AIHEC Cyberinfrastructure Initiative

TCU STEM Leaders Update
September 1, 2020
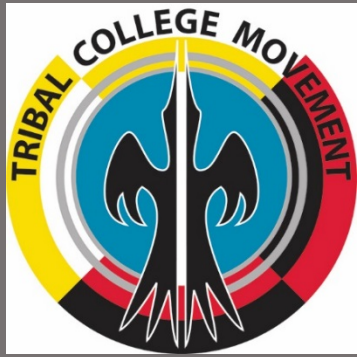
AIHEC's STEM Initiatives
Strengthening the tribal college movement

- Contributing to Native Nation-building
- Growing STEM leaders from the community
- Facilitating Tribal economic development through participation in the national STEM economy
- Strengthening national AI/AN STEM career pathway
- Helping address local issues (e.g. climate change)

AIHEC TCU Cyberinfrastructure Study Project

A two-year project to:

- **examine the capability of each TCU's cyberinfrastructure** to support participation in the national STEM education and research infrastructure

- **provide a primary planning and evaluation resource** of TCU national and regional connectivity, compute capabilities, and human resource requirements

- **provide information needed by each TCU** to articulate (or update) and begin implementing a sustainable Campus Cyberinfrastructure Plan

Cyberinfrastructure 101

- United States federal research funders use the term **cyberinfrastructure** to describe research environments that support advanced data management, data integration, data analytics, data visualization and other computing and information processing services distributed over the Internet beyond the scope of a single institution.

- **In scientific usage, cyberinfrastructure is a technological and sociological solution to the problem of efficiently connecting laboratories, data, computers, and people with the goal of enabling derivation of novel scientific theories and knowledge.**

Study Takeaway #1: IT staffing

- TCUs spend around half of their IT budgets on staff
- Very few TCUs employ students to provide tech support to the campus user community
- Using students could free up IT techs to focus on other issues
- It would provide students valuable hands-on experience and skill-building in IT

Takeaway #2: Equipment replacements

- TCUs don't seem to replace network equipment regularly
- The average is 8.29 years between replacements
- Standard practice is closer to 3-5 years

NETWORK HARDWARE

Takeaway # 3: Internet Connectivity

- Overall connectivity is pretty good: TCUs average 513 Mbps connection speeds

- Maximum: 2,000 Mbps; Minimum: 10 and 15 Mbps

- Average Internet connection cost is $60K/year

Takeaway #4: Information Security

- Over 20% of TCUs don't separate servers that manage credit card, student information from the campus network
- These TCUs can't meet basic data security requirements of PCI, FERPA, GLBA

Some General Recommendations

- Participatory/engaged IT governance
- More focus on risk management
- Dedicate more resources to IT organizations
- Strength in numbers: more collaboration/resource leveraging among TCUs

TCU Cyberinfrastructure Study Outcomes

- **Campus infrastructure:** developed IT infrastructure upgrade/improvement recommendations for 35 TCUs

- **IT personnel:** facilitated IT community of practice, collaboration among TCUs, support for national meetings

- **CI partnerships:** established partnerships with national CI resources/stakeholders: TACC, CCAST, Northern Tier Network Consortium, Internet2, Open Science Grid, HTCondor

- **TCU STEM R&E:** developing CI education platform: Climate Collaboratory, other CI education resources for all TCUs

- **Funding:** study informed the request for the $20M for TCU infrastructure in the CARES Act; secured additional $1.9 million funding to develop CI at TCUs

Next Steps: support TCUs to develop CI-enabled STEM for local needs

Technical focus

Enhanced site visits
IT Community of Practice
IT training
Regional/national partners

Academic focus

Expanded STEM course offerings
Capacity building in research
Research opportunities
Leverage TCUP funding

Cyberinfrastructure Partners

- Texas Advanced Computing Center

- Center for Computational Assisted Science and Technology (CCAST)

- Open Science Grid - HTCondor

- Internet2

- Oklahoma Supercomputing Center

- University of Miami

  - Cooperative Institute for Marine & Atmospheric Studies (CMAS)

  - Institute for Data Science and Computing (IDSC)

Research Computing in the Cloud

You can design and deploy experiments accessing HPC environments with hundreds or thousands of high-end processors from any connection to the Internet.

- Examples of cloud computing resources:

  - Amazon Web Services (AWS)

  - Microsoft Azure

  - Google Cloud Platform

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Here's a snapshot of your progress in your Learning Journeys.

Computational Climate Science

Introduction to Computational Climate Science

13m   Skill Score Avg: ⌃ 20

Introduction to Climate Science
Last accessed 6s ago

Completed 0 of 1 (0%)
11m   Skill Score: ⌃ 40

Introduction To Linux
Not Started

                                       Start Skill

Introduction to Scientific Python
Last accessed 4s ago

Completed 0 of 1 (0%)
2m   Skill Score: ⌃ 0

Using Jupyter Notebooks
Not Started

                                       Start Skill

Fundamental Skills for Comp. Climate Science

Scientific Python Skills
Not Started

                                       Start Skill

Data Access - Thredds Data Servers
Not Started

                                       Start Skill

Wind Vector Analysis
Not Started

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### Vertical Wind Vector analysis
Not Started

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
Pressure Maps
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Intermediate Skills for Comp. Climate Science

Temperature Gradients
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
Frontogenesis
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
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Vorticity
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Precipitation
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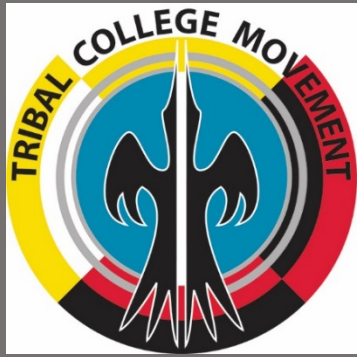
TCU CI Stakeholder Survey
to be sent out mid-September

- The entire TCU campus community invited to participate
- Initiate CI strategic planning at all interested TCUs
- Drive CI-enabled R&E partnerships
- Identify TCU research/education priorities
- Form TCU programmatic clusters (health, climate)
- Align TCU internal and external stakeholders

CI Strategic Planning Workshop Series: NSF TCUP

Goals
- Engage TCUs in CI strategic planning
- Facilitate initial stages of CI strategic planning at participating TCUs
- Assist TCUs in developing CI planning proposals to NSF

Activities
- Start with CI Stakeholder Survey
- Recruit TCUs committed to the CI strategic planning process
- Convene TCU CI stakeholders for plenary web meeting
- Provide MS Teams workspace for each TCU planning team
- Recruit CI consultants based on TCU STEM research priorities and CI needs
- Facilitate asynchronous and synchronous planning activities with each TCU team
- Support TCUs with CI proposal development

CI Research Alignment Project: NSF CC*

Goals
- Develop TCU CI technical capacity
- Support CI-enabled STEM at TCUs
- Facilitate CI strategic planning

Activities

Technical
- Support CI community of practice among TCU IT organizations
- Provide professional development opportunities for IT staff
- Facilitate professional networking for IT staff within CI technical community

STEM programs
- Provide professional development opportunities for TCU faculty in CI-enabled STEM
- Facilitate CI STEM capacity-building

CI Strategic Planning
- Conduct enhanced site visits to support CI needs assessment/upgrades
- Support CI planning through to completed plan at select TCUs

CI Working Group: NSF TCUP

Goals
- Improve the quality of STEM programs through CI partnerships
- Increase engagement in CI-enabled STEM at TCUs
- Reinforce TCU STEM community of practice

Activities
- Virtual meetings (including opening plenary) with CI stakeholder community to share information about programs and generate collaboration ideas
- Online asynchronous discussions among participants
- Develop research opportunities for TCU faculty and students
- Identify TCU STEM course and curriculum gaps/opportunities

AIHEC

TRIBAL Colleges and Universities: *Educating, Engaging, Innovating, Sustaining, Honoring*

CyberTeam Project: NSF CC*
North Dakota TCUs and NDSU

Goals
- Advance ND TCU CI readiness
- Establish CI research and education practitioner community
- Implement workforce development for faculty and students
- Facilitate CI-enabled research partnerships

Activities
- Enhanced TCU site visits
- Support TCUs in implementation of CI upgrades
- Develop CI education/training resources
- Provide training for faculty and students in research computing focused on their research interests
- Train and support TCU students to staff campus IT help desks
- Provide research planning and implementation support to participating faculty

TRIBAL Colleges and Universities: *Educating, Engaging, Innovating, Sustaining, Honoring*

How to Get Involved

- **Complete the CI Survey**
- **Watch for meeting announcements!**
- **Participate in the plenary sessions to learn more**
- **Involve your IT/technology planning team, if you have one**
- **Form a planning team if you don't have one already**

We can get started working with you and your team immediately – Let us know!

Other STEM Projects/Ideas

- Indigenizing STEM Textbooks with Open Education Network
- Climate science curriculum
- Indigenous Design Collaborative
- Online research skills training for student internships
- Your ideas, suggestions?

AIHEC CI Initiative Team

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