

# PEEC P*Ti*PS: Starting Native American Students Towards Becoming Engineers Who Are Natives

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**Abstract** - This paper describes the aspects of a program to increase the participation of Native Americans in the engineering profession without forcing these participants to lose their cultural values and identity. The NSF sponsored program is in its third year of five and involves tribal high schools, tribal community colleges and a mainstream 4-yr engineering program to identify, recruit, educate (largest possible meaning) and nurture native students interested in an engineering career. The program uses a 2+2+2+∞ approach to illustrate to the individuals the path from high school to tribal college to mainstream university to profession, helping the students to develop coping strategies for what could be considered as three first year experiences. The program, connecting four tribal colleges to the state's largest engineering college, takes advantage of an in-place state-wide video network, a history of inter-school cooperation and web-based tools to deliver courses during the academic year to classrooms with very small numbers of students, sometimes just one, in rather remote locations during some of the worst weather conditions that North Dakota has to offer. These are augmented with several face-to-face (F2F) meetings during the semester and a 12 day summer experience that is designed to be intensive at several levels but supportive. During these summer experiences, support is also provided to the engineering instructors to provide professional development opportunities. The value of student –instructor – professor relationships will be discussed in conjunction with individual success stories towards addressing motivational opportunities. The boarder impact of these activities will be illuminated in the context of engaging rural community locations with local stakeholders and resources in partnership with the more mainstream community to leverage efforts towards student success. This program is about to have a relatively large cohort of students transferring to the mainstream institution and steps taken to prepare for that transfer with be presented.

*Index Terms* - Collaborations, Minority, Mentor, Native American, Recruitment

## OVERVIEW

According to a recent NSF publication [1], slightly over one half of 1% of the 68,000 engineering graduates in 2006 were Native Americans (353). And yet reservation communities provide a striking example of the potential for improved lifestyles through infrastructure improvement, roads, housing, water supply, sewage treatment, etc. There are also significant opportunities for economic development because of on employment and underemployment rates in these same communities. The utility of an engineering degree holder to supply traditional services along academic majors or to be utilized for embedded traits such as problem solving, mathematical analysis or team leadership in positions somewhat tangent to traditional occupations (such as political advisor, district or services manager, educator, business owner, etc.) make this degree holder the "Swiss Army knife" of human talent within the Native American community. Besides this large opportunity within their own communities, Native American graduate engineers also have a significant role to play in the mainstream engineering community by providing diversity of approach and perspective to various ongoing engineering challenges. Descriptions of current educational efforts in reservation high schools could be a book unto itself, for example on some reservations, there could be three or four educational systems in play, BIE, parochial, local school district and tribal language. This may not be a bad situation, but it does reflect an extremely diverse situation when one considers that there are 565 federally recognized tribes across this nation. US higher education has attempted to involve Native Americans since British rule. Most royal charters for schools in the colonies included language providing for the education (read that as missionary conversion) to the natives [2]. The situation made a definitive improvement when the tribal college movement started in the late 1960's – 1970's, but only one fully accredited engineering program exists at Salish Kootenai College, in Montana. The National Science Foundation, NSF, has been a leading proponent in developing this human resource. As a result, in early 2009 NSF called a meeting of postsecondary educators of Native American students and some noteworthy educators of other minorities to consider possible ways to increase the engineering opportunities for Native American students. A direct outcome of this meeting was NSF solicitation 10501,

calling for the establishment of educational collaboratives focused on pre-engineering and engineering education.

### **THE PROGRAM**

The resulting NSF program, entitled Pre-Engineering Educational Collaboratives, or PEEC, funded four collaboratives stretching from Wisconsin through North and South Dakota to the Hawaiian Islands. This paper describes the activities of the North Dakota collaborative between four of the five state tribal colleges, Cankdeska Cikana Community College, Fort Berthold Community College, Turtle Mountain Community College and Sitting Bull College<sup>1</sup> and the state's land-grant institution, North Dakota State University.

The focus of the North Dakota collaboration was to involve the geographically dispersed tribal colleges and their communities in the recruitment and initial training of engineering students. This particular collaboration was titled: Pipeline for Tribal Pre-engineering to Society:2+2+2+∞, PTiPS and approached the activities with a '2+2+2+∞' organization to engage tribal high schools, tribal community colleges, mainstream institution and professional practitioners. The mainstream institution would partner with these colleges to aid in the recruitment and then either advise about or provide basic engineering courses expected in the first two years of the general engineering curriculum. The partnership would then insure that the students would seamlessly transfer from their initial institution to the accredited engineering program through familiarity.

This collaborative reaching back to the community was intended to provide an illustration within that community of the usefulness that these future graduates could be to addressing long-standing community problems. Also involved were considerations of optimized tribal college resources when designing curriculums that might only contain two or three students each academic year, but when considered over four colleges becomes more economically viable. This included the establishment of administrative advisory committee and professional advisory committee. Work has been started on assembling a cultural advisory committee as well.

Each of the educational partners has a unique role to play in the collaboration. For example, the tribal high schools are able to prepare the students to a fundamental understanding of their communities and form the basis for their individual cultural identities. They can also sow the initial seeds of in the subject matter areas to be developed later that the higher-level institutions.

The tribally controlled community college is key to the collaboration in many ways. First, the tribal college knows the local school system and is able to effectively target the population of students with the highest potential in engineering education. Once the students are identified, the

tribal college provides a less stressful manner to transition from K-12 to the first year of college because it is much closer geographically as well as conceptually to the students home community. Usually it is also less of an economic burden for the student to start their college career. The PEEC grant was able to provide funding to the partnering tribal colleges for one engineering instructor as well as one math or science instructor thus providing the manpower to support advanced math and science classes, i.e. calculus series through differential equations as well as introduction to engineering, CAD, statics, dynamics, introductory circuits classes. This would allow students in the program to start their engineering curriculum in a familiar environment with much of the hometown support system still in place. It also provided the community more insight into the curriculum demands placed on an engineering student and perhaps to start to understand the opportunity afforded by community-based engineers, including the on-staff engineering instructor.

The mainstream institution needs to play an expanded role in this developing pipeline. The mainstream institution did not simply wait for the transfer of the students but acted as a bridge between the pre-engineering curriculum made available at the tribal college the typical mainstream engineering curriculum. It did this by offering interactive distance education courses in some of the base-level as well as higher-level transitory courses that actually included periodic visits to the sites. The mainstream institution also participated in tribal college faculty development in the form of workshops and seminars and facilitation of professional introductions with other faculty on the mainstream campus and professionals in the area. The mainstream institution also provided fundamental syllabi to act as basic course framework for the tribal college provided engineering courses. This ensures unquestioned quality of the courses provided and saves the tribal college developmental costs. The mainstream institution also acted as a facilitator for the necessary tribal college to tribal college distance class offerings to fully maximize the utility of the four individual engineering instructors. The mainstream institution was a source of motivation, structure and facilitation for periodic gatherings of these Pre-engineering students and instructors from the tribal college to meet each other and to begin the teambuilding process for a self-supporting collaboration. Amongst the students, this collaboration would be carried on after their transfer to the mainstream institution. The mainstream institution also used their connections with Native American alumni to form the basis of the Professional Advisory Committee, assembling former students who had first-hand knowledge of the types of issues that these new engineers-in-training would face. Program faculty participants at the mainstream institution also became advocates for the students and programs with the administration and staff, greatly improving the facilitation of the transfer process for the students.

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<sup>1</sup> The fifth ND tribal college, United Tribes Technical College is involved with the separate program for pre-engineering.

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A particularly effective mechanism for the mainstream to improve the probability of a successful student transfer and transition was to provide the site for an intense two-week on campus meeting of all students in the program. During this camp meeting and intensive schedule of classes, demonstrations, presentations and tours allowed the transferees of first-hand experience with these much larger institutions.<sup>2</sup> During this camp, 55 or more contact hours set aside to teach and intensive fundamental class such as surveying or thermodynamics to the students. This was intended to not only facilitate the curriculum for the students but provide a realistic demonstration of what a particularly horrific two-week period during a normal semester would be like, a "boot camp" like experience. Usually, the instructor of this course was hired as an adjunct from the faculty of the mainstream institution and taught the course in a very similar manner to the way was offered during the academic year. The administrative listing of the course was done through the community college system. The summer camp provided the intense environment that allowed for a solidification of the relationships between students, mentors, instructors and professors that it is hoped would pay dividends in the future.

The entire process was reviewed by the Professional Advisory Committee to ensure that the content of the program would provide fully functional graduates and no shortcuts were taken. This advisory committee also had the additional benefits of being a source of motivation and role models for the engineers-in-training. The committee also provided useful contacts in both the professional community as well as their home Native American community.

The program is about to experience in the fall of 2013 the first most significant wave of transferees from the tribal colleges to the mainstream institution. This will be reported upon in the future.

### ACKNOWLEDGMENT

The authors wish to acknowledge the support of the National Science Foundation through the Division of Human Resource Development under Grant No. 1038080, in the completion of this work.

### REFERENCES

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### AUTHOR INFORMATION

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<sup>2</sup> typical enrollment in a North Dakota tribal college is between 200 to 600 students in a very rural setting while NDSU's enrollment is about 14,000 students in the largest city in the state.

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