduate students and post-docs in science and applied science at SFU and UBC the opportunity to map key events in their careers, learn to make decisions during transitions, clarify values and envision a future career path. The **Chictech** program, which began at SFU in 2005 and was then run simultaneously at SFU, Capilano College and Langara College in 2006, helped teams of 9th and 10th grade girls compete with each other to design web sites for non-profit organizations, expanding the girls' computer science skills and benefiting community organizations. "One time only" events include **funding for the keynote speaker at the 2005 Canadian Association of Physicists Annual Conference.** The keynote speaker raised awareness of the contributions of women and was a guest of honour at a networking event for women.

Three additional projects are described in more detail in the accompanying boxes. The Kwantlen University College project illustrates the creative ways in which an extremely busy faculty member and chair of a department at a small institution can carve out a program that combines student education and outreach in a sustainable way. The Robotics Summer Camps project illustrates how people from different institutions can work together to develop materials and acquire valuable expertise on ways to excite girls about robotics. The Women in Engineering Physics program shows how developing a part-time student coordinator position within a traditionally male department can sustain support structures for women in that department. Yet other projects are described in other papers of the proceedings of this conference.

Funding: The average amount per program funded was approximately $3,000, with minimum and maximum grants of roughly $1,200 and $6,000. Some initiatives have brought in significantly more funding from additional sources. Overall, institutional support (including in-kind support for space, office supplies, and some staff time) for the project between 2005 and 2007 totaled $14,940. The level of funding, together with matching funds, has been sufficient to cover the costs of space and food for an event, the cost of materials and supplies, and/or prizes for competitions. For smaller institutions with tight budgets, even this level of funding would be

impossible to generate from standard operating funds. In some cases, the funding provided a small stipend for a student who played a major role in executing the project.

Bridges Leaders Network: Biannual meetings bring project leaders together to share their collective expertise and discuss ongoing challenges that the projects pose. Jade Bridges project leaders are using the network to share their expertise and discuss lessons learned from their projects and to strengthen their commitment to the goals of recruiting and supporting women in the field. In particular, project leaders have presented and discussed good practices pertaining to

U Can Do IT (Youths Can Do Information Technology)
Organized by Andy Law, Chair of the Department of Computing Sciences and Information Systems at Kwantlen University College, Surrey, B.C.

Jointly sponsored and administered between Jade Bridges and the School of Business of Kwantlen University College, U Can Do IT is a program designed to promote the participation of high school students, particularly female students, in information technology-related careers and education. First offered in 2006, U Can Do IT was delivered as an IT knowledge competition. In the first round of the competition, third- and fourth-year Kwantlen University College IT students visited 22 high schools in Surrey, Richmond, and Langley and administered a written test on IT knowledge to more than 500 students. Test questions were designed with input from IT employers and Kwantlen University College and UBC faculty members. An e-Book containing hundreds of facts about the IT world was posted on the web so that potential contestants could study prior to the competition. Several questions highlighted women's contribution to the history of computing and women's representation in contemporary IT. One girl and one boy were selected as winners at each of the high schools and each received a small prize. These winners entered the final round competition, held online [9]. From this final round, one girl and one boy were selected as winners and awarded grand prizes.

The 2006 program proved successful as outreach, as a large proportion of the participating institutions agreed that the visits provided valuable information for their students. The inaugural year also helped establish guidelines for making the project sustainable over time. Andy Law, Kwantlen's IT department chair, integrated the program into his IT Project Management course so that Kwantlen IT students could continue to gain project management experience. He also recognized the need for making each year's "theme" appealing both to the participants and the Kwantlen students. In 2007, the theme of the program was "Digital Game for IT Learning," in which Kwantlen's IT students again visited area high schools, this time to solicit user requirements for the development of an interactive computer game. Each visit had two parts. The Kwantlen students first briefly explained the hardware and software logic behind video games, passing around an uncovered Play Station box to show its hardware components and demonstrating computer game engine programming. The Kwantlen students then delivered a knowledge competition about computer games. Four game prototypes were produced from these visits and made available in December 2007. New also in 2007 was the addition of two strategies targeted specifically to girls. Kwantlen students showed the high school classes a CISCO video in which women in IT shared their experiences in pursuing IT courses of study and careers and they presented findings from the Web about women's experiences in today's IT industry.

Eliza Kuttner Robotics Summer Camps
Organized by Yvonne Coady, UVic, Tamara Dakic, Capilano College, Paul Carter, UBC

Designed through active collaboration among the University of Victoria, Capilano College, and UBC, the Eliza Kuttner Programming Camps for Girls provided girls in grades 5-7 the opportunity to engage in hands-on work in robotics and engineering in a day camp setting. Offered at each of the collaborating institutions throughout the summer of 2006 and reaching 100 girls, the camps were designed to increase girls' participation in computer science and engineering. Program coordinators researched the best practices of existing science and engineering day camps. Using Lego Mindstorms Robots and other software systems, they developed programming tasks that a girl with no prior programming experience could reasonably complete in one day. They also developed research materials, such as profiles on female role models in science and engineering, for inclusion in a take-away package. Named in memory of Eliza Kuttner, an instructor at Capilano College who spearheaded this project, the programming camps fulfilled the several purposes of Jade Bridges: to increase participation of young women in computer science and engineering programs, to engage in a multi-institutional partnership between Capilano College, the University of Victoria and the University of British Columbia, and to develop the program in such a way that materials will be freely available to other B.C. and Yukon institutions that may wish to run local camps of their own.

Eliza Kuttner's vision continues to drive hands-on activities using robotic devices beyond Lego Mindstorms, including Pico Crickets and even general purpose design boards. Like the original offerings, these exercises are extremely well received by the students, and camps typically sell out in advance. These lines of activities stand as a cornerstone for several continuing outreach offerings to children around the province, with programs now extending to participants from a vast array of age groups and backgrounds, including youth from Aboriginal communities and girls' clubs in B.C. Program organizers have been able to upgrade equipment so that girls are able to work with the latest generation of robots. In one example of a recent activity, teams of participants successfully built their own Neptune Rover to follow a simulated track on the ocean floor and collect samples for scientific observation. Materials developed in this project have been modified and adapted by other departments at UBC for developing their own outreach projects, and thus this program marks the success of a multi-institutional endeavor to develop shared materials and best practices.

project evaluation, as well as strategies to ensure that projects continue when the initial leader moves on to new things. Materials prepared for these meetings are made available from the Jade Bridges Project website [8].

Funding for project leaders to travel to conferences and present the results of their project is also provided. A third means of support is the Jade Bridges Project Newsletter, which is published bi-annually on-line, highlighting the personal and professional successes of project leaders as well as student project participants. The newsletter also provides a means of keeping in touch with students who have participated in any Jade Bridges program. Finally, in a small number of cases, the NSERC/General Motors Canada Chair was able to support project leaders in other ways: providing letters for award nominations, advocating with department heads and faculty members

Women in Engineering Physics: Recruitment and Networking
Organized by Andre Marziali, Director, Engineering Physics, UBC and Anja Lanz, Student Representative, Engineering Physics, UBC

The Engineering Physics Women Recruitment and Network project was created in response to demand from female students in the engineering physics program at UBC. The project is intended to give female engineering physics students an opportunity to meet regularly with other female engineers and to provide mentoring and networking opportunities with engineering alumnae. Through this network and its activities, an additional aim is to increase recruitment of female students to the engineering physics program.

Targeted recruitment includes sponsoring high school females in grades 9 and 10 to attend an engineering physics information event held at UBC each fall. Support from the Jade Bridges Project enables younger female students to attend this event, exposing them to potential career paths before they make decisions about elective courses in high school that may limit their choices in university.

Once in the engineering physics department, many women find networking and social interaction with other female students difficult due to the substantial dilution of women in the student population (engineering physics has the lowest female enrollment of any of the scientific departments at UBC). To address this and other issues, the project created a female student representative position. The representative serves many vital roles. She maintains ongoing contact with other engineering women organizations on and off campus such as Women in Engineering at UBC (WIE/UBC), DAWEG, and SCWIST and can inform students of upcoming events sponsored through those organizations. Via email, she connects current students with alumnae of the program and draws on those alumnae to serve as mentors and to participate in networking events. She also reaches out to potential female recruits to the department and assists them in establishing relationships with current students.

In addition to providing ongoing mentoring and networking opportunities for students, the program also financially assists students who wish to participate in other engineering women events such as conferences and networking events.

to ensure that faculty who were leading significant projects got some relief from other duties, and encouraging faculty members to provide advice and support for students leading projects.

4. Perspective

The strong participation by people in a broad range of institutions in the Jade Bridges Project and in the network affirms that this type of initiative does fill a real need in the B.C. and the Yukon region. The project has brought together an incredibly talented team of women and men who have developed high-quality, creative projects. Some of these leaders have also catalyzed other initiatives at their institutions, although the credit for these lies solely with the project leaders who have shaped them. In the rest of this section, we provide some perspective first on the value

of the project leaders' network, and second on the degree to which institutional engagement, beyond that of the leaders, has been achieved.

4.1 Jade Bridges Leaders Meetings

Experiences at Jade Bridges meetings have provided ongoing insight as to why the network is so useful. At one meeting, a discussion about the merits of running women-only programs ensued, with participants discussing the challenges of defending such programs. One participant noted that her children have asked her why Mother's Day and Father's Day are holidays but no "children-only" holidays are celebrated. Her time-honoured response is that "every day is Children's Day," and the point was made that every day in a typical engineering program is "Men's Day" in that men dominate the environment and set the tone for interactions. The need for forums that allow women to share and compare experiences and identify common concerns is thus of paramount importance. This discussion also underscored the importance of support from department heads or administrative leaders: their visible expression of support sends a strong message to department members that efforts to create a positive climate for women are important, reducing possible discomfort with a targeted program. Interestingly, some project leaders themselves also voice reservations about women-only programs, giving the lie to the notion that women speak with one voice on this (or any) issue. Discussions on such topics help participants deepen their understanding of the ways in which the structural components of an initiative influence its effectiveness, and they sharpen participants' abilities to articulate the rationale for their own program designs.

4.2 Perspectives of Project Leaders on Experiences with Jade Bridges

A survey was used to assess the level of satisfaction of Jade Bridges leaders with their projects and with the leaders network. An invitation to participate was emailed to 29 project coordinators in February 2008, with 19 coordinators completing the survey by the deadline. Of these, 13 identified as faculty members and six as students; 15 identified as female and four as male.

Overall, questions about the value of the Jade Bridges Projects to their respective project coordinators yielded positive responses. As Table 1 below shows, the first four survey questions, discounting those few respondents who replied "not applicable," netted a 100% positive response. Other responses to questions were similarly positive. When coordinators were asked if participation in Jade Bridges activities had provided a renewed sense of importance in their own work, careers, or field, 88% said that it had. Fifty-two percent of respondents disagreed that Jade Bridges activities had been more time-consuming than anticipated, while a full 84% disagreed with the statement that participation had compromised the quality of other work, such as classes, teaching, or research. Fully 95% agreed that their participation had led them to better understand the issues for women in their field. Interestingly, while just 63% agreed with the statement that participation would allow them to better influence their department/unit, a full 89% stated that participation made them more confident in their ability to lead. These numbers allow us more than a guarded measure of hope for the future of these projects in positively influencing the culture of their respective science and engineering departments.

Substantive comments provided by project coordinators yielded a trove of information and ranged from thoughts on the value of individual projects to advice for improving projects in the future and reflections on general strategies for improving the recruitment and retention of women in coordinators' own departments. Many respondents spoke positively of the Jade Bridges Project Leaders' meetings they had attended, finding great value in sharing ideas and supporting each other's vision. Those who had attended one or no meetings reflected that they had missed out on the opportunity and hoped that they would be able to attend in the future. Several respondents spoke of time commitments and the difficulty of balancing teaching duties with meeting attendance.

Table 1 Summary of Project Coordinators' Responses to Survey Questions

Statement	**Agree**	**Disagree**	**NA**
For me, meetings of Jade Bridges Project Leaders have been valuable for networking.	14	0	5
For me, meetings of Jade Bridges Project Leaders have been valuable for information sharing.	14	0	5
For me, participation in Jade Bridges activities has provided personal reward in supporting the next generation.	17	0	2
For me, participation in Jade Bridges activities has provided personal contact with girls or women.	19	0	0
For me, participation in Jade Bridges activities has provided renewed sense of importance of my own work/my career/ my field.	16	2	1
For me, Jade Bridges activities have been more time consuming than expected.	9	10	0
For me, Jade Bridges activities have compromised the quality of other work (classes, teaching, research, etc.).	3	16	0
I felt supported by the head of my department, or authorized departmental representative for my project, for my work on the project.	18	1	0
The head of my department, or authorized departmental representative for my project, valued the project.	18	1	0
As a result of participating in Jade Bridges, I better understand the issues for women in my field.	18	1	0
As a result of participating in Jade Bridges, I am better able to influence my department/unit.	12	7	0
As a result of participating in Jade Bridges, I am more confident in my ability to lead.	16	2	1
For my work on Jade Bridges, I obtained some reduction in other service duties to my department or received a stipend.	1	18	0
I would be interested in sharing my expertise at workshops or in written materials, with department heads and other institutional leaders.	16	3	0

Several ideas were floated regarding effective communication with participants outside of meetings. One respondent wondered about the possibility of a dedicated "communications support" person to alert members to upcoming events, while another suggested writing up a list of ongoing projects, together with tips and advice, to distribute to members unable to attend. To keep abreast of current literature on women and science, one respondent suggested a library of research papers that could be distributed to undergraduate and graduate students. From these comments we believe we could be supporting the community more effectively between meetings by using electronic resources to connect members with each other and with ongoing research, and we plan to follow up on these suggestions.

To augment the program's strengths, the suggestion was made to have meetings combined with a field trip and to have more regular ongoing mentoring meetings between students and scientists and engineers in their fields. Some respondents noted that efforts should be made to increase the visibility of Jade Bridges. Two respondents suggested developing some form of printed matter, such as a brochure or bookmark, that could be distributed to high school students and draw their attention to the program.

Despite the positive evaluations of institutional support received from their departments, a number of respondents noted that the future of their projects is highly dependent on instituting key changes within their department. One coordinator put it this way: "The main issue at this point is institutional support: I either need my institution to take over my project or to give me time release in order for me to continue improving the project and to continue putting it on. Through the Jade Project Leaders meeting I found out that I should have been working toward operationalizing my program right from the start (good advice!), but I didn't receive that message until I was three years into the project and losing energy." Another respondent was equally candid in her assessment of how projects could best be leveraged in the future: "In my experience, an effective way in which the Jade Project could assist in supporting women and in building institutional commitment to such goals would be to support people already committed to such goals to achieve key roles in their respective institutions." Ways in which the NSERC/General Motors Canada Chair can help facilitate such institutional support at additional institutions should be explored.

4.3 Engagement of Departments/Units/Institutions

From the start, the NSERC/General Motors Canada Chair believed that an ongoing challenge would be to see individual projects adopted by and integrated into academic departments, with continuing solid support from department heads and deans. Garnering this support would ensure that the projects will survive after Jade funding has ended. There was no expectation set initially for project leaders that they work out a longer-term plan. Nevertheless, a small number of prescient project leaders were able to build institutional support for their projects. For example, projects in engineering at UBC, led by Elizabeth Croft, have evolved into a suite of programs coordinated by a paid staff person (Erin Biddlecombe). The NSERC/General Motors Canada Chair may be able to build on examples like this to encourage adoption at other institutions.

To further assess institutional support, we surveyed the 29 Jade Bridges project coordinators.

When asked about institutional support for their efforts, their responses ranged from positive to highly positive. For example, 95% of coordinators felt their project work had the support of either the department head or authorized departmental representative and 95% felt that the department head or authorized representative valued the project itself. However, just 1 respondent received a reduction in duties or received a stipend for work performed in the service of the project.

We also surveyed the 17 departmental representatives who signed project proposals to indicate their institution's commitment. Though just six representatives responded, their responses were largely positive. When departmental representatives were asked, for example, if targeted outreach to female K-12 students is part of their unit's mission and if that outreach is successful, a clear majority responded affirmatively. As a group they were divided on whether their unit's strategies for K-12 outreach is informed by the literature on what works for girls. Fully 100% of respondents agreed with the statement that "targeted recruitment and/or support of female students is part of the mission of my unit," though respondents seemed less sure about their unit's ability to recruit and support female students and, as with their responses to the K-12 cohort, they were equally divided on whether their unit's recruitment and retention strategies were informed by the literature on what works for women.

More positively, respondents were largely in agreement with the statement that they are "comfortable/confident when I speak about issues pertaining to recruitment or retention of women in my unit," and 100% of them agreed with the statement "I know who to contact to get statistics on participation of female undergraduates and graduate students in my unit." On the issue of whether they know who to contact for national/North American statistics on participation of female undergraduates and graduate students in their fields, four respondents responded positively and two responded negatively. Four of six respondents have requested and/or read statistics on women in their unit within the last six months, and five respondents have shared statistics on women in their units with their faculty within the last six months.

Fifty percent of respondents have personally attended Jade Bridges activities, and their observations at these events are illuminating. Two respondents enjoyed the events and the energy of the project leaders. One respondent had an eye-opening experience: "I was at first shocked by how little the students seem to have thought about anything beyond 'getting into university'…the details about what fields they might pursue seemed largely irrelevant. I was also quite shocked by accompanying teachers and principals who basically told me that any recruitment of high school females had to appeal to their preoccupation with what was considered fashionable, and 'in.' One principal actually told me that if would help if our female presenters wore makeup (I think she was serious)."

For the following statements, respondents were largely positive: "The project was successful in achieving its goals" (83% affirmative); "Experience with the project has enhanced my unit's commitment to organize outreach events or provide support structures for women" (100% affirmative); and "Experience with the project has increased understanding within my unit on how to effectively organize outreach events or provide support structures for women" (83% affirmative).

Just one of six respondents was committed to the support of their project coordinators through a reduction in service duties or through offering a stipend. Half of the respondents mentored their coordinators, while 80% were able to show their unit's appreciation to the coordinators through some kind of public event or award. Half of all respondents were shown a summary/evaluation upon the project's completion. Fully 100% are either very interested or interested in learning more about statistics on the participation of women in their field, what works to interest K-12 girls in science and engineering, what works in recruiting and retaining female students in their units, how to support members of their unit who work on outreach, recruitment, or retention of women, and funding opportunities for programs targeted at women. Four of six respondents said they already participate in forums to address these topics of interest. 100% of respondents noted that dedicated workshops are the most effective forum, while just half feel that pointers to articles or web resources are effective, and only one respondent believed that regional, national, or international conferences are effective venues for addressing these issues. Three of four respondents noted that events they already attend, such as heads' retreats, are an effective venue.

In all, these responses suggest that while some institutions are engaged, we clearly have work to do to reach more departmental representatives and to more fully engage them if the projects are to succeed in the long term. In doing so it may be instructive to keep in mind the thoughts of one department representative: "It is of critical importance for us to make very clear that this is not an issue that involves competition between individual universities—it is an issue of national importance and we need to ensure we have government and industry support as we try to move ahead."

4.4 Conclusions and Future Outlook

Overall, we believe that the Jade Bridges Project has been successful in its goal of supporting individuals in the B.C. and the Yukon region who are playing leadership roles in supporting girls and women to pursue careers in the physical sciences and engineering. Project leaders' thoughts about their projects are overwhelmingly positive. They find their projects personally and professionally rewarding. They feel a greater ability to lead and to enact change within their own departments and they generally feel supported within their departments. Even when there is a lack of institutional support, they continue to feel excitement about the larger goal of supporting girls and women: "We all do these activities because we believe things need to change for the next generation of young women, and the thanks and feedback we get from the young women participants is the big reward." The network has also been successful in fostering communication among members of diverse institution types in the B.C. and the Yukon region, and the opportunity to get to know people in other institutions has certainly been a valuable and rewarding aspect of the network.

Jade Bridges could certainly strengthen its support of project leaders. One mechanism for this, as indicated by survey comments, would be to improve communications between meetings, for example, to provide information about events, or pointers to new articles or resources on topics pertaining to women in science and engineering. This type of support is certainly feasible, and we expect to act on this in the near future.

We also believe that the talent, experience, and commitment of the Jade Bridges project leaders is a significant asset for our region. We hope that many of these leaders will continue to stay involved as we address the continuing challenges of fostering broader and deeper institutional engagement in advancing the participation and success of women in science and engineering. Despite the modest feedback supplied by department representatives to the Jade Bridges survey, we have seen positive trends with respect to the institutionalization of some Jade Bridges projects, thanks to the initiatives of project leaders. An important next step would be to have a dialogue with a larger group of department heads and deans, which can shape our directions in the future.

One concern for the future is that the term of the current NSERC/General Motors Canada Chair will end in April 2009. It is possible that the current initiative could form the basis for a similar or new initiative of a future chair. However, there is no built-in mechanism for project continuity across chair terms (and it's not clear how desirable such a mechanism would be). Alternatively, it is possible that a network of academic leaders who are working on the advancement of women in science and engineering could be sustained by a partnership among institutions in the B.C. and the Yukon region. Indeed, there could be many advantages to a model in which the network reports directly to administrative heads of institutions in the region. Input from department heads and deans could play a more significant role in shaping future initiatives of the network, and institutions could share data on recruitment and retention of students in their programs. However, such a model does suffer from the disadvantage that there currently is no regional network of administrative heads of science and engineering departments; rather, such networks tend to be organized nationally by discipline. Still, in light of the evident value of a regional network for project leaders, we believe that a regional approach has real merit. We recommend that a regional network of administrative heads be created as a first step, and from there, a natural second step would be the creation of a network of academic leaders who can focus on the advancement of women.

Finally, we note that many other individuals and groups not affiliated with the Jade Bridges network are working successfully on the issues. Future incarnations of the current network should be informed by their input as well. Other organizations that may be able to provide support include the regional NSERC office, which is already facilitating networking among leaders of science and engineering outreach programs, professional organizations such as SCWIST or DAWEG, and industry partners.

References

1. CCWESTT, Women in SETT, Quick Stats, "Women in the Labour Force," http://www.ccwestt.org/Statistics/tabid/59/Default.aspx

2. Almanac of Post-Secondary Education, Canadian Association of University Teachers (CAUT), 2007. http://www.caut.ca/pages.asp?page=442

3. Research report, Centre for Families, Work and Well-being, University of Guelph and available from the Centre at cfww@uoguelph.ca.

4. Women's University Enrolments Trends by Level of Study and Discipline, 1992-2003, Canadian Association of University Teachers (CAUT), March 2008.
http://www.caut.ca/uploads/EquityReview3-en.pdf

5. Women in Engineering and Computer Science. http://wecs.uvic.ca/

6. WICS@SFU. http://wics.cs.sfu.ca/

7. UBC Tri-mentoring programs. http://www.careers.ubc.ca/mentoring.cfm?page=programs

8. The Jade Project Bridges Program. http://www.jadeproject.ca/bridges.html

9. "U Can Do IT: Youths Can Do Information Technology." http://www.ucandoinfotech.com

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