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Project: On Solid Ground: Building the Foundation for Women Faculty and Students in Math and Science

Project Dates: April, 2010-August 1, 2011

Amount Awarded: \$7490

The goals of this proposal were (1) to create a parallel Women in Math and Science (WIMS) initiative at W&L, (2) to grow and develop the UR Women in Math and Science (WIMS) initiative, (3) to create meaningful dialogues and e-dialogues with other ACS institutions interested in advancing women in math and science on a collective level, (4) to contribute a session on Women in Math and Science to the ninth biennial 2011 ACS Gender Studies/Women's Studies Conference to be hosted at UR, and (5) to present these ideas in larger academic circles. Our goals and objectives remained consistent with our proposed aims.

The Women in Math and Science initiative continued at UR, hosting three "larger" events and weekly smaller venues. The larger events featured day-long visits to campus by Dr. Persis Drell, Deputy Director of Stanford Linear Accelerator Center and one of America's "Top 50 Women in Science," Stereotype expert Dr. Jennifer Steele, and Dr. Magdolna Hargittai, a Hungarian research professor at the Budapest University of Technology and Economics and a full member of the Hungarian Academy of Science. Sara Sprenkle and Katherine Crowley launched their parallel WIMS initiative at Washington and Lee (W&L) that featured, among other activities, a day-long visit with Dr. Jan Cuny, Computer Scientist and NSF Program Officer, and a presentation of the play "Truth Values." Their initial work has now helped spawn a Women in Science Speaker Series (see below). Most of the dialogue we created occurred between W&L and UR. Faculty and students from UR and W&L contributed a *session* (not just a single talk) to the ninth biennial 2011 ACS Gender Studies/Women's Studies Conference. In addition to the ACS Gender Studies/Women's Studies Conference, Della Fenster presented research that grew out of this work at the 5th Joint Meeting of the Canadian Society for History and Philosophy of Mathematics and British Society for the History of Mathematics in Dublin, Ireland in July, 2011. Her talk "Expect the Unexpected: Pioneers who Promoted Women in Math and Science" explored the lives of Caroline Fuld and Clare Booth Luce and their significant contributions for women in math and science.

Our celebrated speakers inspired interaction and conversation among a broader group of students and faculty. Dr. Persis Drell, one of America's "Top 50 Women in Science" gave a general talk on "What We Know---and What We Don't Know---about the Night Sky" where she presented sophisticated Physics in colloquial terms and attracted more than 130 students and faculty. Her brilliance in the Q & A session made a permanent impression on our students and faculty. In that fifteen minutes, she fielded questions ranging from "Does God exist" to very specific queries about the superconductor at SLAC. Her interactions with students and faculty throughout the day during meals and classroom opportunities inspired meaningful conversations. The lunch with women faculty at UR was particularly influential since Dr. Drell drew from her administrative position as Director of Stanford Linear Accelerator Center to offer advice as we move forward with a new Dean in the next academic year. Stereotype Threat expert Dr. Jennifer Steele drew 120 students and faculty to her talk and raised awareness about issues facing women in math and science. One compelling take-away point that has stayed with us: "If there is only one woman in the room then gender is an issue." WIMS joined with the Chemistry department to feature Dr. Magdolna Hargittai, a Hungarian research professor at the Budapest University of Technology and Economics and a full member of the Hungarian Academy of Science. Dr. Hargittai met with women faculty and students and offered a Chemistry Seminar on "Inorganic Structural Diversity" during her stay. Her strong interest in the (historic

and contemporary) role of women in science informed her comments and offered new insights to our students and colleagues. Our Washington & Lee colleagues joined us for many of these events and hosted their own opportunities on their campus.

In the inaugural year of WIMS at W&L, Katherine Crowley and Sara Sprenkle grew their initiative to include a general interest group that consisted of 22 undergraduate women students, 18 women faculty, the provost, and 1 career services employee. The 18 faculty included women from all of Washington and Lee's science departments (biology, chemistry, geology, physics/engineering, mathematics, computer science, and psychology) as well as the departments of teacher education and women's and gender studies.

At W&L, Crowley and Sprenkle introduced WIMS with a kickoff event in September. They invited interested women faculty and students to meet for dinner at a local college restaurant hangout for dinner. Seventeen students and seven faculty attended. Conversation centered on science classes, with upper-class students candidly discussing how they had chosen their particular science majors. Students who had not yet declared majors asked questions of those further along in their academic pursuits. **Throughout the dinner, students identified strongly with science rather than other university topics or social events.** Students and faculty alike expressed excitement for a group focused on building a community of women scientists on campus.

We had hoped to broadcast in real time Jennifer Steele's talk at UR for our audience at W&L. Because of challenges associated with merging the technology capabilities of the two schools, we showed a recorded video of the talk instead. About 20 students and faculty attended, including one male spouse of a W&L faculty member, and one male student. We supplemented the talk with an ice cream social beforehand to encourage people to interact and invited our associate professor psychology colleague, Julie Woodzicka, to lead a post-talk discussion. Julie researches issues of stereotyping, prejudice, and discrimination and was able to answer several questions from students related to stereotype threat that arose in the talk.

In March, Jan Cuny, a program officer of the National Science Foundation's Education Workforce Cluster, gave the talk "Broadening Participation in Computing: Engagement, Education, Research, and Policy" to forty students and faculty. We recorded the talk in order to share it with UR and students who could not attend the talk. Before the talk, we had a reception where men and women students and faculty interacted with Jan. After the talk, seven women faculty from different science departments and the Teacher Education department met Jan for dinner at a local restaurant. Student reactions to Jan's talk were extremely positive. Several students expressed new interest in computer science even before leaving the room. Many students stayed to talk with Jan on a variety of computer science and career-related topics, and later, some students asked for the online link to view the talk after hearing they had missed a great opportunity. Faculty comments were equally positive, though more focused on the invigorating post-talk dinner discussion. **In particular, they noted that women science faculty rarely find good reasons to come together, and that this dinner was a reminder to everyone that getting together to discuss important issues was worth doing more often.**

WIMS joined together with other W&L groups to host the play, "Truth Values: One Girl's Romp Through MIT's Male Math Maze." WIMS students helped publicize the show and distribute tickets before they attended the sellout performance in W&L's 440-seat theater. The play was extremely well-attended by W&L faculty in general, including WIMS-related faculty. Seven men and women mathematics graduate students from the University of Virginia also attended the play, along with several math and science faculty (primarily men) from the Virginia Military Institute and other employees from VMI, and a few faculty members from Hollins University and Sweet Briar College. We advertised heavily within the larger Lexington community with positive results; the audience included people of all ages from the community. This play makes full comedic use of the awkward encounters the main protagonist faced as a woman in the MIT math department. Far more importantly, this performance takes a serious look at the role of women in science, written in part as a response to Larry Summers's 2005 comments about women in science.

The talk-back session with the writer/performer and tech crew after "Truth Values" was well-attended by both women and men professors who identified with various aspects of the play, especially barriers to success for themselves or women they knew in graduate school. This conversation continued over the **next several weeks** at W&L as faculty continued to share memories the play had triggered. The context was invariably productive and focused on how to address similar issues relevant to students today.

The capstone of the W&L experience was Della Fenster's visit in May, 2011. Della presented "Expect the Unexpected: Pioneers Who Promoted Women in Math and Science." Before the talk, Della met with women science faculty for lunch, where we compared university and science cultures between our schools and discussed upcoming talks of interest to women in science. One male student also attended the lunch, and he and Della discussed a wide range of topics including **the relevance of male voices in the discussion on women in science**. This talk served to broaden several students' understanding of the range of possibilities within science, having not previously heard from a math historian whose work is rooted in understanding the mathematics behind the story.

In terms of assessment and/or evaluation, at UR, Della collected written responses to the talks by Dr. Persis Drell, Dr. Jennifer Steele and Dr. Magdolna Hargittai. In the case of Persis Drell, the students were most impressed with her career trajectory from a graduate student to a Physics Professor at Cornell to the first woman Director of a National Science Laboratory. Students also appreciated her broad approach to academics, in particular, her emphasis on travel. Students and faculty were especially encouraged by her admonition to work for change. In the case of Jennifer Steele, hands down, the students were outraged by the story of the Physicist who, as a woman undergraduate at MIT, was overlooked for a scholarship because of her gender and, then, after a sex change operation, was catapulted to fame as a male graduate student. For Dr. Magdolna Hargittai, students and faculty were astonished to learn women face similar issues in countries seemingly as dissimilar as Hungary.

At W&L, Sara collected written responses to "Truth Values." Katherine reserved time in two classes where most students had seen the play to hear reactions and allow students to debate questions that arose. We also received some unsolicited feedback in class and via email after various WIMS events.

The written responses Sara collected had three common themes. First, students were left wanting to know more about the details of the woman performer's real-life decision to leave mathematics and pursue a career in theater. The play deliberately leaves open the question of whether that was the best happiest ending, and the students responded strongly to the challenge of wrestling with that question. Second, students were shocked by the sexism in the play and the emotion that elicited among audience members. They commented specifically on their own emotions as well as those they observed in their professors. Finally, students were particularly responsive about how *one* woman played the role of about *thirty* different characters. They were especially impressed with how a single protagonist performed "with great confidence and talent" and kept the audience laughing while addressing serious issues.

In Katherine's class, students wanted to know whether the sexism depicted in the play was outdated (the performer had been a graduate student in the late 1980s) or whether it was still relevant. They asked whether the conditions were specific to MIT, or whether they existed in all graduate programs in math and science. They debated whether the ending was fulfilling or depressing. They were extremely upset about the fact that the protagonist solved a math problem her thesis adviser at MIT had not been able to solve and was then awarded a Master's degree rather than a Ph.D. Several students in class were in the process of choosing graduate schools in science, and we discussed the importance of making wise choices about your working environment.

From the male student who talked with Della at lunch: "...thank you for encouraging me to see Dr. Fenster's talk and having lunch with her. She has a very warm personality and I thoroughly enjoyed meeting her and talking to her. I plan on participating in and supporting WIMS in the future."

From the Teacher Education professor after the dinner that followed Jan Cuny's talk: "Thank you again for including me. It was really a treat to get to know other women professors a bit better."

If we were to redesign our project, we would include more faculty and students (women **and** men) in the project at UR. We put “and” in bold for a reason. We are just beginning to understand that women **and** men faculty and students play a critical role in building an environment where all students have the same access to science careers. W&L has achieved greater success in this area and we hope to learn from their experience.

It was more difficult to merge UR and W&L events than we had anticipated, mainly because of very tightly scheduled students who did not have the flexibility to travel during the week. However, our successful presentation using Skype was encouraging, and we plan to utilize Skype and other videoconferencing technologies to increase the number of interactions between our two groups.

In terms of impact, as outlined above, this work served as a catalyst for faculty at both UR and W&L by creating opportunities for faculty to connect with one another and/or with students to discuss issues related to women in math and science. More often than not, those discussions proved to serve as *beginnings* of conversations that continued on and across our campuses.

Two words capture the main impact of this initiative on both campuses: **education** and **awareness**. Students and colleagues became educated on and aware of issues related to women in mathematics and science. In most cases, this impact was achieved through the lens of women scientists talking about their scientific research and their individual paths to success in the sciences.

Students and faculty continue to be excited about WIMS at W&L. Inspired in part by WIMS events, our geology colleague, Dr. Lisa Greer, started a “Women in Science” speaker series for next year that will include lectures by Naomi Oreskes and Sylvia Earle.

In many ways, students were---and are---the primary beneficiaries of this initiative. They learned critical issues facing women in science and math. They heard woman after woman describe various obstacles they faced---and conquered. They also extended their network of associates in the scientific community. Three students also presented a talk on their WIMS experience at the ninth biennial 2011 ACS Gender Studies/Women’s Studies Conference. They wrote an abstract, put together ideas, and delivered a talk titled “The Genesis of Women in Math and Science,” a process that will benefit them as they move forward in their individual careers. Della Fenster, Katherine Crowley and Sara Sprenkle particularly enjoyed working together and **drawing encouragement for our individual pursuits from the collective enterprise of working for and with women in math and science.**

In terms of dissemination, we have shared our results and insights at the ninth biennial 2011 ACS Gender Studies/Women’s Studies Conference and the 5th Joint Meeting of the Canadian Society for History and Philosophy of Mathematics and British Society for the History of Mathematics. We have also established a relationship with faculty and students at Virginia Union University, a historically black school in Richmond, Virginia.

A publication based on the research presented at the 5th Joint Meeting of the Canadian Society for History and Philosophy of Mathematics and British Society for the History of Mathematics will be prepared for publication.

Our next steps include continuing with (almost) weekly opportunities that bring together students and faculty interested in issues related to women in mathematics and science. Consistency seems to build community. At the end of the 2011-2012 academic year, we will have an opportunity to survey seniors who have been a part of this initiative for three years. We hope to use the results of that survey and/or evaluation to inform our plans as we move forward with this initiative.

Financial statement:

Original Budget:

Brief Summary

For our project, “On Solid Ground: Building the Foundation for Women Faculty and Students in Math and Science,” five faculty from the University of Richmond and Washington and Lee University worked together to continue (at UR) and launch (at W&L) Women in Math and Science initiatives. Through (mostly) weekly speakers, day-long-visits from high profile women in math and science that featured public talks and informal conversations with students and faculty, a “sold-out” presentation of a play that depicted life as a woman graduate student in mathematics at MIT and the opportunity to disseminate our ideas at home and abroad, we became acquainted with the collective and individual issues women in math and science have faced, and continue to face, as they pursue careers in their respective fields.