Partnering with a Native American Community in a Collaboration between a Tribal College and Two Mainstream Universities

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Abstract – We present community outcomes in our unique pre-engineering program, along with lessons learned when a tribal college and community partners collaborate with two mainstream universities in experiential learning on a Native American reservation in the United States. We share our expertise so that others may apply elsewhere what we have learned. We provide guidance through sharing our successes, best practices, challenges, case studies, and hopes for the future. We recognize that every reservation is unique, and what works for one may not work for others. Community outcomes include significant capacity building where partners assemble evidence-based research that strengthens the tribal college and tribal government, allowing them to better manage resources. The OSSPEEC program includes undergraduate, graduate and faculty researchers in water resources, Geographic Information Systems (GIS), geology, surveying, structures, and cross-disciplinary endeavors. Community partners include tribal governmental agencies, reservation-based interest groups, and non-profit organizations. The program is sustainable because the tribal college builds a variety of lasting partnerships offering mutual benefits.

Index Terms – cross-disciplinary, pre-engineering, reservation

INTRODUCTION

Beginning in 2010, the National Science Foundation (NSF) awarded about $15 million for four Pre-Engineering Education Collaboratives (PEECs) over a five year period. The overarching objective is to bring pre-engineering degree programs to Native American tribal colleges and to community colleges that serve Native Hawaiians through linkages to mainstream universities.
The four PEECs are headquartered in four states: South Dakota, North Dakota, Wisconsin, and Hawaii, including 17 institutions. In this article, we tell the story of the South Dakota PEEC, awarded about $3 million of the overall funding ($1.25 million to Oglala Lakota College [OLC] and the remainder shared equally between South Dakota State University [SDSU] and South Dakota School of Mines and Technology [SDSMT]). We share our expertise so that others may learn from the first four years of a five year experience with the South Dakota PEEC, emphasizing community outcomes as a result of the program.

BACKGROUND AND HISTORY OF PROGRAM

The South Dakota PEEC program is known as OSSPEEC (Oglala Lakota College, South Dakota State University, South Dakota School of Mines and Technology Pre-Engineering Education Collaborative). The multi-year initiative is different from most other pre-engineering programs because OLC, a reservation-based tribal college, takes the lead and creates alliances with two mainstream engineering universities, setting it apart from most engineering programs in the United States. Through curriculum articulation agreements between the three schools partnering in OSSPEEC, we built pathways so that students from OLC can matriculate to mainstream engineering schools, SDSU or SDSMT, after earning a two-year pre-engineering AA degree. Among the PEEC programs, South Dakota shares the most similarities with North Dakota.2-3

As a tribal college in a reservation setting, OLC is especially aware of local customs, preferences, and needs. The Greater Pine Ridge Reservation has a sparse population of 18,834 persons of whom 16,906 identify as American Indian (“and Alaskan Native,” a combined United States Census category).4 The vast expanse of the Greater Pine Ridge Reservation includes well over two million acres (809,371 hectares) in all of Shannon County, the southern half of Jackson County, and parts of Bennett County in South Dakota, as well as a small plot in Sheridan County, Nebraska (Figure 1). The Oglala Sioux Tribe (OST) is engaged in a land buy-back program so that the number of acres/hectares regularly increases.5 It is a locale of extreme poverty.6 Striving to improve the quality of life on Pine Ridge Reservation (PRR) provides strong motivation for all partners within OSSPEEC.

OLC operates thirteen campuses in western South Dakota (SD), eleven on PRR, one on Cheyenne River Reservation, and one off-reservation in Rapid City. Collaborating mainstream universities include SDSMT in Rapid City, SD and SDSU in Brookings, SD. Locations matter within the program, since the Greater Pine Ridge Reservation is an hour and a half drive from Rapid City and about a five hour drive from Brookings (Figure 1).
Hybridized Versions of Service Learning: Doing What Works in a Reservation Setting with High Poverty Rates

Within OSSPEEC, leaders place heavy emphasis on experiential learning, including hybridized versions of service learning, research-based hands-on learning, project-based learning, and others--but usually not in their purely defined forms. By “hybrid,” we mean that we simply use whatever works and make adjustments if it does not work. We use aspects of experiential learning pedagogies that are culturally embraced in our reservation setting. We need to remain flexible and willing to adapt, so that the program remains community-defined, culturally-relevant, reservation-based, practical, and tribally-approved by the OLC Institutional Review Board (IRB) and the OST Research Review Board (RRB). For example, “research” is defined by the Oglala Sioux Tribe’s IRB/RRB as activity that is likely to be published or that reports generalizable knowledge, and “human subjects research” may possibly include any activity involving collecting data from people in the reservation community.

The PRR is an area of high unemployment and extreme poverty. For example, the United States Census Bureau reports that from 2009 to 2013, in Shannan County, comprising more than half of the reservation, 53.2 per cent of residents live below the poverty level, compared to 14.1
per cent for South Dakota as a whole. It is a county where 92.9 per cent of residents self-identify as American Indian (or Alaska Native) alone.\textsuperscript{11}

OSSPEEC is funded by NSF for five years (2010-2015). Several participating faculty commute 160 to 200 miles daily to OLC and PRR from Rapid City, South Dakota, or from Chadron, Nebraska. Since the project’s beginning, OSSPEEC included six faculty members from OLC’s Department of Science, Technology and Math (DSTM); as well as five faculty members from SDSMT representing the following departments: Civil and Environmental Engineering, Geology and Geological Engineering, and Mechanical Engineering; and four faculty from SDSU’S Department of Civil and Environmental Engineering and one from the American Indian Education and Cultural Center. During most OSSPEEC summer research camps, SDSU students, faculty, and staff lived in a motel near OLC’s DSTM at the administrative campus, called Piya Wiconi, since a two-way commute exceeds 700 miles. Other SDSU support staff included a post-doctoral research scientist and a laboratory chemist who directs the Water and Environmental Engineering Research Center Water Quality Lab. Five faculty members either retired or moved away since the inception of OSSPEEC, but others took their places. Currently (2014), we operate with four faculty from OLC; four faculty from SDSU, along with two support staff; and three faculty from SDSMT. There is limited equipment and laboratory space at OLC. We observe required permissions and certifications to work in a reservation setting, and we embrace cultural preferences and recognize tribal sovereignty. A large percentage of OLC students are financially challenged and non-traditional. OLC students commute, since all of their campuses are designed without dormitory facilities. Such a system of several campuses at scattered locations, with students living at home, works best in stretching limited local resources and siting campuses at the most convenient locations for students.

\textit{Community Partners}

We needed projects in the first year of our program, as we launched in 2010-2011. To seek out community partners, OLC students and faculty talked to members of tribal governmental agencies and asked about potential projects. Later, other community partners came forward as the OSSPEEC program became known in the community (Figure 2).
In the first year of the OSSPEEC program, the OLC DSTM used a service learning textbook, about which many students provided negative feedback. Despite the unpopularity of OLC’s service learning textbook, we first began the OSSPEEC program with the idea that OLC would benefit by doing things for people outside OLC but within the PRR. At first, we tried service learning, mostly sans reflection, where OLC sometimes played two roles: that of the school and that of a collaborating community partner.

One student summed up his feelings in class by saying, “How can OLC do service-learning with OLC?” He perceived the tribally controlled college as simply a part of the tribe. Thus, from his cultural perspective, how could the community agency partner with the same community agency? In addition, administrative rules at OLC allowed their students to opt out of typical reflection activities in service learning, and nearly all did. The OLC students were not comfortable with reflection in service learning. They instead preferred the Lakota concept of tiospaye (extended family)—to do things because of their responsibility to their community and because they could. That has similarities to the civic-mindedness in service learning, for example, but not enough to be a good fit on PRR.

The SDSMT faculty increased reflection activities with their students by leading discussions during their long commutes to and from PRR. The SDSU students each kept reflection journals and visited about the pros and cons of their service learning activities during summer camps because they lived together in the same housing on the reservation with an SDSU staff person who previously served as a service learning consultant.

Project leaders resolved some of the resistance to service learning reflection by increasing the number of OLC guest speakers on the topic of Lakota culture, increasing the number of OLC potluck lunches where OSSPEEC participants shared food and discussed their projects, as well
as overnight camping trips where students, faculty, and staff could visit informally about the effect of OSSPEEC projects on the reservation community.

We initially developed perfunctory community partnerships with tribal agencies and with a local interest group (those concerned about a deteriorating monument to veterans) (Figure 3.). OLC defined the obvious needs, and OLC and its mainstream university collaborators provided the service. That learning model did not work well because we needed true partnerships where we understood our community partners’ goals and worked with them. We sometimes underestimated what we could learn from them, and what they could learn from us. We did not know how to go about enlisting them as real partners because that involved a paradigm shift for which we were unprepared. As the project moved along, we discovered that real community partnering added power, and it built capacity across the reservation. We discovered that we all gained strength when we worked together.

![Flow Chart of Projects and Community Partner Groups](image)

**FIGURE 3**

FLOW CHART OF PROJECTS AND COMMUNITY PARTNER GROUPS

We retrofitted our experiential learning model to include reflection on the part of faculty and staff, although it remained unpopular among students. We stopped thinking of OLC as one of the community agencies with whom we could partner. OLC took on a central role as catalyst and visionary in its relationships with the community and with its mainstream university
partners. Now we define the community partners as (1) the tribal governmental agencies, (2) the tribal interest groups (or individuals), and (3) the non-profit organizations (Figures 2-3).

Particularly in the fourth year of the program, we focused on strengthening and deepening community partnerships. OSSPEEC participants sponsored a three day meeting of reservation community leaders in spring 2014. We found that the more we listened to them, the more everyone gained. The barriers to entry and resistance to reflection decreased when we talked to community representatives about our vision and the idea of tribal self-sufficiency and growing our program through partnerships. We created more freedom to talk about what works and what does not. We built more and stronger collaborations.

At the 2014 community leaders’ meeting, attendees helped us to identify culturally relevant ways to incorporate more STEM into our classrooms and research. The more we care about community partners’ interests, the more they care about our program. For example, some attendees suggested capturing Lakota culture spatially, using Geographic Information Systems (GIS) technology. They expressed concern that we need to record Lakota Elders’ knowledge, particularly stories, historical events, and place names in our work.

When we looked back over the last four years of our five year OSSPEEC program, we recognized that we lacked the dissemination of information piece. It matters, particularly when we disseminate information that is reservation-based and culturally relevant. Now we look to see how we can combine such desirable information dissemination with teaching and learning in STEM.

Permissions and Certifications Required for Research
The OSSPEEC program and its various projects and procedures need approval from PRR’s Oglala Sioux Tribal Research Review Board (RRB) and their Institutional Review Board (IRB). The OST’s RRB is primarily concerned with environmental research, and the IRB with human subjects. OSSPEEC’s Principal Investigators (PIs) and graduate student mentors and researchers need National Institutes of Health (NIH) certificates obtained through on-line training in ethical practices in working with marginalized and vulnerable populations. Mainstream collaborating universities also have IRBs that oversee their participation in the program. The IRB at SDSU requires that at least one project leader also have Collaborative Institutional Training Initiative (CITI) certification. Researchers operate in an era of increased awareness of cultural sensitivity with enforced protocols.

COMMUNITY OUTCOMES AS A RESULT OF OUR APPROACH

We led or assisted with 17 projects with greater or lesser degrees of contact with community partners (Table I). Fifty students participated in these community projects with most participating in two or more. Of those 50 students, 70 per cent self-identify as Native American. In every project, students and faculty succeeded through building capacity for themselves, their schools, and the PRR community partner. Sometimes the benefits were immediately identifiable such as improving the skills of a local water technician. Other times, the benefits were less visible such as the continuation of data assemblage for heavy metals concentrations for soil, sediment, water, and plants on PRR. Michael Catches Enemy, Director of the Oglala Lakota Sioux Tribe Natural Resources Regulatory Agency (OST NRRA) in 2011, noted that such recent studies have short term and long-range value in managing natural resources (personal communication).
OSSPEEC activities help to empower the OST and to encourage self-determination so that local community opinions have more impact. OSSPEEC directly and indirectly demonstrates value by increasing the capacity of community partners and all stakeholders to achieve their missions and goals. Our projects help community partners to establish more expertise and evidence-based research to help promote economic development and employment, to improve public health, to manage natural resources, and to provide a tribal perspective rather than relying on outsider information (Table I).\textsuperscript{19-21}

The program builds capacity for OLC students, faculty, and staff, and it increases their confidence in what they can achieve in their community through STEM. It builds networking between OLC and collaborating mainstream universities with strong colleges of engineering. As a result, community partners and academic collaborators view OLC as a resource with continually increasing value and power.\textsuperscript{19-21}

TABLE I
COMMUNITY PROJECTS, PARTNERS, AND CAPACITY BUILDING WITH NUMBERS OF PARTICIPATING FACULTY/STAFF, GRADUATE STUDENTS, AND UNDERGRADUATE STUDENTS BY SCHOOL AND BY CUMULATIVE TOTALS

<table>
<thead>
<tr>
<th>Community Project Name</th>
<th>Community Partner</th>
<th>Capacity Building</th>
<th>OLC</th>
<th>SDSU</th>
<th>SDSMT</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind Energy on PRR</td>
<td>OSPRA/OST NRRA</td>
<td>AC</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1 3</td>
</tr>
<tr>
<td>Pine Ridge Aquatic Ecology</td>
<td>OST EPP</td>
<td>ABC</td>
<td>2</td>
<td>2</td>
<td>9</td>
<td>1 3 4 5 12</td>
</tr>
<tr>
<td>Hydrogeology of PRR</td>
<td>OST EPP</td>
<td>ABC</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>9 4 0 10</td>
</tr>
<tr>
<td>Surface and Ground Water/White Clay Fault</td>
<td>OSPRA</td>
<td>ABC</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1 3 0 3</td>
</tr>
<tr>
<td>Heavy Metals in Water/Sediments</td>
<td>OSPRA/OST NRRA</td>
<td>ABC</td>
<td>3</td>
<td>7</td>
<td>1</td>
<td>8 1 5 3 16</td>
</tr>
<tr>
<td>Heavy Metals in Plants and Soils</td>
<td>OSPRA/OST NRRA</td>
<td>ABC</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>6 3 2 8</td>
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<tr>
<td>GIS Support Projects</td>
<td>Most partners</td>
<td>ABC</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>3 2 1 6</td>
</tr>
<tr>
<td>Memorial Wall in Wanblee</td>
<td>THPO/local interest group</td>
<td>D</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>4 1 3</td>
</tr>
<tr>
<td>Surveying at OLC/Thunder Valley</td>
<td>Thunder Valley/NASHI</td>
<td>AC</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>2 3 0 8</td>
</tr>
<tr>
<td>Irrigable Acreage PRR</td>
<td>OSPRA/OST NRRA</td>
<td>AB</td>
<td>2</td>
<td>1</td>
<td></td>
<td>2 0 1</td>
</tr>
<tr>
<td>Total Maximum Daily Loads/Streams</td>
<td>OST EPP</td>
<td>ABC</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>4 1 2</td>
</tr>
<tr>
<td>Green Building and Green Energy</td>
<td>Thunder Valley, NASHI</td>
<td>ABCD</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>2 1 3 1 5</td>
</tr>
<tr>
<td>GIS Viewshed Analysis</td>
<td>OSPRA/OST NRRA</td>
<td>ABC</td>
<td>1</td>
<td>2</td>
<td></td>
<td>1 0 2</td>
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<tr>
<td>Floodplain Analysis</td>
<td>Thunder Valley/NASHI</td>
<td>ABCD</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2 0 2</td>
</tr>
<tr>
<td>Thunder Valley Water Sustainability</td>
<td>Thunder Valley/NASHI</td>
<td>ABCD</td>
<td>1</td>
<td></td>
<td>3</td>
<td>4 0 0</td>
</tr>
<tr>
<td>Ornate Box Turtle Habitat</td>
<td>OSPRA</td>
<td>ABCD</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>4 1 7</td>
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<tr>
<td>Sustainable Housing/Energy</td>
<td>Thunder Valley/NASHI</td>
<td>ABCD</td>
<td>1</td>
<td>4</td>
<td></td>
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Key: **OSPRA**=Oglala Sioux Parks and Recreation Agency, **OST NRRA**= Oglala Sioux Tribe Natural Resources Regulatory Agency, **OST EPP**= Oglala Sioux Tribe Environmental Protection Program, **THPO**= Tribal Historical Preservation Office, **Thunder Valley** non-profit organization, and **NASHI**=Native American Sustainable Housing Initiative.  
OLC=Oglala Lakota College, SDSU=South Dakota State University, SDSMT=South Dakota School of Mines and Technology, F=Faculty/Staff, G=Graduate Student, and UG=Undergraduate Student.
LESSONS LEARNED

Successes:
1. We made major strides in attracting community partners and a wide range of leaders from across PRR to talk about their needs and to obtain information about the OSSPEEC program.

2. We succeeded in partnering to improve water resources and to build locally relevant data sources for heavy metals (particularly uranium) concentrations in water, sediment, soil, and plants on and near PRR.

3. We embraced cross-disciplinary collaboration since it worked better and drew many more stakeholders with wider interests in a variety of projects. Our engineering model also fit the environmental sciences.

4. We established a two year pre-engineering A. A. degree program in DSTM at OLC during the first two years of OSSPEEC. This degree program has experiential learning as an integral part of every course in a student’s learning plan. OLC practices non-abandonment of students and subsequently creates unique experiential learning opportunities that create synergies between student interests and community partnerships.

5. Through curriculum articulation agreements, established in year three, between OLC, SDSU, and SDSMT, we established pathways for OLC students to matriculate to four-year engineering programs after earning a two-year A. A. pre-engineering degree at the tribal college. Ideally, students would earn an A. A. degree and then transfer to SDSU or SDSMT to earn a BS in engineering within two to three years of full time study.

Best Practices
1. Use various experiential learning pedagogies, but modify them to work for your program. Hybridize pedagogies if that is what works. Particularly in this reservation setting, culture matters.

2. Clarify the IRB/RRB process as early as possible in the program, ideally a year before a program actually begins. Talk to partners about necessary community protocols that are appropriate for a particular reservation, respecting tribal sovereignty. Report all project data to the tribal college so that it is accessible to tribal IRB/RRB and other tribal agencies. Comply with agreements in permissions documents. Observe ethical standards consistent with the Engineering profession, NIH, and CITI.

3. Disseminate information to community partners and local residents about collaborative accomplishments, even during periods when there is little to report.

4. Identify champions. We conducted an informal survey of the tribal governmental agencies with an engineering interest near the beginning of our program. The only sustainable program projects were those with OSSPEEC champions inside the community agency.

5. Establish a strong tie to a partner organization’s mission and be in lock-step with what that group wants to do.
4. Where there is an existing community program, add value to start the collaborative relationship, since inertia already exists there.

5. Create inter-dependencies and work closely with community partners. Create situations where both parties derive benefits from the relationship.

**Challenges**

1. Listen carefully to what the community wants before making assumptions. For example, in the case of our plan to repair a deteriorating memorial wall honoring veterans, a community interest group let us know that they preferred that the wall be left in its natural state out of respect for those who built it. What we saw as “deterioration,” the community interest group saw as a natural weathering process that added value and even more significance to the memorial.

2. We underestimated the number of times it took to discuss our program with potential community partners in order to get buy-in and to create action. We needed to continue the conversations. There was an inertia challenge. To get the motion going, it may take a long time to move it forward.

3. We need to continue to reduce resistance to reflection practices in experiential learning.

**Hopes for the Future**

We will build upon lessons learned. Through capacity building, accelerated by the OSSPEEC program, we anticipate a bright future for the pre-engineering program at OLC. We will continue to nurture relationships between OLC, SDSU, SDSMT, and community partners on PRR. Especially important in the future, is OLC’s newly evolving role in community leadership, enhanced during the OSSPEEC project. Because of OLC’s ever-growing alliances with tribal governmental agencies and other community partners, OLC is becoming a powerful ally in helping the PRR to achieve sustainability, self-sufficiency, and self-determination that impacts the entire community. We believe that OLC students will be future leaders, with the education and the research skills to accomplish their goals, and with the wisdom to recognize the value of flexibility in both experiential learning and collaboration.19-21

**CASE STUDIES OF TWO PROJECTS**

In both case studies that follow, we gathered data and conducted analysis to build capacity for all stakeholders. We present brief descriptions of the overall projects that empowered the community partners. In conducting water quality research, we increased the capacity of a community operator for the program, as well as the capacity of students and faculty who gained field skills and understanding through preparing a final report. We found that the more we involved community partners directly in the research, the more visibility we created for the OSSPEEC program, resulting in greater overall community interest and support.19-21

We recruited student interns through relationships, media, and events. Co-teaching of some engineering courses by OSSPEEC faculty helped create networking and comradery within the group. Participating OSSPEEC faculty and staff recruited student interns within their respective departments and through professional relationships with colleagues. Organizations that participated in recruitment included the Applied Science Program in the DSTM at OLC; the
American Indian Education and Cultural Center, and the Native American Club at SDSU; and the Office of Multicultural Affairs and Tiospaye Scholars Program at SDSMT. We recruited through newspaper articles, an OSSPEEC website, and campus posters. Other recruitment activities included OSSPEEC booths at college and career fairs, as well as pow wows, and the Lakota Nation Invitational basketball tournament. Students, faculty, and staff hosted recruitment booths providing information about STEM-related reservation community service opportunities.

**Case Study One: Surface Water Quality**

Water quality is a high priority across PRR, particularly in the White River Watershed (Figure 4). Using aspects of service learning pedagogy, from 2010-2014, the OLC DSTM partnered with the OST Water Pollution Control Program (WPCP), a division of OST EPP. Building on previous water quality reports by private consulting firms, OLC DSTM (1) examined water quality data collected from 2008-2011 across PRR by OST WPCP, (2) incorporated macro invertebrate stream data collected by OST WPCP from 1993-2008 and collected by OLC DSTM from 2010-2011, and (3) re-examined recommendations for monitoring and for best management practices. As a result, OSSPEEC faculty and students produced an open file report for the OST EPP, providing important data to the tribal agency charged with “developing watershed based plans for water quality restoration, identifying impacts to water quality, implementing the monitoring program, and identifying best management practices.”

The water quality project showcased the increasing capacity of OLC’s faculty, staff, and students as catalysts for self-determination on PRR. The work provided opportunities for learning basic research; literature review; technical report writing; map production; GIS analysis; sample collection, preparation, and laboratory procedures; management skills; logistics; and computer skills, including chart and table production. In the end, the teamwork of eight co-authors, including one faculty member, one graduate student, and six undergraduate students, produced a valuable and accessible document of use in improving the quality of life for the community. The project is on-going.
FIGURE 4
THE WHITE RIVER FLOWS THROUGH PRR FROM SOUTHWEST TO NORTHEAST AND IS AN IMPORTANT FOCUS FOR WATER QUALITY STUDIES, SINCE THE WHITE COMPRISSES THE LARGEST WATERSHED ON THE RESERVATION

Case Study Two: Heavy Metals Concentrations

The PRR is an area of relatively high levels of naturally occurring heavy metals including uranium, arsenic, selenium, and barium, among others. Of particular concern to the OST are current and former off-reservation uranium mines near the headwaters of both the Cheyenne and White Rivers. Both rivers flow through PRR. In addition, there is longstanding curiosity among the reservation community about overall heavy metals concentrations on a large World War II gunnery range on PRR that has been the focus of debris clean-up by the Federal Government continuing to the present-day.

During OSSPEEC summer camps from 2011 through 2013, four faculty, two staff, and twelve students launched heavy metals research studies on PRR with the community partner OST NRRA. The two lead students were seeking advanced degrees at SDSU, directed by their committees and OSSPEEC Project Investigators. Undergraduate assistants were recruited from the ranks of OSSPEEC interns. Then OST NRRA director, Michael Catches Enemy, and his assistant, Catherine Converse, championed an alliance with OSSPEEC, beginning in 2011. OSSPEEC participants collected and tested samples of water, sediment, soil, and plant tissues on and near PRR (Figures 4 and 5). Using microwave digestion and inductively coupled plasma optical emission spectroscopy (ICP-OES) equipment in a laboratory at SDSU, we estimated heavy metals concentrations. Thus, we collected data to assist OST NRRA, to continue management of natural resources on PRR. An M.S. thesis\textsuperscript{17}, and a Ph.D. dissertation\textsuperscript{18} (in partnership with nearby Rosebud Reservation) (Figure 1) resulted from the research. Other OSSPEEC students and their mentors presented additional heavy metals results in posters with
all data accessible to OLC and OST NRRA. The research is continuing with encouragement from OST NRRA’s current technician, Dennis Yellow Thunder.

FIGURE 5
WE TESTED INTERMITTENT DRAINAGES SUCH AS THIS ONE WEST OF WOUNDED KNEE FOR HEAVY METALS CONCENTRATIONS IN PLANT TISSUES AND THE SOILS IN WHICH THEY GROW. RESULTS HELPED BUILD DATA AVAILABILITY FOR OLC AND OST TO IMPROVE THE QUALITY OF LIFE IN THE RESERVATION COMMUNITY

CONCLUSION

We shared our experience in building a pre-engineering education collaborative between a tribal college and two mainstream universities. While all Native American tribal colleges and reservations are unique, in our program we identified the need for cultural sensitivity and the centrality of the tribal college and the reservation community agencies within the collaborative venture. We learned the value of observing necessary reservation protocols early in the process in order to obtain permission to conduct research. We found that disseminating information to the community partners should be early and often, an area where we need to improve. We used culturally relevant aspects of experiential learning that the community supported, adapting as necessary.

Examples of successful community outcomes within OSSPEEC include the two case studies presented: Surface Water Quality, and Heavy Metals Concentrations. What worked included true collaborations with community partners, involving them directly in the research when possible. We succeeded when we listened to their needs and worked in lock-step with their missions and goals, particularly linking to on-going projects with inertia already in place. We sought out and recognized the value of champions within community partner groups, as in both case studies.

Collaborators within OSSPEEC have great expectations for the program in the future. If one word could describe the OSSPEEC alliance, we would select “flexible.” Its strongest feature is
the sustainability created through OLC’s community partner alliances. OLC will continue to build ever-stronger linkages both within and outside the borders of PRR. Their efforts will carry far into the future and continue to create positive community outcomes for PRR.

ACKNOWLEDGMENTS

The NSF (grants 1037661, 1037708, and 1037797) provided funding for OSSPEEC, and the SD Humanities Council (SDHC) provided funding for related research on Rosebud Reservation. The opinions expressed do not necessarily reflect those of NSF or SDHC. We are grateful for the assistance of the Oglala Sioux Tribe and the Rosebud Sioux Tribe and their agencies, as well as their IRB/RRBs for support. We are indebted to the communities of Pine Ridge Reservation and Rosebud Reservation. We appreciate the collaborative efforts of Rob Pyatt and Native American Sustainable Housing Initiative (NASHI). We thank Janet Gritzner, SDSU Professor Emeritus, for assistance with the map.

REFERENCES