RESEARCH INFRASTRUCTURE IMPROVEMENT (RII 4)
PROPOSAL DEVELOPMENT PROCESS

EDUCATION & OUTREACH WHITE PAPER

FOR DISCUSSION
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TITLE: SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS (STEM) EDUCATION FOR DEVELOPING AND SUSTAINING ENERGY, ENVIRONMENTAL, AND HUMAN RESOURCES OF TRIBAL COMMUNITIES

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Science, Technology, Engineering, and Mathematics (STEM) Education for Developing and Sustaining Energy, Environmental, and Human Resources of Tribal Communities.

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1 - Tribal Colleges STEM Education Challenges: New local, national, and global economical challenges, in general, and economical development and employment challenges of Native youth and Native communities, in particular, coupled with fast pace of technological advances has created new problems as well opportunities. US are posed with big challenges in its competitiveness and share of innovative technology-based economy. Several private and government studies have pointed to the problems in STEM education. Most of the advanced technology and engineering programs, nationwide, are suffering from low enrollment and struggling to stay afloat. The problems range from the lack of preparation of HS graduates, lack of faculty professional development, out-dated and obsolete curriculum and labs to fewer manufacturing jobs due to outsourcing and globalization.

We have identified strategic areas that, upon investment of resources, will help our tribal colleges STEM programs to grow, stay adaptive and responsive to the new challenges.

We need to incorporate the following thrust and focus areas in our annual planning and requests for funding from our long-term partners such as DOI, DOE, DoL, DoEd, Dept. of Agriculture, NASA, NSF and private and non-profit organizations. I believe there is no shortage of funding for Native American Colleges.

We need to invest in the strategic areas by short-, mid-, and long- term development of 1) outreach and students placement, advisement, retention, education and training, 2)faculty professional development and new hires, 3)student timely graduation, and university transfer or career advisement and placement, in each area.

We are concerned with our students' retention and graduation rates, which in some cases is due to the lack of needed course offerings for timely graduation. I am afraid that, in some cases, we lose, turn-off, or discourage our more talented, prepared and enthusiastic students. We need to finalize an organization chart based on our strategic plans for the next 10 years. We need to expedite hiring of new and competent faculty and support staff and technicians in the areas of physics, chemistry, Math, civil engineering, CAD, natural resources, and IT. We need continuity, sustainability and stability in STEM areas. A successful education system needs memory, seniority, endurance, and continuity. The study shows more than 50% of what we teach in technology areas is obsolete by the time our students graduate. We are training them for jobs that do not exist in ten years. The world technical information doubles every two years.

STEM curriculum designed for tribal colleges and universities need to have the following features:

1 – Enrichment Year (1 + 2 + 2 model)
2 – Multiple entry and exit points with certification
3 – Distance Learning Component
4 – Project-based and hands-on courses front-loaded
5 – Down, across, and up articulation. 4-year, high-school, and other tribal colleges.
6 – Summer research opportunities
7 – Inclusion of Internship, Design Project, and Special Topics courses.
8 – CADCAM, GIS/GPS, IT Essentials,

9 – Tele-presence and tele-operated laboratories, distance learning.
10 – Community work and VIP model.
11- Sufficient budget and time for institutionalization- 10 years, $10M
12- Computational tools, Materials Science, Renewable Energy, and Engineering Ethics
13 - Educating the administrators and policy makers!
14- ABET accreditation challenges
15- Small business and entrepreneurship, 2 + 1 and 3 + 2 programs
16 - ROSE STEM for Life!
17 – Strategic planning for grants and soft funds.
18 – Introduction to Engineering and Design Course – Upfront
19 – Students Research Experience teams: O&R, I&D, and I&D teams
20 - Indigenous science and technology courses

2 – The format for the collaboration between tribal community colleges and the main stream universities: Within the framework of an agreement approved by the highest institutional authorities, both institutions should focus on the development of the following activities:

1 - Faculty Development and Exchange
a. The university partner will develop a Summer Faculty Program for the tribal college faculty in order to promote research collaboration among institutions.
2. Student exchange
a. The university partner will provide travel and living support on a semester basis for Ph.D. students to serve as mentors in the tribal college design project courses.
b. The university partner and the tribal college will develop and support joint educational design projects involving undergraduate student teams from both institutions.
c. Tribal community college will provide assistance in identifying and encouraging potential Native American students to apply and enroll in the undergraduate and graduate programs at the partner university.
3. Joint Curriculum development
4. Accreditation support
5. Laboratory development
6. Sharing research resources
7. Joint training and research programs
a. the university partner and the tribal community college partner will develop joint proposals in areas of mutual interest.
8. Distance, continuing, and E-education and the development of the "Special Topics" focus.

3 – The strategic educational programs

1 – Develop, enhance and expand ATE department **Internet and web presence, online resources, E- learning, distance education, and remote-controlled STEM labs**. We need to fully automate the outreach, recruitment, and placement, and student registration, library research processes. This will facilitate our outreach, public relations, and flexible and adaptive community reach and better education and training for our on-site and remote learners. .
2 – Expand and enhance the **CCTI initiative, HS technology/engineering academies, and our partnership with BIE, area and regional middle and high schools with pre-dominantly Native students population**. We need to down-articulate our "Enrichment Year" with those 9-12 schools and articulate with other TCU's for concurrent, dual enrollment and student's lateral transfer. CCTI initiative, which is a version of the tech-prep, program, which SIPI had for years, will save us huge resources we put in ABE and developmental education by sending us more prepared incoming students. A major reason for low enrollment in STEM areas is the lack of

preparation of HS graduates in STEM areas. This has transformed colleges into overgrown and glorified high schools.

3 – Expand, enhance and develop modules, courses, laboratory experiments, students design projects, special topics courses, internships, certificate programs in the areas of ***Native technology-based small businesses and entrepreneurships***. These areas can be integrated into all ATE STEM academic programs.
4 – Expand, enhance and develop modules, courses, laboratory experiments, students design projects, special topics courses, internships, certificate programs in the areas of **renewable energy and sustainability**. Energy, environment, technology, and life are holistically connected and these areas can be integrated into all ATE STEM academic programs
5 – Expand, enhance and develop modules, courses, laboratory experiments, students design projects, special topics courses, internships, certificate programs in the areas of **Voice over IP (VoIP), wireless networks, and computer security**. These areas can be integrated into all ATE STEM academic programs
6 – Expand, enhance and develop modules, courses, laboratory experiments, students design projects, special topics courses, internships, certificate programs in the areas of **supercomputing, data presentation, visualization, and mining, and computer graphics and animation**. These areas can be integrated into all ATE STEM academic programs
7 – Expand, enhance and develop modules, courses, laboratory experiments, students design projects, special topics courses, internships, certificate programs in the areas of **computer-aided design and drafting**, **GIS, GPS, urban planning, surveying, and resource management**. These areas can be integrated into all ATE STEM academic programs.
8 – Expand, enhance and develop modules, courses, laboratory experiments, students design projects, special topics courses, internships, certificate programs in the areas of **civil engineering, power engineering, and construction management**. These areas can be integrated into all ATE STEM academic programs.
9 – Expand, develop modules, courses, laboratory experiments, students design projects, special topics courses, internships, certificate programs in the areas of **bio-informatics and biotechnology**. These areas can be integrated into all ATE STEM academic programs.
10 – Expand, develop modules, courses, laboratory experiments, students design projects, special topics courses, internships, certificate programs in the areas of **instrumentation, control, automation, and robotics**. These areas can be integrated into all ATE STEM academic programs