1.0 Previous NSF Sponsored Research

GSE Supplemental (DUNS# 929928018), in progress

This grant addresses the low enrollment and high attrition of women in STEM majors on the South Dakota School of Mines and Technology (SDSM&T) campus by adapting the Purdue Women in Engineering Program’s Mentors and Mentees (M&M) for the undergraduate women at SDSM&T. The M&M program development is underway, and the first cohort of mentors and mentees will begin in the fall of 2005. This is the initial program of the newly formed Women in Science and Engineering (WISE) program on the SDSM&T campus. WISE and M&M are indicative of SDSM&T’s new emphasis on and commitment to increasing diversity and improving the climate for women on campus.

2.0 Introduction and Motivation

2.1 Institutional profile

SDSM&T is a 4-year, predominantly undergraduate specialty institution (PUI) that offers degrees in science and engineering fields. The institution does not offer a BA degree, and all majors require at least one semester of Calculus. Of the 2300 students, approximately 87% are undergraduates and 60% are majoring in engineering. The percentage of women earning doctoral degrees from SDSM&T actually outperforms the percentage earning undergraduate degrees on campus; of the 50 PhDs granted in the past ten years, 22% were earned by women. However, women accounted for just 13% of the freshman 2003-04 class in STEM (science, technology, engineering, and math) majors. In the graduating class in 2003, 15% of those who received B.S. degrees in STEM majors were female and only 9.8% of the engineering B.S. graduates were female.

Campus demographics are strongly affected by location and size. The campus is geographically isolated from other institutions with emphases in STEM fields, and based on recent internal market surveys, the school has an outstanding reputation regionally, but is not well known nationally. Consequently, over 70% of the students are South Dakota natives, and the student body is predominantly composed of white male students. Native Americans make up just over 8% of the state population [7] but less than 3% of the student body. However, in 2003, seven Native American students earned B.S degrees in engineering at SDSM&T, the largest number granted by any single institution in the country. Over 50% of entering Native American freshman in 2004 were female.

On the national level, the low percentages of women faculty in STEM fields are sobering. As of 2001, less than 9% of all engineering faculty and less than 5% of engineering faculty with 10 or more years of experience were female [1]. In science, where the numbers are somewhat more encouraging, 31% of all faculty and 24.5% of all faculty with 10 or more years are female [1].

What these statistics do not convey is how being on a small campus greatly magnifies the disadvantage in numbers for women. For example, in their ADVANCE proposal, Virginia Tech reported that only 7.2% of engineering faculty and 17.2% of science faculty were female; this translated to a total of 65 female faculty [2]. SDSM&T’s percentages are slightly lower but similar; however, at a school of this size, the percentages translate into a total of just eight tenure track or tenured women in STEM departments (see Section 2.2), and six of these eight women are isolated as the only tenure track woman in their respective departments. Many of the known programs for women faculty may be effective in larger engineering or science programs or at large comprehensive institutions, but they can be very difficult to successfully adapt and implement at a small institution. In particular, mentoring programs or campus networking events simply do not have the critical mass required to be strong resources for the women on a small campus. SDSM&T is not alone in the scarcity of women faculty; for example, in 2004-2005, the schools of engineering at University of California Chico and Western Kentucky University each had only one female faculty member, despite engineering enrollments of approximately 750 and 400 students, respectively. However, small increases in numbers of women on smaller campus can have significant impact, and SDSM&T currently has the personnel combined with an institutional climate to successfully implement a substantive transformation on campus (see Section 2.4).
2.2 The state of women in SDSM&T

The 12 NSF indicators used by current ADVANCE awardees [e.g. 3,4] to measure improvement are used in this section to illustrate the state of women tenure track faculty at SDSM&T. Data for Indicator 1, “Number and percent of women STEM faculty by department,” are presented in Table 1.

Table 1 NSF Indicator 1: Number and percent of women STEM faculty by department

<table>
<thead>
<tr>
<th>Science Departments</th>
<th>Total Faculty</th>
<th>Women</th>
<th>Rank of Women in Department</th>
<th>% women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmospheric Science</td>
<td>6</td>
<td>0</td>
<td>Full</td>
<td>0%</td>
</tr>
<tr>
<td>Chemistry</td>
<td>5</td>
<td>1</td>
<td>Full</td>
<td>20%</td>
</tr>
<tr>
<td>Computer Science</td>
<td>7</td>
<td>1</td>
<td>Full</td>
<td>14%</td>
</tr>
<tr>
<td>Geology</td>
<td>7</td>
<td>1</td>
<td>Associate</td>
<td>14%</td>
</tr>
<tr>
<td>Math</td>
<td>4</td>
<td>0</td>
<td></td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>2</td>
<td>Associate (1) Assistant (1)</td>
<td>25%</td>
</tr>
<tr>
<td>Overall</td>
<td>37</td>
<td>5</td>
<td></td>
<td>14%</td>
</tr>
<tr>
<td>Engineering Departments</td>
<td>Total Faculty</td>
<td>Women</td>
<td>Rank of Women in Department</td>
<td>% women</td>
</tr>
<tr>
<td>Mechanical</td>
<td>10</td>
<td>0</td>
<td></td>
<td>0%</td>
</tr>
<tr>
<td>Metallurgical</td>
<td>4</td>
<td>0</td>
<td></td>
<td>0%</td>
</tr>
<tr>
<td>Mining</td>
<td>2</td>
<td>0</td>
<td></td>
<td>0%</td>
</tr>
<tr>
<td>Civil and Environmental</td>
<td>11</td>
<td>1</td>
<td>Assistant</td>
<td>9%</td>
</tr>
<tr>
<td>Chemical</td>
<td>6</td>
<td>0</td>
<td></td>
<td>0%</td>
</tr>
<tr>
<td>Geological</td>
<td>3</td>
<td>0</td>
<td></td>
<td>0%</td>
</tr>
<tr>
<td>Electrical</td>
<td>9</td>
<td>1</td>
<td>Assistant</td>
<td>11%</td>
</tr>
<tr>
<td>Industrial</td>
<td>5</td>
<td>1</td>
<td>Assistant</td>
<td>20%</td>
</tr>
<tr>
<td>Overall</td>
<td>50</td>
<td>3</td>
<td></td>
<td>6%</td>
</tr>
<tr>
<td>Overall Science and Engineering</td>
<td>87</td>
<td>8</td>
<td>9%</td>
<td></td>
</tr>
</tbody>
</table>

Data for Indicator 2, “Number and Percentage of Tenure-Line Women by Rank,” are presented in Table 2 below. Of particular note is the fact that in engineering, the three tenure track women have a combined total of five years experience; the two most senior women tenure track faculty in engineering joined the institution at the beginning of the 2003-2004 academic year.

Table 2 NSF Indicator 2: Number and Percentage of Tenure-Line Women by Rank

<table>
<thead>
<tr>
<th>Tenure Track Faculty &amp; Depts of Women</th>
<th>Total Faculty</th>
<th>Women</th>
<th>Men</th>
<th>% women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assistant Professors (CE, ECE, IE, Math)</td>
<td>16</td>
<td>4</td>
<td>11</td>
<td>27%</td>
</tr>
<tr>
<td>Associate Professors (Geo, Math)</td>
<td>21</td>
<td>2</td>
<td>19</td>
<td>10%</td>
</tr>
<tr>
<td>Full Professors (Chem, CS)</td>
<td>50</td>
<td>2</td>
<td>47</td>
<td>4%</td>
</tr>
<tr>
<td>Total</td>
<td>87</td>
<td>8</td>
<td>77</td>
<td>9%</td>
</tr>
</tbody>
</table>

Indicator 3, “Tenure and Promotion Indicators by Gender,” Indicator 4, “Years in Rank by Gender,” and Indicator 5, “Time at Institution and Attrition by Gender,” do not yield statistically significant results because of small sample size and high tenure success rates at the institution. While one tenured female faculty has left the institution in the last five years, this move also involved her spouse, who was also a tenured professor on campus.

Indicator 6, “Number of Women STEM instructors and research scientists,” shows that there are currently 7 non-tenure track women (2 assistant professors, 3 instructors, 2 research scientists). In total, 43% of all STEM instructors are female, and just over 20% of all research scientists are female.

Indicators 7, 8 and 9 all concern STEM females in administrative positions. There is currently one STEM female in an administrative position as provost. There are currently no female STEM department chairs or deans. While there are two women on the tenure and promotion committee, neither are STEM faculty members. There are five named chair positions in STEM departments; none are occupied by women.
Indicator 10 looks at the “Salary of STEM faculty by gender”; however, based on the small sample of STEM women on campus a comparison of salaries by gender is not a statistically significant indicator. Lastly, Indicators 11 and 12 both concern “Space Allocation” and “Start-up funding” by gender. These indicators were not available for this proposal; however, it is important to note that there is limited funding for any new faculty to receive a start-up package in the South Dakota university system, regardless of gender.

It should be noted that statistics alone do not accurately describe the status of women on the SDSM&T campus. The recent female hires in engineering report a great deal of support and active mentoring from their respective department chairs. In addition, SDSM&T is a cooperative rather than competitive institution; faculty are hired with the expectation that they will be supported, to the extent possible, in their path towards tenure, not required to compete with fellow faculty for promotion. But as is the case with many small institutions [5], the expectations for tenure with respect to both teaching and research output are high and are steadily rising, and financial support for these endeavors is extremely limited. The economic conditions contributing to this are described in Section 2.3.

2.3 Social and economic factors affecting the state of faculty diversity on campus

If the campus climate is generally supportive to new faculty regardless of gender, why has the lack of diversity not received more attention and action on campus and across the state? The answer is found in the social and economic factors at play in South Dakota and at the institution. A 2004 report on the Status of Women in South Dakota [6] paints a bleak picture. Women with education beyond a bachelors degree earn just 68.1% of what men the same level of education earn. The state ranks 46th in women’s institutional resources, 50th in median annual earnings and 50th in reproductive rights. For overall participation of women in the political process, the state ranks 48th. For Native American women, things are much worse. Native Americans constitute 8% of the state population, and less than 55% of Native American women in the state live above the poverty level. Women’s issues have simply not been a priority in South Dakota societal or political affairs.

South Dakota has very limited state financial resources available for higher education. The state population is just over 760,000 [7]; the median per capita income is 80% of the national average; and there is no state income tax. The State ranks 7th out of 8 states in this region in 1) tax expenditure per capita on higher education and 2) the percentage of state revenue allocated to higher education per $1000 of personal income [8]. Extremely little state funding exists for initiatives not labeled as priorities by the State Board of Regents. SDSM&T has been named one of America’s 100 Best College Buys for seven consecutive years [9] which means that high tuition does not compensate for unmet costs; the overall cost per student of attending SDSM&T is approximately 60% of the national average.

South Dakota faculty members are among the most “efficient” in the country based on a University of Delaware study [10]; the State Board of Regents advertises the following facts:

- The average faculty member teaches more students (17.7 vs. 15.8 nationally) and more organized class sections, including labs (4.4 vs. 3.6);
- A regular faculty member is more likely to teach an organized undergraduate class section than an adjunct instructor or graduate assistant (85% vs. 72% nationally) and is nearly twice as likely to teach an undergraduate lab course (74% vs. 41%).
- Instructional expenditure in South Dakota per credit hour is less than 75% of the national average.

Within the state, SDSM&T has the third largest student to faculty ratio, and over 88% of undergraduate classes are taught by tenure track faculty. Despite the teaching load and a general expectation of excellence in teaching, the amount of research on campus (based on competitive research dollars per tenure line faculty) is two to three times higher per faculty member than the two comprehensive and Ph.D. granting institutions in the state [8]. As is typical on any campus, faculty involved in teaching and research are also involved in both campus and national service. In short, the workload of the average SDSM&T faculty member is, arguably, the highest of that at any institution in the State. For those who seek to transform the SDSM&T campus culture, the workload issue amplifies challenges and significantly limits the time available to address issues of climate or social change.

Based on the numbers of women in Science and Engineering tenure line positions as recently as 2002 (6 science, 0 engineering), there was little opportunity for the women faculty on campus to place diversity in the
faculty ranks as a priority without release from some of their workload, or without the state Board of Regents identifying faculty diversity as a priority. It is important to note, however, that a significant improvement has occurred in the past five years with respect to diversifying the faculty based on hire dates of current faculty, as shown in Table 3, and that these hires already had an impact on campus climate and diversity.

<table>
<thead>
<tr>
<th>Arrival Date</th>
<th>Total New Faculty</th>
<th>Women</th>
<th>% Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-2005</td>
<td>21</td>
<td>4</td>
<td>19.0%</td>
</tr>
<tr>
<td>1995-1999</td>
<td>11</td>
<td>1</td>
<td>9.1%</td>
</tr>
<tr>
<td>1990-1994</td>
<td>14</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>1985-1989</td>
<td>12</td>
<td>2</td>
<td>16.7%</td>
</tr>
<tr>
<td>1980-1984</td>
<td>13</td>
<td>1</td>
<td>7.7%</td>
</tr>
<tr>
<td>1975-1979</td>
<td>5</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>1970-1974</td>
<td>4</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>1965-1969</td>
<td>5</td>
<td>0</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

2.4 The state of change at SDSM&T

Over the last two years, SDSM&T has begun an organizational transformation. The institution’s first externally hired president since 1966, Dr. Charles Ruch, began his tenure in 2003. As part of the institutional self-study, the college structure has been re-examined and will be restructured from four colleges, with varying mixes of science and engineering departments, to two colleges, a college of Engineering and a college of Science and Letters. In 2004, the university created a new position, Vice President for Research. In 2005, an Associate Vice President for Academic Affairs position was created and tasked in part with supporting the new Women in Science and Engineering office.

To create consensus on the campus reorganization now taking place, the president held eight all-campus planning sessions over the past two years and conducted multiple faculty and staff surveys. The degree of participation and amount of input was extraordinary by any measure. The openness of the administration to ideas from the entire campus has allowed every member of the campus community to feel a part of the institutional change process, regardless of whether he or she agreed with the decisions made. A priority identified in these all-campus sessions was increasing the diversity of both the student and faculty populations, a process that had already begun to advance in 2003 with the hiring of two tenure-track women in engineering.

In 2004, the two new engineering tenure-track women faculty members worked with the provost to secure NSF funding from GSE to emulate a successful mentoring program for women students on campus and to create the Women in Science and Engineering (WISE) office. The director of the WISE program will serve as the Program Manager for the proposed ADVANCE site on campus.

In sum, events on campus are evidence of what can be accomplished despite the faculty workload and with a passionate faculty that enjoys administrative support at the highest level. The new president has modeled an effective method of managing true and lasting change that makes SDSM&T well poised for the institutional transformation outlined in this proposal.

3.0 Conceptual Framework and Proposed Programming

3.1 Framework and Objectives

The proposed ADVANCE program at SDSM&T considers recruitment, retention, and advancement of a diverse faculty population to be the number one objective in an overall framework for diversity in STEM fields. The objectives of the proposal are based on implementing, assessing, adapting, and institutionalizing programs, policies, and procedures that will allow for the recruitment, retention, and advancement of women at SDSM&T, in the South Dakota university system, and at the regional tribal colleges.

The philosophy behind these objectives can be summed up by Morgan [11]: “transforming our institutions to better serve the needs of women must include serious new kinds of hiring and retention programs, financial incentives for change, and circulating data on successful programs.” The proposed program is based on an extensive literature review of the status of women in STEM fields [11 – 23], a review of programs developed
at ADVANCE sites nationwide [e.g. 2-4, 24-26], and an in-depth assessment of climate and needs of the institutional and state. The proposed project will:

- Develop a network of women faculty throughout South Dakota and the regional tribal colleges that can be connected with women at other institutions regardless of geographic isolation;
- Increase the critical mass of women in STEM faculty positions at the institution and in the state through improved faculty search programs;
- Provide personal and financial support to women faculty from hire to retire through mentoring, networking, training, and funding;
- Develop and disseminate programming relevant to and appropriate to institutions lacking in both percentages and critical mass of women in STEM fields;
- Develop an awareness of gender issues on campus and throughout the State of South Dakota system, with an emphasis on the department level;
- Ensure that campus and state policies and procedures provide for an equitable experience for all faculty;
- Develop resources and opportunities for Native American women through financial support and collaboration with faculty at the tribal colleges; and
- Create an inclusive environment for all faculty and administrators in order to achieve a permanent, positive change in campus climate.

The conceptual framework is simple: increased diversity in the faculty ranks combined with high personal achievement and satisfaction for the women in this portion of the pipeline will lead to increased diversity in all portions of the pipeline (see Figure 1.) The highlighted area of Figure 1 represents the portion of the “diversity loop” directly addressed in this proposal. The keys to success are:

- a focus on the recruitment, retention, promotion and advancement of women faculty in STEM fields;
- strong administrative support;
- department-level commitment and inclusive faculty participation (i.e. buy-in); and
- policies and procedures and climate changes that support an equitable environment for all genders and cultures on campus.

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- policies and procedures and climate changes that support an equitable environment for all genders and cultures on campus.

3.2 Recruitment

In order to recruit a more diverse faculty pool, search and screen procedures will be re-examined. The best practices for attracting a diverse applicant pool developed by current ADVANCE sites will be studied and adapted to the needs of the institution, including:
A group of tenured faculty will be given release time to develop an understanding of the biases often inherent in faculty searches and methods for countering them. As part of the Faculty Search Resource Team, these faculty members will visit ADVANCE sites to study best practices, will review hiring policies and procedures, and will serve as resources to search committees on campus.

3.3 Retention, Promotion and Advancement

Retention of female faculty is a well-defined objective. However, there is no “typical” career path for women faculty [13, 16, 31], and both paths to advancement and choices concerning advancement are as individual as the women who follow them. This is even more relevant for Native American women faculty in the tribal colleges due to cultural differences. The proposed programs seek to provide resources, information, options, and support for all STEM women faculty to advance in the manner that best suits their career objectives. Women faculty are not always aware of their options for advancement (discussed in the panel of [31]); therefore, one aspect of the ADVANCE site will be to promote awareness in women across the state of South Dakota and in the tribal colleges of some of the different paths and support mechanisms that are available. The retention, promotion and advancement programming proposed herein has been developed to address concerns with faculty development from hire to retire.

3.3.1 Faculty Fellowship Program

Economic factors in South Dakota result in limited to nonexistent start-up funding for young faculty of either gender (Section 2.3). Most new faculty members do not receive start-up packages, although small competitive seed grants in limited emphasis areas have been made available. The lack of start-up causes even greater problems for female faculty due to the additional workload young female faculty typically are assigned [32], issues with mentoring (Section 3.3.2), and gender and cultural biases that often go undetected or unaddressed. The faculty fellowship program provides support for untenured female faculty across the State of South Dakota and in the partner tribal colleges as they develop sponsored research programs, improve teaching and develop a support network of colleagues.

The proposed fellowship program is based on providing those support mechanisms that enable young faculty members to succeed [32 – 36], including both financial and developmental support. Faculty Fellowships are also a means of creating a statewide community, since women prefer to feel integrated and place a higher importance on interpersonal satisfaction than their male colleagues [37].

The centerpiece of the fellowship program will be a joint meeting for all fellows to be held on the SDSM&T campus. The meeting is modeled on young faculty development programs, such as the Science and Engineering Education Scholars Program [38] or the North Carolina New Faculty Workshop sponsored by the SUCCEED Coalition [36]. Significant input will be requested from the participating tribal colleges to ensure content relevant to the cultural needs of their female participants. The meeting will specifically help the participants to:

- Develop pedagogical skills, including course development, active learning methods, etc.
- Develop research skills, including proposal writing, budget development, and graduate-student advising
- Develop an awareness of gender issues in STEM fields and the survival skills to best advance on one’s chosen career path
- Develop a cross-discipline, cross-campus, and cross-cultural community of women in South Dakota and the tribal colleges.

The fellowship program includes both rewards for and responsibilities of the participants, as outlined below.

**Rewards**

- Travel funding to establish networks in technical areas of expertise
- Eligibility to apply for small competitive seed grants open only to fellows
• Summer stipends to provide time to pursue personally chosen activities towards career development
• Career development and networking through annual meetings

**Responsibilities**

• Attendance at all sessions of the annual meeting
• Research presentation at annual meeting
• Participation in WEB² networking (Section 3.3.2)
• Annual report presenting professional development and accomplishments made possible by the fellowship.

In grant years 2 to 4, the fellowship program and annual meeting will be limited to participants from the three state schools with the highest emphasis on STEM fields and the partner tribal colleges. These institutions include:

**South Dakota State Schools:**  
South Dakota School of Mines and Technology (SDSM&T)  
South Dakota State University (SDSU)  
Dakota State University (DSU)

**Tribal Colleges:**  
Oglala Lakota College (OLC)  
Sinte Gleska  
United Tribes Technical College (UTTC)

In grant-year 5, the training offered at the annual meeting will be opened up to an additional 45 participants with a preference for participants from South Dakota institutions, tribal colleges, other EPSCOR states, and/or schools that lack a critical mass of female STEM faculty.

3.3.2 **WEB²: Interactive Group and Individual Mentoring Without Geographic Boundaries**

A plethora of articles exist on mentoring and its importance in faculty development [40]. Faculty mentoring is predominantly based on a male model which fosters a challenging, competitive environment and stresses independence [39]. However, women prefer inclusive, cooperative environments that provide a sense of belonging [37]. Chesler and Chesler [15] discuss innovative mentoring strategies related to gender, including the “distributed mentorship.” This approach breaks the traditional one-on-one, senior faculty as mentor model and includes alternative methods such as peer mentoring and electronic methods for distance mentoring. This model is particularly suited to an institution lacking critical mass of women faculty and/or geographically isolated from other institutions. To quote a wise student on the SDSM&T campus when asked about isolation and meeting other women on campus, “Just because you have another woman in class doesn’t mean you’re going to like her.” While gender may be one criterion in choosing a mentor, it cannot be the only criterion, nor does it guarantee a successful mentoring relationship [15, 40].

The proposed Women’s Electronic Brown Bag (WEB²) is designed to provide real-time networking and mentoring opportunities for women faculty at institutions like SDSM&T that lack the critical mass of women in STEM fields to build successful on-campus networking or mentoring communities. The program, which will utilize AccessGrid (AG) and Virtual Rooms Videoconferencing Service (VRVS) technology, is designed to:

• Use electronic networking capabilities to provide live, interactive mentoring and network opportunities;
• Create “virtual” critical mass by combining campuses, disciplines, and cultures
• Provide an inexpensive means of interactive networking (set-up costs are significantly less than travel expenses for a single meeting)
• Provide an opportunity for dissemination of research on gender issues and best practices in an accessible live format that does not require conference travel by the participants

WEB² will provide opportunities for both group mentoring on a monthly basis and individual interactive mentoring, as desired by the participants. The project will be tested using the institutions that are partners in this proposal and will be broadened in years 4 and 5 to include any interested institution. A special emphasis will be placed on identifying and inviting those institutions with low numbers of female faculty. As part of the dissemination plan, instructional manuals outlining the technical requirements for participation, as well as the
mechanisms for mentoring opportunities, will be developed and included on the ADVANCE website (among other means of distribution).

3.3.3 Leadership Training Opportunities

A number of excellent training programs for women seeking campus leadership positions have been developed by both ADVANCE programs and other institutions. Part of the program will give tenured and tenure-track women travel funding to attend these workshops including (but not limited to)

- National UW ADVANCE Summer Leadership Workshop for Department Chairs
- NSF ADVANCE Leadership Institute for Senior Women Faculty
- Summer Institute for Women in Higher Education Administration at Bryn Mawr
- Women in Engineering Leadership Institute (WELI).

Attendees of these conferences will share their experiences as part of the faculty fellowship annual meeting.

3.4 Campus and State Climate

Change does not always mean progress, but certain strategies significantly increase the likelihood that the changes made through the SDSM&T ADVANCE site will have positive impact on the campus and state climate for women [41]. Moss Kantor [42] describes seven attitudes that foster change and improvement:

- **Tune into the environment** – The faculty, staff, students, and administrators at SDSM&T and the partner campuses all have ideas for bettering the climate for STEM women and other under-represented groups. The ADVANCE site will seek out these voices through campus discussions and team-based opportunities.

- **Kaleidoscope thinking** – New patterns of thinking come from putting together various ideas. The SDSM&T ADVANCE site ethos will be that the whole really is more than the sum of the parts.

- **Communicating a clear vision** – SDSM&T is in the fortunate position of having both a president and a core group of faculty and administrators who dream of creating a better climate for STEM women and other under-represented groups on campus and throughout the state. The SDSM&T ADVANCE site leadership team will work with the Project Manager to paint the picture of a better SDSM&T and South Dakota to the rest of the stakeholders.

- **Building coalitions** – To build support, the Provost has already begun discussions of gender awareness with several campus constituencies. Following the model set by the President, the SDSM&T ADVANCE site will conduct campus-wide discussions and workshops. These sessions will work toward building awareness on campus of gender and cultural issues concerning under-represented groups. The WISELI Department Chair Climate Workshops (UW-Madison ADVANCE) model will also be adapted for use on campus.

- **Working through teams** – Teams of campus community members will be fully utilized to bring additional voices to the strategy table and to give participants a voice in this institutional change. Teams will select the faculty fellowship participants, distribute the faculty fellowship seed money grants, and review policies and procedures.

- **Persisting and persevering** – Well managed and sustainable change takes time. The 5-year grant period is the beginning of the transformation. Institutionalization and sustainability of the changes outlined in this proposal are addressed in section 7.

- **Making everyone a hero** – The SDSM&T ADVANCE leadership team and Project Manager will make a point to show public appreciation to everyone involved in this institutional transformation. It is not by coincidence that the university president and provost are members of the leadership team; the promotion and tenure approval path runs straight through their offices.

3.4.1 Policy and Procedure Review

A vital step to removing administrative obstacles to an equitable climate for all STEM faculty is a systematic assessment and review of polices and procedures. Because most policies and many procedures are set for the entire system by the Board of Regents, changes made will have a statewide impact. The policy and procedure review will be conducted by teams of faculty, staff, administrators, and, where appropriate, students. These teams will consider how each policy and procedure contributes to encouraging or inhibiting diversity.
3.4.2 Department Level Buy-In

On any campus, individual departments must be engaged in order to achieve positive, lasting changes. To this end, department chairs will receive training, participate in discussions, and be eligible for certain resources. The department chair awareness training and peer-to-peer discussions will occur in monthly chairperson meetings with the President and in annual retreats. The ADVANCE Project Manager, campus leaders, and external experts will conduct the training.

The following resources will be available by application to the departments to reward participation:

- **Supplemental graduate-student stipend dollars** – These dollars will be available to supplement the graduate student payroll pool for departments employing women graduate students in research roles.
- **Training-oriented travel money** – Department chairs and senior faculty may apply for money to travel to the conference of their choice, provided the conference contains significant sessions on women in the given field. The traveler must attend and report on multiple targeted sessions.
- **Graduate student recruitment** – Department chairs may apply for money to send a faculty member to another institution to recruit graduate students. The application must describe how the effort will encourage women to apply to the graduate program, and will be judged accordingly.

These incentives for participation will achieve 3 things: 1) departments that assume a leadership role in this change effort are rewarded, 2) departments with the “will” but not the “way” are assisted, and 3) departments that appear immune to change will nonetheless observe the examples offered by peer departments.

3.4.3 Implementation of Support Mechanisms in HR

The quality of the human resources (HR) department and the resources it provides have a “profound impact” on the climate and effectiveness of the campus organization as a whole [43]. The HR office at SDSM&T is firmly and enthusiastically committed to working as a full partner with this ADVANCE site project. Full participation by the HR department at SDSM&T includes:

- **Sensitivity Training Workshops** – These will be geared towards training and awareness for all SDSM&T employees. Topics will include gender, cultural diversity, and intrapersonal relationships.
- **Awareness and Anti-Harassment Online Modules** – The ADVANCE site resources will create an online system to provide information, testing, and tracking of results for training modules in awareness and anti-harassment. Additionally, employee participation in these modules will be recorded in the employee’s personnel file.
- **Succession/Career Advancement Workshops** – On location training will be provided to prepare faculty and non-faculty to become effective administrators and good leaders. Emphasis will be on how SDSM&T policy and procedure affects the climate for diversity. For example, discussion of performance evaluations will look not only at climate issues and best practice, but also the specific system used at SDSM&T.

These workshops and modules will be made available to other institutions through the SDSM&T and ADVANCE web sites.

3.5 Work Plan by Program and Planning Activities

The work plan begins with initial planning and baseline data collection before the beginning of the grant period. This planning will be continued into the grant period and through a complete continuous improvement feedback loop. The work plan by program and planning activities during the grant period is summarized below. The ADVANCE team will engage faculty members and upper-level administrators from across the campus to complete the work plan shown in Figure 2.
4.0 Management Structure

The management structure of the SDSM&T ADVANCE site is designed to encourage input from all faculty and administrative stakeholders at all involved campuses. The management structure has been specifically developed to support a program at an institution the size of SDSM&T taking into account the partner institutions (which have a combined total enrollment of under 20,000, less than many comprehensive institutions that currently have ADVANCE sites.). The Project Manager is key in the management structure; he will work with the Leadership Team, Internal Assessment Team, and External Evaluator Team to close the feedback and strategy loops. The management structure is summarized in Figure 3. Each segment of the structure is described in more detail below.

Figure 3. Organization Chart of ADVANCE Site Management Structure
4.1 Program Manager

The director of the Women in Science and Engineering (WISE) program, Mr. Curtis Cook, will serve as the Program Manager. He will be responsible for the day-to-day operation of the ADVANCE site and its programs. He will regularly update the leadership team and the external evaluators as to status of ADVANCE efforts and programs. Additionally, the Project Manager will coordinate with the internal assessment team to assure formative assessment is part of the programming continuous improvement loop. In the university organizational structure, the ADVANCE Project Manager will report directly to the Associate Vice President for Academic Affairs. Efforts are already underway to endow this position.

4.2 Leadership Team

The Leadership Team will be responsible for the overall coordination and oversight of the SDSM&T ADVANCE site. The Leadership Team will receive regular updates from the project manager and provide feedback. The members of the Leadership Team will make themselves available individually to the project manager for consultation and feedback on an ad hoc basis. The Leadership Team will meet as a formal advisory board annually (at a minimum) to receive feedback from the external evaluation team and to provide formal feedback to the project manager. The membership of the Leadership Team will include:

- SDSM&T President
- Provost (also the PI)
- Vice-President for Research
- Vice-President for Business and Administration
- Department Chair Representatives (2)
- Faculty (2, also the Co-PIs)
- Partner Institution Representatives (5) (refer to partner list in Section 3.3.1)

4.3 Internal Assessment Team

The Internal Assessment Team will consist of a social scientist and an engineer. These two individuals will be responsible for formal assessment of the Faculty Fellowship program and WEB² program. This assessment will be both formative and summative. Additionally, the Internal Assessment Team will aid in the analysis of the Campus Climate and Awareness Survey data. The Campus Climate and Awareness Surveys are described in more detail below.

4.4 External Evaluation Team

The External Evaluation Team will receive regular updates from the project manager and provide feedback. Members of this team will also visit the SDSM&T ADVANCE site for formal site visits where they will provide feedback and strategy advice to the Project Manager and the Leadership Team. The general membership of the External Evaluation Team is as follows:

- 2 representatives from other ADVANCE sites
- 1 female STEM faculty member from another institution
- 1 female STEM administrator from another institution
- 1 external expert on cultural issues pertaining to Native Americans
- 1 external research consultant

To date, the following individuals have agreed to serve as external evaluators:

- Peggy Layne, P.E., Virginia Tech AdvanceVT Program Director
- Dr. Joyce Yen, University of Washington ADVANCE Program/Research Manager
- Dr. Donna Llewellyn, Director, Georgia Tech Center for the Enhancement of Teaching and Learning
- Dr. Jane Fraser, Chair, Industrial Engineering Department, Colorado State University Pueblo

5.0 Program Assessment and Evaluation

The ADVANCE site leadership team is committed to the development of a quality educational and workplace climate for all members of the university community through a continuous assessment and
improvement process. Closing the feedback loop with data-based quantitative and qualitative assessment will build credibility within the institution for the ADVANCE program and its goals [44]. A key element to the success of the program is the annual site visit by members of the external evaluator team to review, analyze, and discuss assessment results as well as aid the leadership team as they clarify strategies for overall program improvement. Program evaluation questions and the assessment plan follow.

5.1 Program Assessment Questions
The program evaluation questions to be answered by the assessment processes are:

- Have the initiatives of SDSM&T’s ADVANCE site strongly enhanced the climate for women?
- What is the efficacy of the institutional climate and awareness programs?
- What is the efficacy of the Faculty Fellowship program?
- What is the efficacy of the WEB² program?
- What are the best practices of the SDSM&T ADVANCE site, including the Faculty Fellowship and WEB² programs?
- Are the programs adaptable to other institutions that lack critical mass and/or are geographically isolated?

5.2 Assessment and Evaluation Mechanisms
To discover concrete answers to these simple but crucial questions, the following six assessments will be employed:

Campus Climate and Awareness Survey
The provost will “strongly encourage” all faculty and staff to complete a confidential Campus Climate and Awareness Survey. Typically, there is a strong participation in faculty surveys at SDSM&T. The results of this survey will aid the Project Manager and the Leadership Team in refining efforts aimed at improving the campus climate. Additionally, the results of this survey will be used to direct efforts to adopt and create web-based awareness resources.

Faculty Fellowship and WEB² Assessment
The internal assessment team, consisting of a social scientist and an engineer, will conduct both formative and summative assessment of the Faculty Fellowship and WEB² programs. This assessment will include content surveys, interviews, and attitudinal surveys. Results of this assessment will be used both for continuous improvement of the programs and to determine the form of the Faculty Fellowship program when, at the end of the grant period, it is broadened and institutionalized. Quantitative data will include the STEM women, non-STEM women, and men populations under the hypothesis that a more equitable distribution of resources improves conditions for the entire campus population.

Longitudinal Tracking of Faculty Cohorts
Cohort groups of faculty will be tracked until retirement or attrition from SDSM&T. Promotion rates and attitudinal data will be tracked and compared in stratified groups. Data will be stratified by several variables, including gender, marital status, and the presence of dependents in the home. Attitudinal data will be gathered through surveys and interviews. Typical interview questions will include:

- How could your department chair increase your research productivity?
- How could your department chair increase your effectiveness in the classroom?
- What is your current work/life balance? What do you feel is effective about this situation? What do you feel is ineffective?
- If you could change one thing about the climate at SDSM&T, what would it be?
- What initially attracted you to SDSM&T? Has that changed in your time here?

Annual Indicator Data
The NSF indicator data described in section two will be collected yearly by the Provost. This data will be prepared and analyzed in accordance with the “Proposed Toolkit for Reporting Progress Toward NSF
ADVANCE: Institutional Transformation Goals” as prepared by the ADVANCE Institutional Transformation Indicators Working Group in January of 2005 [3].

Best Practice Reports
Best Practice Reports (BPRs) will be created to document department and institution-level strategies to improve climate. As formative assessment mechanisms, the BPRs will demonstrate effective change. Additionally, the BPRs will be available on the ADVANCE web site for both the SDSM&T community and academe at large. The BPRs will include:

- A description of the strategy, including expected benefits
- Relevant context issues
- The outcomes of the strategy (quantitative and qualitative)
- Continuous improvement suggestions

External Evaluators
Members of the external evaluator team will travel to the SDSM&T ADVANCE site for rotating regular site visits, with a portion of the external evaluator team on site each year. During these visits, the external evaluators will discuss the regular updates they have received from the ADVANCE Project Manager, view the operations of the ADVANCE site, and participate in feedback and strategy discussions with the Project Manager and the Leadership Team. The membership of the External Evaluation Team is described in the management structure section, above.

6.0 Broader Impact and Dissemination

6.1 Broader Impact
The broader impact of the SDSM&T ADVANCE site is embedded in both the model for recruitment/retention/promotion and the process by which the site’s goals will be accomplished. As one of many smaller institutions with significant STEM programs, the SDSM&T ADVANCE site will serve as a model for other similar institutions. The faculty recruitment and retention model will be valuable to other institutions since many institutions are experiencing increased research expectations, high teaching loads, and a dearth of start-up funding [5]. The SDSM&T ADVANCE site will have additional broader impact by creating “virtual critical mass” of women faculty in STEM fields. A critical mass of mentoring and networking participants will be created (where currently there would be none) by linking women STEM faculty throughout academic institutions. This is urgently needed by women faculty members at geographically isolated institutions and members at institutions with smaller STEM faculties.

The processes of the SDSM&T ADVANCE site also support the broader impact of the proposal. First, the South Dakota university system is structured such that positive policy and procedure changes will have a direct and immediate effect on all of the other South Dakota institutions. Second, tribal colleges constitute significant membership among the partner institutions. This ADVANCE site will not only provide an additional link between the regional tribal and public institutions, but also foster networking and mentoring relationships among the female faculty members in these otherwise isolated towns. Finally, the web-based awareness resources will be available to other institutions around the world through the internet.

6.2 Dissemination
Dissemination of the ideas, data, analysis, and best practices formed by the SDSM&T ADVANCE site will occur through many channels. Papers and presentations will be submitted to both women’s issues oriented conferences, including WEPAN (Women in Engineering Programs and Advocates Network), SWE (Society of Women Engineers), and AWIS (Association of Women in Science), and to engineering and science focused conferences, such as ASEE (American Society for Engineering Education) and the discipline society meetings. The SDSM&T ADVANCE site will also add to and build on the network created by the already established ADVANCE sites.

The SDSM&T ADVANCE site will also use three dissemination channels rooted on the SDSM&T campus. The bimonthly meetings of the WEB² program are an opportunity to discuss with the participants from many institutions, among other topics, best practices and lessons learned. The SDSM&T ADVANCE
website will be the repository of evaluation reports, Best Practice Reports (BPRs), web-based awareness resources, and other information. Finally, the annual summer workshop of the Faculty Fellowship program provides an opportunity to disseminate the work of the ADVANCE site, particularly in the final grant year when an additional 45 seats are made available to STEM faculty from other EPSCOR states and/or institutions lacking a critical mass of female STEM faculty.

7.0 Institutionalization and Sustainability

7.1 Institutional Climate
Institutional climate changes will be sustained through changes to the policies and procedures as well as the continued support of the SDSM&T administration. Continued support of the SDSM&T administration includes not only allocation of resources and training for department chairs and other faculty, but also visible, intentional inclusion in campus decision making processes.

7.2 Faculty Fellowship Program
On the SDSM&T campus, the Faculty Fellowship program will be institutionalized and broadened to include both female and male junior faculty while retaining content on gender and cultural equity. Money to fund this program will come from on-campus faculty development funding and summer project money. Additional sources of funds are under consideration.

7.3 WEB²
The Women’s Electronic Brown Bag (WEB²) will be sustained after the grant period through a nominal fee paid by the institutions whose faculty are involved in the internet-based video conferencing mentoring network. The participation fees will be used to maintain the WEB² web site, advertise the WEB² program, and assure WEB² remains technologically current and accessible.

8.0 Budget Justification

8.1 Personnel
The PI of the SDSM&T ADVANCE site is Dr. Karen Whitehead, Provost and Vice President for Academic Affairs at SDSM&T. Dr. Whitehead joined the SDSM&T faculty in Mathematics in 1981. Since then, she has been promoted to full professor and served as department chair and dean before her current appointment. Since becoming the Vice President for Academic Affairs, Dr. Whitehead has both encouraged and helped to find resources to support women STEM faculty and students.

Dr. Jennifer Karlin, Assistant Professor in Industrial Engineering, and Dr. Andrea Surovek, Assistant Professor in Civil Engineering, both joined the SDSM&T faculty in 2003. Drs. Karlin and Surovek each have a positive reputation on the SDSM&T campus as catalysts for change, as the co-authors of the successful NSF proposal described in section 1.0, and as role models through contributions in their respective technical areas. As Co-PIs of the ADVANCE site, measures have been taken to assure that they are both provided with sufficient resources to maintain both their teaching/research workloads and ADVANCE responsibilities as they gain this valuable leadership experience.

The Project Manager of the SDSM&T ADVANCE site is Curtis Cook. Mr. Cook is in the process of joining the SDSM&T community as the founding director of the Women in Science in Engineering (WISE) program. To come to SDSM&T, Mr. Cook is leaving the American Association for the Advancement of Science (AAAS) where he spent the last four years administering the Women’s International Science Collaboration Program, a competitive peer-reviewed program funded by NSF that has awarded 200 travel grants to U.S. women scientists and their foreign collaborators. A succession plan is in place to help Mr. Cook find funding for any necessary additional staff.

The Internal Assessment Team is composed of a social scientist, Dr. Sidney Goss, and an engineer, Dr. Stuart Kellogg. Drs. Goss and Kellogg have extensive experience in assessment and understand both faculty life and faculty development. Dr. Goss has done assessment for the state Board of Regents among other groups. Dr. Kellogg is an engineering department chair.
Other key campus personnel included in the budget are:

- **Summer workshop logistics** – Nancy Anderson-Smith is the Director of Educational Programs & Professional Conferences at SDSM&T. Ms. Anderson-Smith will play a key role in the logistics of the Faculty Fellowship Summer Meeting.
- **Collaboration with tribal colleges** – Bruce Carter is the Director of Multi-Cultural Affairs, an active office that is strongly tied to both regional and national tribal colleges. A Native American himself, Mr. Carter will coordinate networking and collaboration with the partner tribal colleges.
- **Technical support** – SDSM&T Information Technology Services (ITS) is actively engaged in providing technical support for internet based video conferencing. ITS will provide technical support for all electronic media based projects at the SDSM&T ADVANCE site.
- **Students** – Undergraduate students at SDSM&T will be hired to provide support to the ADVANCE site.

8.2 **Institutional Climate**

Budget items for improving institutional climate include the Faculty Search Resource Team, the Policy and Procedure Review Teams, adoption and creation of web-based awareness, travel to view and discuss best practices, and leadership training for female STEM faculty. Specific items for the Search Resource Team include release time for the training of the team members, consultants to assist in the training, and WEPAN conference attendance for the team members. WEPAN conference attendance is also included for the Policy and Procedure Review Teams.

8.3 **Department Level Buy-In**

Budget items to encourage department level buy-in are focused on the items designated as resource rewards to encourage participation, specifically: conference travel, supplemental GRA dollars, and travel for graduate student recruitment.

8.4 **Faculty Fellowship Program**

Budget items for the Faculty Fellowship Program revolve around resources to aid the individual faculty member participants including: the faculty summer stipends, desktop AG/VRVS access for each Faculty Fellow to join the virtual mentoring network, conference attendance, and attendance at the summer meetings. Additional supplies are budgeted items for the summer meeting.

8.5 **WEB²**

In order to effectively create, moderate, and assess the WEB² program, the budget includes the necessary hardware and furniture for the AccessGrid/VRVS room and desktop AG/VRVS access for leadership team, internal assessment team members, and the faculty fellows.

8.6 **Dissemination and Discovering Best Practices**

Travel is included in the budget both to discover and discuss best practices at other ADVANCE sites and as one mechanism to disseminate the best practices of the SDSM&T ADVANCE site.