COMMUNITY-BASED STUDENTS RESEARCH EXPERIENCE PROJECTS FOR TRIBAL COLLEGES

VERTICALLY INTEGRATED PYRAMID APPROACH TO RESEARCH, OUTREACH, AND STUDENT EDUCATION, SCIENCES, TECHNOLOGY, ENGINEERING, AND MATH.  
(VIP ROSE STEMS)

QUALITY EDUCATION FOR MINORITIES (QEM) NETWORK  
NATIONAL SCIENCE FOUNDATION (NSF) TRIBAL COLLEGES AND UNIVERSITIES PROGRAM (TCUP)  
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Southwestern Indian Polytechnic Institute—Overview

SIPI is an accredited national Indian community college with students from over 100 Native Nations.

Approximately 550-650 students
Located in Albuquerque, NM
USDA Land Grant Institution since 1994

SIPI Mission Statement
Southwestern Indian Polytechnic Institute is a National Indian Community College that prepares Native American students to be productive life-long learners as tribal members in an ever-changing global environment. As a land grant institution, SIPI partners with tribes, employers, and other organizations with a stake in Indian education. An enduring commitment to student success is the hallmark of SIPI’s operations.
NSF, NASA, DOE, and DoD assisted SIPI in Developing S Programs

New Science and Technology Building opened Fall of 2003
74,000 sq. ft with office, laboratory and classroom facilities
The mission of the Advanced Technical Education (ATE) Department is to provide students with a comprehensive and up-to-date technical and scientific education in their program areas. This education is based on a rigorous general education component that allows our graduates to transfer to four-year baccalaureate programs and/or enter the workforce. The ATE Program supports students through their crucial first two years of college, providing them with both the necessary academics and the student success skills they will need to complete a four-year degree.

SIPI offers Associate of Science and Associate of Applied Science degrees in several areas:

- Natural Resource Management
- Geospatial Information Technology
- Environmental Science
- Instrumentation & Control Technology
- Computer Network Management
- Pre-Engineering
NATURAL RESOURCES PROGRAMS AT SIPI

SIPI is a Land Grant Institution (1994)

Natural Resources, and Environmental Science

Emphasize successful transfer programs to 4-year Universities

Strong science education with equal emphases in both field ecology and training in laboratory techniques
**Electronics Technology Programs**

- Instrumentation and Control Technology
- 2-year A.A.S program
- Graduates employed by INTEL, FAA, BLM
- Transferable to 4-year Engineering Technology Programs
Network Management Programs at SIPI

Network Management program
A+ and Cisco Certification
25 students
Two-year A.A.S. program
Engineering Programs at SIPI

Integrated laboratory stations, CADD tools, and project design and implementation shop

Integrated Outreach, Education, and Research for Lab. facility utilization
MARS YARD DEVELOPMENT

Science & Technology Bldg Indoor Mars Yard
Artist rendering

LED lighting and Green Screen Tech
- Actual Mars Scenery superimposed over walls

- Mars Yard Building is systematically being updated

- Interim Development Robot
  - Similar control system as Main Robot
VIP ROSE STEMS PROJECTS
I-C-MARS GROUPS

- Research and Development
  - Mobile Robots Platforms
  - Intelligent Cooperative Multi-Agent Robotic Systems
  - Mars Yard Team
  - Alternative and Renewable Energy Sources

- Student Education and Outreach
  - Roadrunner Curriculum
  - Electronics Design Lab.
  - Senior Design Projects
  - I-C-MARS Curriculum

- Documentation and Information Dissemination
VIP ROSE STEM Research Experience Projects
Fall 2013- Summer 2014
(For students enrolled in the ENGR 105 and ENGR 290 courses)

1 - Project Team A:
Development of the SIPI Educational Mobile Robot and RPI Mobile Studio Kits for Research, Outreach and Students Education – SIPI Road-Runner Series.
Faculty Advisor/mentors: Dr. Nader Vadiee, Mr. Mike Majedi
Mentors: Jonathon West, Zach Netzer

2 - Project Team B
Development of the SIPI Educational Wind Tunnel Test-bed and integration of the RPI Mobile Studio Boards
Faculty Advisor/mentors: Dr. Nader Vadiee, Dr. Riccardo Bevilacqua, Daniele Gallardo,
Mentors: Jonathon West, Kevin Blackhorse, Zach Netzer, Wendi Cole

3 - Project Team C Exploring Bio-Engineering Systems Modeling and Simulation .
Faculty Advisor/mentors: Dr. Jaime Juarez, Dr. Jennifer Pascal, Dr. Nader Vadiee

4 - Project Team D Jemez Pueblo Mega Solar Power Plant Studies-DOE Project.
Faculty Advisor/Mentors: Dr. Nader Vadiee, Dr. Mehrdad Khatibi (NAU)
Mentors: Mr. Jonathon West, Matthew Collins, Tomzak Billie

5 - Project Team E: The pulse of the Bosque: Design an environmental monitoring system and Integration of the RPI Mobile Studio Board.
Faculty mentor: Dr. Mark Stone (UNM) , Dr. Nader Vadiee,
Mentors: UNM Student mentors: Colin Byrne, Jeffrey Samson, Rafael Perea, and Sophie Stauffer.
Seven Pillars of Research Experience for Undergraduates (REU)

1- Understanding the Relevance of Math, Physical and Social Sciences, and Computational tools to Engineering and Engineering Technology Research and Development

2 – Acquiring Soft Skills, creative and critical thinking, life-long learners, teamwork, time and resource management, communication, etc.

3 – Exposing to Career and Professional Opportunities

4 – Mentoring and Tutoring opportunities, VIP structure

5 – Learning New and Cutting Edge Research and Development in the Field

6 – Cross-disciplinary team projects

7 – Community-based Research and Development (Renewable Energy, Sustainability, Construction Engineering, Mars Yard, Summer TCU Engineering Institute, etc.)
Venues and Vehicles for Delivering

Intro. to Engineering and Design-ENGR 105
Intro. to CADD- ENGR 101

Intro. Computer Information Systems-CIS 101
Intro. To GIT- GIT 101
Intro. To Electronics-ET 101

Computing Tools for Engineering– ENGR 110

Engineering Internship-ENGR 280
Engineering Design Project- ENGR 285
Special Topics Course- ENGR 290
Some of the Key Best Practices

1 - Safety Net Certificate Programs

2 – Multiple-Exit and Multiple-Entry Point

3 – 1 + 1 + 2 + 2 Curriculum Structure

4 – Four Capstone courses:
   a - Intro to Engineering Sciences and Design,
   b – Design Project,
   c – Internship,
   d – Special Topics Course
Engineering education is and will continue going through major paradigm shifts

The new concerns over environmental impacts and energy usage sources and efficiency of engineering projects, processes, and products, the advent of computational tools all fuel those changes and impact the way we teach and practice engineering. We need to understand that it is the age of “access” and not “posses” of information and knowledge. The students need to be trained to have be life-long learners, critical thinkers, and problem solvers. They need to be able to work in teams, communicate, and collaborate on projects. The future educational system will offer personalized and customized, with multiple entry and multiple exit points for a life-long learning, programs of study in a multi-function and reconfigurable dynamic, interactive, team-based, problem-based, teaching-learning environment. Future classrooms will be multi-functional and offer 1- Interactive multi-media-based lecture, 2 - Computer lab., 3 – Physical Lab., and 4 – field or shop facilities.

The curriculum is multi-modal and will present topics, concepts, and ideas in a holistic approach in all of the following seven formats or world models:
Examples Community-based Research Projects

The SIPI sub-award is designed to build the "capacity for engineering education and research experience on the "Renewable Energy Technology" at SIPI and other tribal; colleges through SIPI dissemination of information and summer "Tribal Colleges Faculty Professional Development" Institute.

Diabetics Diagnosis and Management Technology

Jemez Mega Solar Power Studies
The NAU university partnership provides support for SIPI engineering courses: ENGR 105, ENGR 280, ENGR 285, and ENGR 290, described briefly in the following:

SIPI Supports Dream Catcher STEM Program - 2012
A team of SIPI students from the engineering programs, offers the "“Engineering” & Design" workshop for the 2012 Sandia National Labs Dream Catcher Science Program. The “Engineering & Design” workshop is comprised of Hands on activities on Microsystems Education, Robotics, and CNC machines.

Energy Audit of the SIPI Student Union Building, Smart Lighting Project

SIPI-AISES-NSF Jemez Pueblo Geo-Thermal Outreach and Education

SIPI Solar House Design

UNM-DOR SOLAR DECATHelon Project
SIPI Engineering Programs invited to join UNM and ASU for the 2013 Solar Decathlon Competitions. UNM and ASU have recently been selected as one of the 20 teams to participate in Solar Decathlon 2013. SIPI students will to work with UNM and ASU teams on incorporating some of the Native American heritage into the design work

SIPI_Educational Mobile Robot Platform/NASA TCU ELO Project
Tribal high schools and colleges can use the SIPI RoadRunner 3.0 platform to teach C, MATLAB, LabView computer programming, robotics, computer networks, microcontrollers, microprocessors, sensor technology and etc.
ENGR-SIPI / Roadrunner 3 Training Manual
World Models

1 – Linguistic, word, text-based, story-telling, natural language, fuzzy and qualitative descriptive world models
2 – Multi-media, electronic games, animation and computer graphics-based, artistic world models
3 – Experimental, analog and digital Simulations.
4 – Logical models, flow charts, block diagrams, signal flow, etc.
5 – Numerical, data-based, look-up tables, sensory and measured collected data
6 – Computational, rule-based, expert systems, statistical, and data mined world models
7 – Analytical, mathematical, theoretical models
8 – Intuitive, common sense, and cognitive world models
List of Major Universities and Institutions of Higher Education Partnerships

UNM, NMT, NMSU, RPI, NAU, UNT, U of A, ASU, CNM, SFCC, Ten. Tech

List of the Public Institution Partners:

NM MASC, NMHED, NASA, DoD, AFSOR, AFRL, NSF, USPTO, NM EPSCOR, UNM ASERT, NM AMP, NATIONAL MUSEUM OF NUCLEAR SCIENCE AND HISTORY, SNL. ARGONE NATIONAL LAB. LAWERANCE LIVERMORE NATIONAL LAB.

List of the Private Institutions,

DMA, WOLFRAM ALPHA, AIHEC, SACNAS, AISES, NIEA

K-12 Schools
BIE SCHOOLS, NATIVE AMERICAN SERVING HS,
Tribal Schools
SKC, DINE, NWIC, and 11 colleges members of the TCU Engineering Programs Working Group
SIGN UP NOW!
Fall 2014 Trimester!
ENGR 105
Introduction to Engineering and Design

Instructor: Dr. Nader Vadiee
Pre-requisite: Your interest in Engineering or Robotics!
CAD / CAM JOURNEY TO ENGINEERING

- Making Connection
- Making it Simple
- Making Effective Tools & Techniques into Daily Life Practices
- Native Community Projects
Making Connection

- Familiar to Cross Over Knowledge & Experience
- Knowledge of HS CADD as a Familiar Tool

Dimension & Annotate
- Used in Every Trade
- Read & Create Blueprints

Welding Experience
Fillet
Chamfering
MAKE IT SIMPLE

Making a proven Design For Manufacturing (DFM) Technique Part of Daily Life, including Education

Kaizen & Design Consideration:
• Cont. Improvement, Environment, Recycle, Value Added, Respecting Customer, ...

“I may not be there yet, but I'm closer than I was yesterday.”

~Author Unknown
NATIVE COMMUNITY PROJECTS

How Can I Benefit My Community: Water for My Community

Introduction
Fort Defiance, Arizona, is a tribe that is very proud of its community. There are many local businesses and organizations that want to help the community.

Problem
Many people in Fort Defiance are on the water side and need water storage. This project will benefit people by providing them with the water they need.

Solution
The project will provide water to Fort Defiance and it will be used for community purposes as well.

Proposed System Design
The proposed system design will consist of a water distribution system that will provide water to the community. The system will be designed to meet the needs of the community and will be cost-effective.

Drinking Water Storage
The system will be designed to store water in a way that is safe and efficient. The water will be stored in large tanks that are located near the community.

Bioengineering in the Native Community
Stratton Ellsworth, Anthony Yazigi, Caleo John, Ryan Moen, Mark Magdalen, Engineering and Design Department, Southwestern Indian Polytechnic Institute

Instructional Wind Tunnel Design & Manufacturing for Civil Engineering Applications
Settling Chamber and Contraction Section

Setting Chamber
The purpose of the setting chamber (Figure 1) is to remove air turbulence by stagnating air flow. The airflow component can cause unintentional variability and danger carried throughout the entire system. There are numbers of fans and turbines as well as other equipment which can cause turbulence if not handled properly. The Enclosure (Figure 2) prevents turbulence contamination from outside of the wind tunnel.

Contraction Section
The contraction section accelerates the flow gradually within a steady condition to the velocity needed in the wind tunnel. The acceleration has to be gradual to avoid developing of the flow that would generate turbulence.

Form Factor
S, the compression ratio: the desired ratio of the area of A_s to the area of A, is

PV and Screen Filters
The PV and Screen Filters are designed to provide air flow reduction, which further straightens the air flow preparing it for the contraction section.

ACKNOWLEDGMENT
I would like to acknowledge, BIL, Yiyung, Zuhuy, Fort Defiance, Fort Defiance Chapter House, Dr. Kerri Allison, UNM, The Advances Technical Education, for the support given to us.

ACKNOWLEDGMENT
With these improvements, our community will benefit from reduced energy costs and increased access to safe drinking water.

REFERENCES
1. American Indian Center, "Water and Sanitation in Native Communities: A Community Development Perspective.
2. National Water Research Institute, "Water Quality Assessment in Native Communities."
Thank You!

Questions?