Creating a Diversity Education and Engagement Laboratory (DEEL) for the Computational Geosciences: Final Report

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This document constitutes the final report to the NCAR Directorate by the Principle Investigator for the NCAR Diversity Project entitled “Creating a Diversity Education and Engagement Laboratory (DEEL) for the Computational Sciences.” I am happy to report, and hope to demonstrate in the pages that follow, that, although the project took some unexpected directions during its course, the overall impact of the DEEL proposal within CISL and the university community has been substantial and positive.

The original project proposal stated that:

“…we propose to leverage our new Diversity Coordinator’s unique skills in education research, her passion for diversity, and her outreach and networking efforts as Diversity Coordinator in FY13, to create, within CISL, a Diversity Education, and Engagement Laboratory (DEEL) in the computational geosciences. In a nutshell DEEL concept is to introduce an education research component into CISL’s diversity engagement and education efforts, thus positioning our organization as an education and engagement “laboratory”, i.e. a place for developing, testing, and measuring the efficacy of novel ideas in diversity engagement and education.”

The proposal went on to outline several planned approaches to realizing the DEEL vision. These included:

1) Provide half-time support of Stephanie Barr for an additional year beyond her appointment term date in 2013.
2) Stephanie would return to graduate school while continuing to work half-time at NCAR as Diversity Coordinator through FY14 to develop the DEEL concept.
3) Her graduate research would be aligned with her Diversity Coordinator role in CISL, and this would stimulate grant writing (presumably with her advisor) and more systematic assessment activities within CISL’s E&O activities.
4) We would accelerate and focus the building of the collaborative network necessary to support the DEEL vision through a Diversity in the Geosciences Workshop in FY14.
Upon award by the NCAR Diversity Committee, Stephanie Barr was extended a full year until August 2014, but she subsequently decided not to enroll in the graduate school at the University of Colorado at Boulder (CU) as the DEEL proposal envisioned. This decision on her part was taken for several reasons: increasing interest in the impactful activities she was engaged in her CISL position and a mismatch between her research interests and those of the potential advisors in the CU Boulder School of Education and Human Development. The project therefore regrouped around this fact and CISL budgeted additional CISL funds to retain Stephanie as a full time employee throughout the year. This changed the education research components of the proposal, but also opened up time for new areas of related activities. Documented below are the DEEL-related efforts in 2014 that the Diversity Coordinator engaged in, including externships and internship initiative from the CISL FY14 NCAR Diversity award, diversity outreach work, with a highlight of the very successful diversity program at the Software Engineering Assembly (SEA) Workshop. Perhaps most significantly, the DEEL project planned and hosted the Diversity in the Computational Geosciences (DCG) workshop as promised in June of 2014. The interactions and activities of the DCG workshop are described below. The ideas, sense of community, and personal relationships established at this meeting must be considered one of the most significant accomplishments of the project.

**DEEL accomplishment: DCG Workshop**

The project organized and hosted the first Workshop on Diversity in the Computational Geosciences (DCG) on 23–25 June 2014. This workshop was created to develop and sustain a robust national community dedicated to broadening participation in 21st century geoscience. The DCG workshop brought together 30 diversity leaders from 21 different U.S. research universities and national laboratories. The workshop’s organizing committee was led by Stephanie A. Barr (CISL Diversity Coordinator at NCAR), and included Dr. Richard D. Loft (CISL Director of Technology Development and Outreach at NCAR), Kristin Mooney (CISL Outreach Specialist), Dr. Shela Aboud (Senior Research Scientist at Stanford University), Dr. Denise Barnes (National Science Foundation (NSF) Section Head for Experimental Program to Stimulate Competitive Research (EPSCoR)), and Dr. Linda Hayden (Professor of Computer Science at Elizabeth City State University). Presenting keynote addresses were Dr. Diane A. Baxter, Associate Director for Education at the San Diego Supercomputer Center (SDSC), and Dr. Juan E. Gilbert, Associate Chair of Research in the Computer and Information Science and Engineering Department at the University of Florida and head of the Human-Centered Computing Lab. A second NSF contributor was Marilyn J. Suiter, a program director in the Education and Human Resources Directorate.
Many of the contributors to the Workshop on Diversity in the Computational Geosciences at NCAR.

DCG provided a forum and ample time for vigorous discussion and brainstorming. Diane Baxter, the first keynote speaker tackled a key question on the first day: “Why connect diversity with computational geosciences?” She pointed out that underrepresented groups are increasingly motivated to participate because climate change is disproportionately affecting socioeconomically vulnerable populations that are currently underrepresented in the geosciences. Second, computational science is thought to have a “democratizing” influence by lowering the barriers to access to information and enabling entrepreneurship, for example. In another discussion, workshop participants discussed Dr. Warren Washington’s suggestion of forming a Society of Computational Geoscientists with a core purpose of “Engaging and empowering all people and communities to thrive through intercultural and interdisciplinary partnerships amid the complex challenges of a changing planet.” The participants distilled this society’s role into two statements: “To bring opportunities” and “To provide a legacy of embetterment.”

In plenary sessions and breakout groups, the participants drew on their personal and professional experiences to illustrate the principle that people having diverse world-views enrich the quality of research in the computational geosciences. For instance, Dr. Juan Gilbert from the University of Florida described how computer science students were motivated to develop a workable electronic voting machine. He described the barriers he encountered to funding the project via grant proposals, the technical challenges the project faced, how it ultimately was successful in changing how people
vote in the United States, and how a project with real societal impact motivated students to excel in computer science.

Juan Gilbert's keynote address provided numerous case studies illustrating how the University of Florida's Human-Experience Research Lab produced impactful results for its clients and the participating students.

In other breakout sessions at the DCG workshop participants began identifying barriers to success, remembering the past and looking to the future. Several proposals for tackling the daunting challenge of awakening, developing, motivating, and sustaining the STEM (Science, Technology Engineering, and Mathematics) talent of all U.S. citizens from all backgrounds were actively discussed.

Workshop participants will be working to produce a report summarizing the shared vision, knowledge, and experiences of the participants and that helps define the research, curricula, and best practices needed to increase the diversity of the geosciences. This report will then be distributed to relevant NSF Directorates, Programs, and Offices to inform and influence NSF policy. The report will also explain and disseminate best practices to the research community. Producing the report has been delayed by an unfortunate extended absence of the Diversity Coordinator during the fall of this year.
Diane Baxter’s keynote presentation offered many insights into motivating new people to pursue careers in the computational geosciences. “People are more likely to invest their time and talent when they have a personal reason to engage and they see that their input is critical to a solution. The challenge and the opportunity for us is to help students see that the real question is not why they should participate, but how they could possibly NOT participate.”

**DEEL engagement at the Software Engineering Assembly (SEA)**

During the DEEL period of performance, the CISL Diversity Coordinator had a key role in advertising funding opportunities that allow students, staff, and faculty to attend conferences and training events. The SEA Conference and Scalable Profiler Workshop is an annual technical conference that convenes at UCAR’s Center Green campus in Boulder, Colorado, and the 2014 event was held on 1-5 April. Continuing a practice inaugurated last year, Stephanie recruited interested students at qualifying Minority-Serving Institutions (MSIs) and EPSCoR-state universities to attend the SEA Workshop, and some were offered travel scholarships that paid their registration fee and travel expenses through CISL’s Research and Supercomputing Visitor Program.
Using new connections made in recent months, she enrolled 10 students from four institutions -- Universidad del Turabo in Puerto Rico, Salish Kootenai College, Elizabeth City State University, and Prairie View A&M University -- to participate in the conference. The meeting offered hands-on computing tutorials and opportunities for students to meet and make connections with professionals in attendance. In addition, Stephanie coordinated and co-facilitated participation by students in internship opportunities and in an informal lunch with NCAR scientists and engineers.

Other CISL diversity outreach efforts enabled by the DEEL award

As a result of the one-year extension of the CISL Diversity Coordinator position from August 2013 to August 2014, Stephanie Barr was able to perform or contribute to the following outreach activities with cosponsored support by CISL’s Outreach Services Group:

- Rocky Mountain Advanced Computing Consortium (RMACC) High Performance Computing (HPC) Symposium (formerly Front Range Consortium for Research Computing – FRCRC). CISL supported the travel costs for Stephanie and four faculty members from Minority Serving Institutions (MSIs) to attend the August 2013 symposium in Laramie Wyoming, which led to a new collaboration between CISL and two MSIs (Hampton University and Salish-Kootenay College) that led to the creation of CISL’s Raspberry Pi Externship pilot program at NCAR.

- The Association of Computer/Information Sciences and Engineering Departments at Minority Institutions (ADMI). The CISL Diversity Coordinator
facilitated a 3-day Science Gateway workshop for ADMI Computer Science faculty and student members from eight southern MSI’s. (Aug 2013). Approximately 20 students and faculty attended the workshop led by CISL Diversity Coordinator, Stephanie Barr, and featuring Dr. Michael McLennan and colleague of Purdue University’s Rosen Center for Advanced Computing, Dr. Rion Dooley of the Texas Advanced Computing Center, as speakers.

- **STEM Expo** In September 2013 the CISL Diversity Coordinator and other CISL and UCAR staff performed STEM outreach to hundreds of K-12 students over two days at the STEM Expo in Dulles, Virginia. Area of focus was computer science and algorithms.

- Diversity Coordinator performed Outreach to Houston area MSI’s in October 2-6, 2013. Institutions visited and number of people impacted (in parentheses): Prairie View A&M University (PVAMU) (50 people); UT, San Antonio (25 people) St. Mary’s (25 people); Texas Tech (10 people); TOTAL over 100 attendees, mostly from underrepresented groups.

- **The Society for Advancement of Chicanos and Native Americans in Science (SACNAS) Conference** October 2013 The CISL Diversity Coordinator developed, with Rebecca Haacker-Santos, a grant to re-establish a UCAR presence at the SACNAS conference, and then helped staff the booth at the Conference. Number of people impacted: ~3,700 people attended the 2013 SACNAS conference, many from underrepresented groups.

- **Engagement Scholarship Consortium (ECS) Conference** in Lubbock TX, October 6-10, 2013 presenters/community partners pre-conference committee & attendee. During the ESC conference, CISL Outreach Services Group members Stephanie Barr and Kristin Mooney facilitated a pre-conference workshop and gave a presentation titled “Evolution of an Internship Program: Adaptation through Increased Diversity Engagement.” Estimated number of people impacted: approximately 75 people attended the workshop.

- **American Indian Science and Engineering Society (AISES), Exhibitor – October 31- Nov 2.** At the Diversity Coordinator’s initiative, shared an exhibitor booth at the AISES with NEON. Number of people impacted: ~1,500 people attended AISES, many of Native American heritage, and potentially all visited the booth.

- NSF EPSCoR Annual Meeting November 2-6, 2013 – the CISL Diversity Coordinator performed outreach at NSF EPSCoR annual meeting in Nashville Tennessee. Number of attendees impacted: over 350 faculty, community partners, and students, effectively all from EPSCoR states.

- In November 2013, the Diversity Coordinator as well as other CISL staff participated in the Student Job Fair at Supercomputing (SC) 2013 at the Convention Center in Denver, Colorado. Dozens of students from diverse backgrounds visited CISL’s career booth. One student from the University of Wyoming (UW) was eventually hired as an NCAR student assistant as a result of this engagement.
DEEL impact on diversity in summer internships and externships

Summer Internships in Parallel Computational Science (SIParCS) is a CISL internship program offering undergraduate and graduate students real, hands-on research and development experiences in a diverse set of areas of computational science, including: applied mathematics, geostatistics, computer science, visualization, software engineering, system administration and data facility operations. Now in its ninth year, the SIParCS goal is to build a diverse and qualified workforce that can exploit supercomputers to advance scientific research in the atmospheric and related sciences. The 2014 SIParCS program hosted 12 students from 12 U.S. institutions, including three from MSIs, two from EPSCoR state institutions, and seven from underrepresented minority groups in STEM fields (one of these students is from one of the EPSCoR states and two from two of the MSIs). This diverse representation equals more than two thirds of the 2014 program’s participants, up from 50% in 2013. The steadily improving diversity statistics can be traced directly to the activities of the Diversity Coordinator: at least four students in 2014 were from institutions where she had directed her outreach efforts: namely, Philander Smith College (2), Salish-Kootenai College (1), and Hampton University (1).

At left, extern Justin Moore of Salish Kootenai College works with Raghu Raj Prasanna Kumar (seated) and technical mentor Rich Loft work on the Raspberry Pi cluster. At right, SIParCS interns, SIParCS externs and SIParCS student assistants at NCAR’s Mesa Lab campus during their first week of the 11-week program.

Finally this year, the SIParCS program hosted an extern pilot program, funded by CISL and NCAR and a new Directorate Diversity grant entitled, “A Pilot SIParCS Externship Project for Building Diversity-oriented Partnerships with Target Institutions.” Thanks to the DEEL funding, the CISL Diversity Coordinator was able to work under that project to conceive of the externship model, spearheaded the proposal writing effort for it, and organized the logistics of the externship pilot program. Two students from MSIs were selected in 2014, along with advisors from their home institutions, to build and manage inexpensive parallel Linux clusters composed of Raspberry Pi computers. These externs worked closely with a team of CISL student assistants, with the CISL Diversity Coordinator providing assessment and student support functions to the project, and the CISL TDD director and a visiting professor from Utah State University providing Boulder-based technical leadership and mentoring. During their 11-week externship, the students
spent a total of four weeks on the NCAR campus and presented their research findings during the SIParCS colloquium. Both students returned to Boulder to present posters in the annual symposium of the Rocky Mountain Advanced Computing Consortium.

**DEEL Budget Summary**

The DEEL budget summary is attached below. It shows the financial and staffing data for salaries, benefits, purchased services, travel, participant support costs, and G&A overhead. Of the original $39,853.43 of Directorate diversity funds provided for the project, a total of $348.51 remained unspent at the end of October 2014. Of the monies spent, $16,429.42 went to salaries and benefits for the project’s share of the CISL Diversity Coordinator’s salary during the period from August of 2013 to August of 2014. $700.86 of the budget went toward purchased services associated with the DCG workshop. Participant support cost of $12,763.99 went towards other workshop costs, primarily travel support for 11DCG workshop participants, including the two keynote speakers and nine others that applied for such support. This support facilitated the participation by attendees from Minority Serving Institutions and EPSCoR state institutions such as Spelman College, Interior Athabascan Tribal College, and Northwest Arkansas Community College.

The travel costs ran significantly higher than the $10,000 estimate originally budgeted in the original proposal due to higher than average airfares – funds were repurposed from the Diversity Coordinator’s project travel budget of $3,245.00 to cover the overage. Associated G&A overhead related to the project’s activities came to $9,710.65.