THE GENESIS OF A MULTI-INSTITUTIONAL COLLABORATIVE EDUCATIONAL INITIATIVE PROPOSAL

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Abstract

A proposal for a collaborative educational initiative between the five tribal colleges in North Dakota and the North Dakota State University was funded ($1.27M) recently by the Office of Naval Research. The initiative is aimed at increasing the Native American participation in Math, Science and Engineering careers. Activities for the five year proposal period focus on attracting the Native American high school students to the tribal colleges, retaining them through the college, facilitating their smooth transfer to the university, and motivating them for higher studies. Because of the vast distances involved between each of the five tribal colleges and the university, and the sparsely populated nature of the region, distance education technology will necessarily play a key role. For example, some of the activities will be over a two-way video network (Interactive Video Network) connecting all of these colleges and the university. The development of the proposal involved representatives and resource persons from each of the tribal colleges and the university. Because of the large number of people involved, busy schedules and large distances, advanced communication avenues were utilized such as video network conferencing and group decision-making technology to enhance the face-to-face meetings. The discussions clearly pointed to the need for the principal members to fully appreciate the cultural backgrounds of all the participants. Diverse cultural approaches to the education in the Tribal Colleges were recognized. A recently instituted Group Decision Center at North Dakota State University provided the ideal setting for such decision making processes. The use of the electronic discussion software at the Group Decision Center levels the playing field for the discussion and allows for easy prioritizing of ideas. All discussion is simultaneous and anonymous so the discussion can move quickly and more equitably than sometimes possible in verbal discussions. This system allowed a very detailed discussion of the project to address the cultural issues and needs of the Tribal Colleges and to determine where and how to invest the project resources. This paper will describe the evolution of the proposal from its conception to submission. The description will include five sections: introduction, prior collaboration, ONR project collaboration, Group Decision Center’s role, and the ONR proposal concept with Student Pathways, Project Management and Activity Flow Charts as submitted in the proposal.
I. Introduction

The five North Dakota Tribally Controlled Colleges (TCC) continue to make great strides toward improving the lives of tribal members by creating educational opportunities. However, the low numbers of students who attempt and succeed in careers requiring higher level mathematics, science, and technology skills presents a significant challenge to the TCCs. These potential technology professionals are critical to the future development of this country as well as the reservations where the tribal colleges are located.

Achievement statistics reveal that a significant number of Native American students enrolled in the schools on the North Dakota reservations are only partially proficient in mathematics which means their skills are below average. More than half of the Native American students enrolled in the schools on the North Dakota reservations are proficient which means they are average. A small number of the Native American students enrolled in the schools on the North Dakota reservations are advanced in mathematics. Even though the numbers are low, it is significant considering the limited resources and the circumstances of the students. The following sample of Native American students attending schools on North Dakota reservations illustrates the findings:

Table: Mathematics Statistics North Dakota Native American Population

<table>
<thead>
<tr>
<th>Number of Native American Students in sample</th>
<th>Partially Proficient</th>
<th>Proficient</th>
<th>Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>2890</td>
<td>1044 (36%)</td>
<td>1694 (59%)</td>
<td>152 (5%)</td>
</tr>
</tbody>
</table>

The 1990 United States Census reported that nearly two million American Indians and Alaskan Natives lived in the United States, nearly a third of whom were below the age of 15. About half of American Indians live on reservations where the unemployment rates soars as high as 85% and are well below the national average in education, income and housing quality. The American Indian population residing in North Dakota TCC communities totals 23,868. Each of the reservations has a tribally controlled college. These colleges have been characterized as the most potent force for positive educational reform available to the Indian communities served (Carnegie, 1989).

The TCC’s prime source of funds comes from the Federal Government through special legislation for that purpose. Each receives a per-student appropriation is approximately $2,900 per full-time student—hardly enough to support an institution. To meet the needs of the Native American students enrolled, the colleges seek outside resources. Each of the TCC’s participating in this project is a 1994 Land Grant College charged with the development of programs and research for their respective tribes. Carrying out that charge requires tribal expertise, especially in mathematics, science, and engineering. Another initiative created a special relationship between the tribal colleges and the United States Government. On October 19, 1996, the tribal colleges participating in this proposal were named in Executive Order #13021 signed by President Clinton directing the agencies of the Federal Government to grant special consideration to tribally controlled colleges.
There is a need to address the recruitment, academic preparation, transfer and retention of Native American students in mathematics, science, and engineering programs at the North Dakota tribally controlled colleges. All students deserve the opportunity to seek careers in mathematics, science, technology and engineering. Among the students who are proficient and the students who are advanced, there is potential to have students who desire to pursue careers that require higher level mathematics and science courses. Since 1995-96, there have been 131 students who graduated from the tribally controlled colleges with Associate of Science degrees. Fifty-three of them have gone on to the Universities to pursue a bachelor’s degree. Of those who transfer to the Universities, research shows that more than half will drop out and only five of the fifty-three transfers will actually complete their program of study. This is not satisfactory.

II. TCC and NDSU Prior Collaboration

As the only four year land grant institution in North Dakota, North Dakota State University (NDSU), is keenly aware of the TCCs positive impact on their communities and their limited resources. This presents NDSU with the opportunity and responsibility to support the TCCs. For example, a FIPSE (Funds for the Improvement of Secondary Education, Office of Education) call for proposals served as a catalyst for dialogue between the President and Academic Vice President of Turtle Mountain Community College (TMCC), NDSU staff and engineering faculty. This dialogue included discussions about the needs of the Native American students who transfer to NDSU engineering program and the potential support that would increase the retention and completion rates of these students. The conversations took place both on the NDSU campus and the TMCC campus. The site visit to TMCC provided an opportunity for the TMCC faculty and 5 NDSU faculty and staff to meet face-to-face and discuss the educational needs and challenges of the TMCC students who were transferring to NDSU. This discussion would be a baseline for the collaboration resulting in the development of the Office of Naval Research (ONR) proposal.

III. ONR Project Collaboration

The initial steps of this ONR process began with TCC college administrators meeting an NDSU engineering faculty at a conference in May 1998. He was very receptive to the idea of getting involved with tribal colleges for the purpose of helping Indian students succeed at engineering careers. They all agreed that we would look for an opportunity to seek funding to get a project started. When the North Dakota Tribal College Deans were presented the opportunity to them to join in this search, they all wanted to be involved. These tribally controlled colleges are Turtle Mountain Community College, Sitting Bull College, Cankdeska Cikana Community College, Fort Berthold Community College and United Tribes Technical College.

The opportunity presented itself in July of 1998. When TMCC received a Request for Proposal (RFP) from the Department of the Navy, Office of Naval Research. This RFP invited proposals from minority institutions who desired to assist minority students with programs designed to help them succeed at mathematics, science and engineering careers. The TCCs agreed to apply and asked the NDSU Engineering Department to become involved.
IV. GDC’s Role in ONR Proposal Development

TCC representatives, NDSU engineering faculty and GDC director discuss how to develop a response to this RFP with five TCCs, address the diversity among the TCC sites, and meet the time constraints, travel distances and the demanding schedules of the TCC and NDSU representatives. A decision is made to use an electronic discussion tool available in the Group Decision Center on the NDSU campus.

The Group Decision Center is a conference room with a computer network and electronic meeting software. This software is designed to gather ideas, discuss and reach consensus in an anonymous and simultaneous electronic discussion and provide a complete report of all the ideas, discussion and all polling results. This tool enhances discussions by providing a level field for all participants. It provides the TCC and NDSU representatives an opportunity to 1) generate ideas, 2) make recommendations and to discuss the pros and cons of each others ideas and suggestions, 3) participate in the electronic discussion which focuses on ideas rather than personalities, and 4) immediate response to ideas and suggestions rather than having to wait for a turn to respond in a verbal discussion. The development of the meeting agenda is critical to successful application of this tool.

The TCC and NDSU faculty and GDC director design an agenda to address the challenges facing TCC and NDSU faculty to increase the numbers of Native American students participation in Math, Science and Engineering careers.

Factors that need to be addressed in the design of the agenda include: proposal goals, project activities, size of the college and area high school student body; location; course offerings; instructional needs including teaching staff, materials, equipment and laboratories; possible process/procedures; how to determine priorities; and how the proposed resources would be allocated.

The meeting leaders plan an agenda including the following activities:
1. Discussion of the three primary goals;
2. Identify the three most critical activities for each of their colleges, discuss them, and prioritize them;
3. List and discuss the information necessary for each activity;
4. Describe what the activity would need to look like at each site;
5. Identify Summer Programs and develop the concept;
6. Describe the Scholarships and other financial support needed;
7. Design the curriculum and necessary infrastructure, i.e., faculty exchange, distance learning, collaborative teaching with high school teachers, TC faculty and NDSU faculty;
8. Discuss project management models and arrive at consensus;
9. Determine resources needed; and
10. Review the discussion and Next Steps

The last activity of the session was an evaluation of the meeting. The comments were very favorable and included the following remarks:
“IT gets everyone involved.”
“I could see everyone’s comments right away.”
“…A lot more got done in less time, not only generated ideas but also processed them.”
“Time saving, helps organize thoughts and eliminates cumbersome note taking.”
“Group participation and seeing what others are thinking and building on those ideas”
“Saved us a lot of time in putting together our ideas for a grant.”
“…Group effort made easy. FUN!!”
“I think it is a good way to share information, everyone gets to be heard!!”
“…Pulls these ideas together in a timely fashion.”

Indeed, this process works very well in gathering information in an organized process, prioritizing ideas, custom design the various proposal activities and factor in the unique situations at each site. When writing a complex proposal based on the collaboration of five TCCs and NDSU it was imperative to gather detailed information, and design, as a group, the activities which would make this project viable.

V. The ONR Proposal Concept

The electronic discussion of the project, potential outcomes and design the project’s mission, goals, objectives, activities and budget justification was basically completed in an eight hour meeting. The budget was refined using the Interactive Video Network (IVN). The proposal text was refined by email.

The proposal represents a collaborative effort between North Dakota's five tribally controlled colleges and North Dakota State University College of Engineering. The document describes a mathematics, science, and engineering initiative designed to nurture Native American youth from North Dakota's Indian reservations into careers involving these disciplines by creating a pathway for success for the students.

The proposal addresses the needs inherent in the recruitment, academic preparation, transfer and retention of Native American students in mathematics, science, and engineering programs at the North Dakota tribally controlled colleges.

This project has the potential to impact the needs of the North Dakota Native American reservations in the following ways: (1) The tribally controlled colleges will develop the infrastructure required to continue to address mathematics, science, and engineering at the tribal college level. (2) The reservation high schools will become aware of the academic needs of Native American students who desire to pursue mathematics, science, and engineering careers and will be able to put programs in place to nurture those students. (3) The University faculty will become aware of the diverse needs of the Native American students by participating in the cultural awareness activities of the mathematics, science, and engineering faculty. (4) The tribal colleges and NDSU will have a working relationship in place to continue nurturing Native American students. (5) Some Native American graduates will return to their communities as role models and will be able to address the mathematics, science, and engineering needs of the reservations. (6) Some Native American graduates will continue their careers off reservation and make contributions to society in general.

Reservation's high schools do not offer complete pre-college math and science experiences due to remoteness, inadequate facilities, and limited staff. It is essential to offer additional math and
science exposure to these students to attract and prepare them for math, science and engineering careers. Therefore, summer camps are proposed at each of the TCC locations to benefit the students from the high schools feeding the colleges. Both juniors and seniors will be included for participation in these camps.

The students enrolled in the tribal community colleges will find it easier and desirable to transfer to the university for completion of their math, science or engineering programs, if the TCC courses transfer and if the demand on the cultural adjustment is made smoother. The proposed curriculum development activities and the summer camp for the TCC students are designed for achieving just the same.

The planned activities are designed to stimulate the interest of Indian youth from the North Dakota reservations in careers such as engineering and those involving higher level mathematics, science and technology skills. It also charts a plan for improvement of mathematics, science and technology skills of Indian students and the systemic reform of curriculum at reservations schools where they are in attendance. (See Native American Student Pathways, p.7 Figure 1)

It contains a high school component that is designed to attract, recruit, and prepare Native American students for entry into tribally controlled colleges by involving them in summer programs and Sunday academies throughout the academic year. While they are on the reservations participating in the summer programs, special emphasis will be placed upon introducing the NDSU faculty to the tribal culture of the Native American students so they are sensitive to the tribal backgrounds of the students. This component also addresses the implementation of curriculum at the high school level to complement the career goals of students seeking careers in mathematics, science and engineering. Upon graduation from high school, the students will be encouraged to enter the tribal college to seek an Associate of Science degree.

The Native American tribal college component contains scholarships and summer program experiences at the North Dakota State University (NDSU) campus designed to nurture, retain and prepare the Native American students for mathematics, science and engineering careers. Development and articulation of the courses in the tribal college engineering programs of study will also be a focus of the grant.

When the students transfer to NDSU, special support systems, including scholarships, will be in place as well as opportunities for students to participate in cooperative work experience positions with professionals from mathematics, science, and engineering disciplines in the private sector. The NDSU engineering faculty who are part of this project will act as mentors to the Native American students which should enhance their probability for success. (See Project Management, p7, Figure 2; Activity Flow, p8, Figure 3)

At the conclusion of the project, the North Dakota tribally controlled colleges anticipate that they will have programs in place on their campus and leadership in their communities to continue the programs. The North Dakota State University will have faculty who are sensitive to the needs of Native American students. The project will greatly enhance the future of the North Dakota tribally controlled colleges and the clientele they serve.
Figure 1. Native American Student Pathways

PATHWAYS
- High School
- Tribal Community College
- North Dakota State University

APPROACH
- FACILITATE ENTRY
- FACILITATE TRANSFER
- ATTRACT
- RECRUIT
- PREPARE
- NURTURE
- RETAIN
- SUPPORT
- COMPLETE

ACTIVITIES
- General Population
  - HS summer camps
  - Sunday academy
  - Mentoring
  - Scholarships
- Skilled Population
  - Summer camp
  - Course development and articulation
  - Mentoring
  - Scholarship
- Professional Population
  - Co-op
  - Undergraduate research experience
  - Scholarship

Figure 2. Proposed Project Management Structure

Community college
- C. Davis
- PI
- Co-PI’s

NDSU
- G. Padmanabhan
- R. Pieri
- PI and co-PI’s

Campus Coordinators
- Cankdeska Cikana
- Fort Berthold
- Sitting Bull
- Turtle Mountain
- United Tribes
- NDSU
- Pieri

Program Coordinators
- Gourneau
- Borgen
- Padmanabhan
- Lin
- Davis, Young Bear
- Vermillion
- Yellow Bird
- Patterson

Project Evaluation
- Internal
  - PI and co-PI’s
  - Campus
- External
  - J. Hoover

Internal
- PI and co-PI’s

External
- J. Hoover

PI and co-PI’s
- Campus

Co-PI’s
- J. Hoover

Faculty
- J. Hoover

Support
- J. Hoover

Research
- J. Hoover

Development
- J. Hoover

Infrastructure
- J. Hoover

Co-op
- J. Hoover

Mentoring
- J. Hoover

Scholarship
- J. Hoover

Course development and articulation
- J. Hoover

Summer camp
- J. Hoover

Mentoring
- J. Hoover

Scholarships
- J. Hoover

HS summer camps
- J. Hoover

Sunday academy
- J. Hoover

Mentoring
- J. Hoover

Scholarships
- J. Hoover
Biographical Information

CAROL DAVIS, PI (TMCC)
Carol Davis, the Vice President at TMCC, will serve as the PI for this project. She joined TMCC in 1989 as Academic Dean. She became Vice President in 1994. Her duties include supervision of academic and support programs. She is Co-Principal Investigator for a National Science Foundation Rural Systemic Initiative project which serves nineteen American Indian tribes in six states.

G. PADMANABHAN, Co-PI (NDSU)
Dr. G. Padmanabhan is a Professor and Chair in the Department of Civil Engineering and Construction at NDSU. Has been responsible for developing experiments and an instruction manual for the Fluid Mechanics laboratory at NDSU. Recently, Dr. Padmanabhan attended a meeting ‘Engineering Articulation Summit’ discussing ways of articulation of courses taught at tribally controlled colleges to Universities.

ROBERT PIERI, Co-PI (NDSU)
Robert Pieri is Professor and Mechanical Engineering Chair at NDSU. Ten years of his teaching career were spent as an instructor/professor at the United States Air Force Academy (USAFA). Dr. Pieri has a ten year involvement with the American Society for Engineering Education and has served as a co-chair for ASEE’s new Engineering Educator Division.

WEI LIN, NDSU
Dr. Wei Lin is an Assistant Professor in the Civil Engineering Department at NDSU. He received his Ph.D. in civil/environmental engineering from State University of New York at Buffalo. Dr. Lin teaches several environmental engineering courses at NDSU. He incorporated computer application and experimental studies in his course to address the multi-disciplinary nature of environmental engineering.
FLOYD PATTERSON, NDSU
Floyd Patterson is an Associate Professor of Electrical Engineering at NDSU. He has been a faculty member at NDSU since 1968. Professor Patterson has several years experience teaching the introductory and motivational material to Electrical Engineering freshmen. In this course he has illustrated physical phenomena in graphical and/or mathematical form using MATLAB.

SHARON COBB, NDSU
Sharon Cobb has developed the NDSU Cooperative Education Program which realizes over 600 placements annually, with a network of nearly 400 active employers. This campus-wide program will serve as the employer base for the ONR project. Currently, she directs the Group Decision Center which will be used through out the project.