

# Living Science



*Strengthening and Sharing Native Knowledge at TCUs*





# Building Knowledge

Tribal college students in the STEM fields are not only grounding their scientific research within their homelands—they're breaking ground by pushing boundaries, solving problems, and exploring questions that benefit the nation at large.

In 1950, Congress created the National Science Foundation (NSF) to promote the progress of science; advance national health, prosperity, and welfare; and secure national defense. At its core, NSF builds knowledge. By supporting the research of thousands of scientists, the agency has changed how Americans think about everything from supernovas to embryonic stem cells.

With an annual budget that in fiscal year (FY) 2010 reached \$6.9 billion, NSF awards 10,000 grants each year and funds about 20 percent of the federally supported research at America's colleges and universities—including, to a modest extent, at tribal colleges and universities (TCUs).

Although the numbers of American Indian students pursuing degrees in the Science, Technology, Engineering, and Mathematics (STEM) fields at mainstream universities have been low, at TCUs, STEM student bodies are growing.

"At some tribal colleges, STEM majors represent a quarter of all students enrolled," said Dr. Jody Chase, NSF's program director for the Tribal Colleges and Universities Program (TCUP), at the 2011 STEM Leaders Forum in Arlington, VA. "There are no other institutions that represent that success." In recent years, for example, Navajo Technical College (NTC, Crownpoint, NM) has experienced a more than 700 percent increase in STEM students.

## Tribal Colleges and Universities

- Aaniiih Nakoda College (formerly Fort Belknap College), MT
- Bay Mills Community College, MI
- Blackfeet Community College, MT
- Cankdeska Cikana Community College, ND
- Chief Dull Knife College, MT
- College of Menominee Nation, WI
- College of the Muscogee Nation, OK
- Comanche Nation College, OK
- Diné College, AZ
- Fond du Lac Tribal and Community College, MN
- Fort Berthold Community College, ND
- Fort Peck Community College, MT
- Haskell Indian Nations University, KS
- Ilisagvik College, AK
- Institute of American Indian Arts, NM
- Keweenaw Bay Ojibwa Community College, MI
- Lac Courte Oreilles Ojibwa Community College, WI
- Leech Lake Tribal College, MN
- Little Big Horn College, MT
- Little Priest Tribal College, NE
- Navajo Technical College, NM
- Nebraska Indian Community College, NE
- Northwest Indian College, WA
- Oglala Lakota College, SD
- Red Lake Nation College, MN
- Saginaw Chippewa Tribal College, MI
- Salish Kootenai College, MT
- Sinte Gleska University, SD
- Sisseton Wahpeton College, SD
- Sitting Bull College, ND
- Southwestern Indian Polytechnic Institute, NM
- Stone Child College, MT
- Tohono O'odham Community College, AZ
- Turtle Mountain Community College, ND
- United Tribes Technical College, ND
- White Earth Tribal and Community College, MN
- Wind River Tribal College, WY



Audra Stonefish (SBC, Oneida) collects prairie turnips for a project on sustainable harvest of traditional plants. Photo by Ron Walters, SBC.



Ed Jones (CDKC) inflating the Kingfisher balloon at the 2011 Fourth of July Kenneth Beartusk Memorial Powwow Grounds, Lame Deer, MT. Photo by Bob Madsen, CDKC.

Front cover: Jacob West (UTTC, Cheyenne River Lakota) releases a snapping turtle as part of Harriet Black Hoop's (not pictured) (SBC, Standing Rock Dakota) study of contaminants in turtle shells. Photo by Dr. Jeremy Guinn, UTTC.



Participants in the 2011 ND Tribal College Research Experiences for Undergraduates (REU) Program are trained on bird banding techniques by mentor Katherine Haas. From top are Jacob West (UTTC, Cheyenne River Lakota), Harvey LaRocque (TMCC, Turtle Mountain Chippewa), and Chad Austin (UTTC, Standing Rock Lakota). Photo by Dr. Jeremy Guinn, UTTC.

For more than a decade, the American Indian Higher Education Consortium (AIHEC) has been a key component of this success. Working closely with the NSF TCU program, AIHEC has provided professional development workshops, executive awareness to the TCU leadership, and “just in time” technical assistance that targets resources as they are needed to support TCUs with STEM planning, project management, and program evaluation. The 2011 STEM Leaders Forum, which brought together over 50 TCU faculty and presidents with NSF officials and program experts, is an example of that partnership. During the Forum, participants shared their ideas for growing—and retaining—TCU STEM students.

They reiterated that increased numbers don’t represent only the success of individual students or tribal colleges. Thanks to STEM faculty who emphasize community-relevant

research, fieldwork, inclusiveness, and collaboration, students are carrying out research on topics ranging from the environmental health impacts of heavy metals and radiation to climate change and the migration patterns of bird species. Tribal college students in the STEM fields are grounding their scientific research within their homelands and breaking ground by pushing boundaries, solving problems, and exploring questions that benefit the nation.

The tribal college movement is also building knowledge in areas such as transformative curriculum, culturally responsive education, and place-based learning. Although these models are unique to the tribal college movement—with its emphasis on educational excellence and Indigenous knowledge—mainstream universities and agencies such as NSF can emulate and benefit from them.

TCUs have demonstrated success within STEM education in four unique areas: culturally responsive teaching methods in mathematics, the successful transition of students from high school to college, inclusive classrooms that respect everyone’s background, and teaching authentic and meaningful science to students of all levels.

NSF has always funded transformative research that excites imaginations and draws people to frontiers of knowledge. Adding diverse perspectives to the STEM research, engineering, and education community is critical to building knowledge, in part because scientists need multiple perspectives to drive innovation, solve problems, and present new ideas. Looking at the world in different ways, exploring new realms of thought, and drawing upon Indigenous knowledge and ways of learning are all crucial to helping NSF stay at the cutting edge of science.



## Broadening Impacts Across the Nation

The scientific community has much to learn from the educational and research models employed by tribal colleges, which view diversity as a cornerstone of the institution—not as a problem to be solved.

Over the course of more than six decades, NSF's mission has evolved to recognize that a more diverse population must participate in the Science, Technology, Engineering, and Mathematics (STEM) fields. In fact, the agency's FY 2006–2011 Strategic Plan specifically calls for seeking and accommodating contributions from all sources and for reaching out to groups that have been underrepresented.

Just as researchers, faculty, and students rely on NSF for funding and guidance, many are realizing just how much NSF—and the nation—need the educational models TCUs provide.

Broadening participation, says NSF Deputy Director Dr. Cora Marrett, is bigger than adding cultural elements to textbooks. It has to do with examining scientific concepts from an Indigenous perspective and ensuring more Native students enter STEM-related careers. Broadening participation also acknowledges that the scientific community itself benefits from diversity and its variety of perspectives. To stay on the cutting edge of science and discovery, the scientific community must not only recognize diversity, but also embrace it.

The scientific community has much to learn from the educational and research models tribal colleges employ, which view diversity as a cornerstone of the institution—not as a problem to solve. TCUs engage the entire community in the knowledge-building process and recognize the importance of culture in shaping lived experience. That lived experience includes creating and applying knowledge in its many forms.

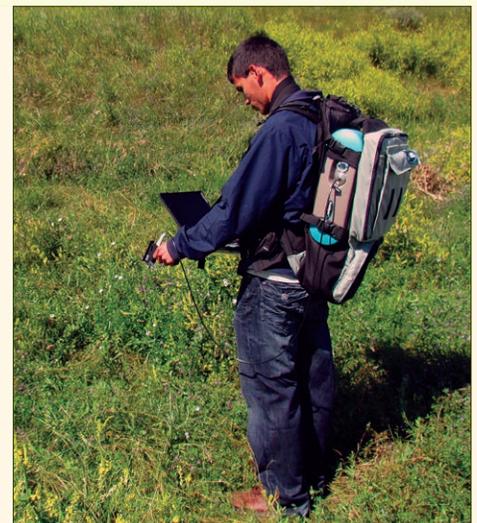
As Marrett noted, if NSF is to remain at the frontier in developing transformative new ideas and fostering innovations, it must integrate discovery into the educational process. Merging the world of discovery with research and education is something at which tribal colleges nationwide are excelling—and it's something they can share with the rest of the world.



U.S. Geological Survey - Coast Salish Water Quality Workshop, Northwest Indian College. Student Maggie (Makokis) Picard (NWIC/U of Idaho, Saddle Lake Cree Nation) examines a YSI 650 water quality monitoring display unit. *Photo by Dr. Joel Green, Science Director, NWIC.*



Fort Berthold Community College students conducting amphibian sampling. *Photo provided by Dr. Kerry Hartman, FBCC.*



Harvey LaRocque (TMCC, Turtle Mountain Chippewa) scans vegetation using a field spectrometer for his summer REU project. *Photo by Dr. Jeremy Guinn, UTTC.*



# Stories Behind the Science

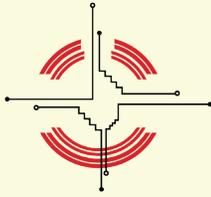
## NAVAJO TECHNICAL COLLEGE

At the 2011 American Indian Higher Education Consortium (AIHEC) Student Conference in Bismarck, ND, Navajo Technical College (NTC), Crownpoint, NM) students Patrick Kínlicheene and Malanie Begay (both Diné) stood before a small group of people. Before presenting their study on the effects of radiation on piñon pine, each spoke of their clans, families, and homes. They also spoke of how piñon sap has been used traditionally by the Diné and told of uranium mining's tragic impact on the Navajo Nation.

Along with NTC environmental science professor Steven Chischilly (Diné), the two-year students were studying the impacts of widespread uranium mining and milling throughout the reservation. They mapped which communities were affected by the mining activities—now banned by the Navajo Nation—and conducted dendrochronology fieldwork, performed DNA sequencing on piñon samples collected from both radiated and nonradiated sites, and are trying to determine whether radiation sources at abandoned uranium mines are causing mutations in the vegetation. Their research serves an additional purpose. "I feel like a real warrior," said Begay. "Doing this, I'm fighting the monster of uranium."

As astonishing as it is that associate degree students are carrying out cutting-edge scientific research, that's business as usual at NTC.

In the past few years, NTC has developed a host of new STEM programs. These include a bachelor's degree in Information Technology (IT) with three different foci (computer science, digital manufacturing, and new media) and a Bachelor of Science in Industrial



Engineering, which was recommended for approval by a team of consultant evaluators to the Higher Learning Commission in December 2011. NTC is also developing bachelor degree programs in environmental science, electronics and computer engineering, and a new associate's degree in mathematics.

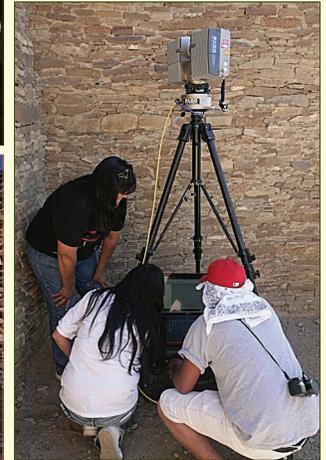
The biggest success NTC's Dean of Instruction Tom Davis has witnessed in his six years at the tribal college is the increase in the number of STEM students. Currently, more than 400 students study in STEM fields at NTC—a more than 700 percent increase in the past few years.

The tribal college regularly partners with mainstream universities, federal agencies, research laboratories, and local agencies. For instance, students of IT Director Jared Ribble (Diné) use their visualization wall for both supercomputing and local projects. Working with the University of New Mexico and the Navajo Nation Emergency Management Service, students developed a database that can create satellite images within ten minutes. These images can help people stranded in inclement weather or provide information for fighting forest fires. The tribal college is building contracting opportunities, including those with NASA and The Boeing Company that allow NTC to pay students for their work.

NTC also nurtures interdisciplinary cooperation. Recently, baking students partnered with construction and renewable



Navajo Technical College students setting lasers for experimental scans in Pueblo Bonito Chaco Canyon, NM. Photos by NTC.



energy students to develop a solar oven. After winning a gold medal in a national competition, the students worked to overcome challenges at home. "On the reservation, you'll find places that have no electricity, no running water—and students were able to showcase their solar ovens," says Jason Arviso (Diné), NTC's director of institutional development and director of the NSF-funded TCUP project at NTC. "Now, they're being asked by chapter houses to come and give demonstrations on how to make them."

With consistent support from NTC President Elmer Guy (Diné), the faculty and students at NTC are making a difference on the Navajo Nation. By expanding scientific research and continuing to advance technology, the Navajo are in a position to be leaders, says Arviso. "Why do we always have to be at the end of the train? Why can't we be at the front end of the locomotive, powering development?" he asks. "There's no reason why we shouldn't be. And technology is one resource we can use to develop. The Navajo Nation and our students have that capability."



# Setting High Standards

## SALISH KOOTENAI COLLEGE



Within the past few years, a host of new degree programs have been accredited at Salish Kootenai College (SKC, Pablo, MT). These include a Bachelor of Science in Secondary Education, Forestry, Environmental Science, Information Technology, Computer Engineering, Hydrology, and Life Science. Each program ties into the tribal college's plan to become a center of science education that emphasizes a Native worldview and the application of science to Indigenous issues.

Within the heart of many of these programs lies mathematics—a challenging subject to teach and to learn. Fifteen years ago, the current head of SKC's mathematics department, Matt Seeley, was the tribal college's only math instructor. Today, the



department offers lower level math classes and a variety of upper level courses required for students seeking bachelor's degrees in biology, hydrology, engineering, forestry, and other STEM-related fields.

The challenges of teaching mathematics to anyone are complex. "I try to slow things down," says Seeley, "and work with students one-on-one as much as I can and show them how mathematics shows up in their everyday life and how an understanding of mathematics and quantitative reasoning can help them succeed financially—and understand the world better."

Seeley also teaches "number sense." Rather than requiring students to blindly follow procedures, he helps them focus on how numbers work together. He frequently uses real-life scenarios, demonstrating how games and gambling scenarios work, and tying lessons into personal finance, loans, and investments.

Once students transition into higher level math courses, SKC's mathematics instructors ensure they continue to receive individual attention in one-on-one situations and small group settings. Instructors also support student research by helping them apply mathematics to local issues, including measuring stream flow, studying disease within a population of trees, or conducting wildlife counts.

Students within the new Life Sciences Department are already conducting innovative research: In 2009, two students and department head Dr. Doug Stevens published a peer-reviewed paper in the academic journal *Environmental Bioindicators*. The students conducted an integrated mercury risk evaluation study of lake trout in Montana's Flathead Lake. According to Stevens, the students' research had a "real community health impact" by causing a revision of the Confederated Salish and Kootenai Tribes' fish

consumption advisories. He anticipates that ongoing work will lead to three follow-up manuscripts.

Funded primarily through the National Institute of Health's Research Initiative for Scientific Enhancement (NIH RISE), NSF's TCUP, and the U.S. Department of Defense Tribal College and University Instrumentation Program, the department also hosts two undergraduate research laboratories: the SKC Cellular and Molecular Biology laboratory and the SKC Environmental Chemistry laboratory.

Whether 15 years ago or today, building new programs requires more than just finding grants and securing funding. "One of the big pieces is bringing in new people who are very motivated and inspired to create new programs: Tim Olson was the driving force behind the computer engineering program, and Doug Stevens has really pushed biological sciences and chemistry research," says Seeley. "It's about finding good people who take it on as their personal mission to bring these about—any important and significant new effort is going to be traced back to one or two people who had a vision and pushed through."

He also points out the importance of administrative support, especially when it comes to small programs. Boosting representation of Native students in STEM fields requires small steps and extra dedication, but it's worth it because the success of even one Native student has resonance within the community.

Successful students return to campus as role models, Seeley says, sharing their research and tutoring students. Many return home to work within environmental and management agencies. "Even just a few students can lead to a great impact down the road," Seeley continues. "It's nice to see them, especially as they travel the world, presenting and going to school in other places, come back and set the standard for the students who follow them."



SKC student Kody Ensley (Confederated Salish and Kootenai Tribes) with his computer engineering instructor, Dr. Frank Stomp. Photo by DJ Pretty On Top, SKC.





# Inclusive Classroom, Creative Collaborations

## **INSTRUCTOR JEREMY GUINN, UTTC**



When teaching ornithology, Dr. Jeremy Guinn doesn't just stand in front of the classroom, lecturing the students seated before him. He relies on real-life situations and Lakota culture to engage his students.

"We talk about feather structure, the parts of the feather, and how they were used for fletching on arrows," says Guinn. Before coming to United Tribes Technical College (UTTC, Bismarck, ND) in 2011, he taught for six years at nearby Sitting Bull College (SBC, Fort Yates, ND). "To make the lesson more realistic, we take the feather apart to see how strong it is, and learn about its barbs and barbules."

At SBC, Guinn taught within the Environmental Science Program, which over 15 years evolved from an employment-based training program to one focused on research training. To graduate, students must develop, conduct, and defend a full research project. Between 2005 and 2010, the Environmental

Science Program averaged more than 80 percent annual retention rate, almost double SBC's overall retention rate.

Research-based science is a great retention tool, Guinn says. Students enjoy hands-on fieldwork and want to see their projects through to completion. They're curious about what their data means—and are excited to bring that knowledge home. "Students talk with the community and their family about their research," he says. "One of the ways the tribal college makes a presence in the community is through those students."

Native STEM students are often able to conduct research never before carried out on their homelands. "I think that's one of the main reasons it's so attractive to community members—it's about their reservation lands—and the importance of that to the entire community is very clear," says Guinn. "Even if it's not a cultural study, it may be a project doing small mammal surveys, but it definitely has a connection to the place, and

it's adding to the knowledge—both scientific and cultural—of the place."

While teaching a full course load at SBC, Guinn earned an associate's degree in Native American Studies (NAS). His intent wasn't to earn a degree. He wanted to be a better teacher.

"I was interested in the culture and learning more about it, but I was also interested in understanding how I could use (Lakota language and culture) to get students more interested in the topics we were covering," he says, explaining that he uses Lakota in class to better describe the natural world. He worked with SBC's leadership to provide incentives to other faculty interested in earning an NAS degree.

Although Guinn wonders what students first thought of him standing in front of class speaking Lakota, he believes he has been accepted by fluent and non-fluent Lakota speakers "It brought everyone together in the classroom," he says. "It bonded the classroom."

## **INSTRUCTOR BOB MADSEN, CDKC**



Bob Madsen believes in using research to build student interest. After all, it sustained his interest in college and graduate school.

An entomologist and former Peace Corp volunteer, Madsen began teaching at Little Big Horn College (LBHC, Crow Agency, MT) 28 years ago. "The first thing I did was start a research program," he says, recalling the initial program was one student and him.

He spent 12 years there, then set about the same type of capacity building at Chief Dull Knife College (CDKC, Lame Deer, MT), where in 1998, he was hired as the NSF-funded Rural Systemic Initiative coordinator. "We built this science program from scratch," he says. "I got in touch with the University of Montana and with duct tape and bailing wire—whatever we could find—built a program here."

Collaboration with mainstream universities, including the University of Montana (UM) and Montana State University, was crucial during those early years. For ten summers, Madsen brought his TCU students with him on his summer research projects with UM—always with the plan to build capacity at the TCU. Eventually, CDKC started procuring grants, including a NIH RISE and grant from the National Institutes of Health, NSF TCUP grants, and an NSF Office of Experimental Program to Stimulate Competitive Research (EPSCoR) grant. Initially, research projects were based out of the mainstream universities, says Madsen. That has changed in recent years. "Now, the research is going on here, with collaboration from Montana State and the University of Montana," he says. "It's really switched around and the research money is now coming from us."

In the almost three decades he's taught at TCUs, Madsen has worn a lot of hats. With an easy laugh, he notes that he's taught everything from biology to statistics. "Being at a tribal college taught me everything I wasn't trained in," he says. "You can get pretty fearless, too, in finding partners and grants."



Instructor Bob Madsen with student Angie Bearquiver (CDKC, Northern Cheyenne) collecting sediment samples from the Tongue River, MT. Photo by Wayne Roundstone, CDKC.



# The Power of Imagination

## DERECK STONEFISH, SBC Alumni

During his last year as a student at Sitting Bull College (SBC, Fort Yates, ND), Dereck Stonefish (Oneida) conducted his fieldwork in the winter. Six days a week, from sunup until dark, he faced North Dakota's winds and freezing temperatures. "That was tough, tough work, but it gave me a basis for what really heavy research is," he says.

Later, when he met some Ivy League students at a conference, he was shocked to learn that their STEM educations had been confined to the classroom. "They had no clue about fieldwork," he says. "I thought that was what everybody does. I had no idea."

Not everyone does what Stonefish has done. The SBC graduate has been a research intern at NASA's Goddard Space Flight Center; presented posters and talks at a dozen symposiums and conferences, including AIHEC Student Conferences and those of the American Geophysical Union, the American

Indian Science and Engineering Society, and EPSCoR.

Now a graduate student at North Dakota State University in Fargo, Stonefish was recently awarded an NSF Graduate Research Fellowship for his work studying the migratory ecology of red-winged blackbirds and yellow-headed blackbirds. In August, he was appointed by the mayor of Fargo to the city's Native American Commission.

Humbly reflecting on his accomplishments, the 33-year old acknowledges he has come a long way in the past decade.

When he moved from Canada to the United States in 2001, he was seeking a change of lifestyle. On a lark, he decided to take classes at SBC.

There, Dr. Daniel Buresh encouraged him to enroll in courses within the Environmental Science Program. "He did a lot of ecology in that class. We were outside all the time, doing labs," Stonefish recalls. Stonefish was also happy to be in small classes with other Native students.

Adrift for much of his youth and without male role models, Stonefish began to find his way at SBC. He became immersed in his research and connected with student groups, including the AIHEC Student Congress. At conferences, recruiters from mainstream universities and internship programs began to court him. He expanded his research, took advantage of new opportunities, and even brought new ideas back to SBC.

After graduation from SBC, Stonefish spent two years teaching middle school science on the Standing Rock Reservation. "I had never had so much fear in my entire life," he says. "I had no clue what I was supposed to do." So he taught what he had learned at SBC. He took the students outside, and he made sure they had a role model.

"They would always tell me, 'We've never seen a Native science teacher, especially a Native male science teacher,'" he says, adding that he's still in touch with many of his former students. "A lot of them had never thought about college until I came around, until I drilled it in their heads: 'You can do whatever you want.'"

Although he's embarrassed by the attention, Stonefish admits he is proof that education can change someone's life. He repeats advice he frequently shares with young people: "The trick is to figure out what you love to do and then it's never going to seem like work," he says. "That's how it is for me with science. I love science. I love field research. It's tough, and I put in a lot of hours, but it doesn't seem like work to me because I love it."

He also believes in the power of imagination: "I have a very big imagination, and that's one of the reasons I'm good at science," he says. "I think my imagination is also what helps me relate to kids. I tell them: 'Use your imagination to your advantage. Have a big imagination and dream big.'"



Dereck Stonefish (Oneida) was awarded an NSF Graduate Research Fellowship for his work studying the migratory ecology of red-winged blackbirds and yellow-headed blackbirds (SBC/NDSU).  
*Photo by Dan Koech, Publications Service, NDSU.*



# Tracking History

## DEBORAH KIRK, HINU Alumni/Faculty



Deborah Kirk (Cherokee) knows what it's like to wonder about the past. Thanks to her education at Haskell Indian Nations University (HINU, Lawrence, KS), she's able to find her own answers.

Though a part of her family history, the Trail of Tears wasn't something anyone spoke of when Kirk was a child. "My grandparents would say, 'It was cold and dark,'" she says. "They just didn't want to talk about it because it was just so painful."

When her family moved to Tennessee, she attended a local meeting of the Trail of Tears Association. "I wanted to know where my family walked, I wanted to walk on that trail, I wanted to honor them," she says, explaining that the Cherokee tried to resist removal. They could have stayed and fought, but they would have been killed. By leaving as a group, they maintained their identity, their culture, and their way of life. "To find their footsteps and walk in them and honor them in that way became really important to me."

Then she learned that the Trail of Tears may have passed within a few blocks of her home.

She listened to local stories, searched through archives, tried to find roads no longer marked on maps, and wondered why no one

had aligned historic maps with current maps. Then her life circumstances changed, she says, and she ended up in Kansas, where her cousin was attending HINU.

She enrolled in a GIS (Geographic Information Systems) class at the tribal college, and when planning a final project, told her instructor she wanted to know where her ancestors had walked. "Looking back on it now, it was laughable," she says. "The project wasn't expert, it wasn't professional—but it lit that fire in me." Her instructor at that time, Dr. Rex J. Rowley, put her in touch with the University of Kansas (KU) and helped her find funding.

In 2008, she began conducting fieldwork—walking and driving throughout northern Tennessee with her father—finding historic and topographic maps, and overlaying maps with one another. So far, she has mapped three segments of the trail through Tennessee. Her goal is to create an interactive project that includes a map and a historic archive. "I think GIS maps are actually really ugly, and I want to make mine beautiful," says Kirk, who is now pursuing a graduate degree at KU "I want to draw people into the experience and into remembering the removal and how it was."

She also hopes her project will serve as a model to other Native students. "Other

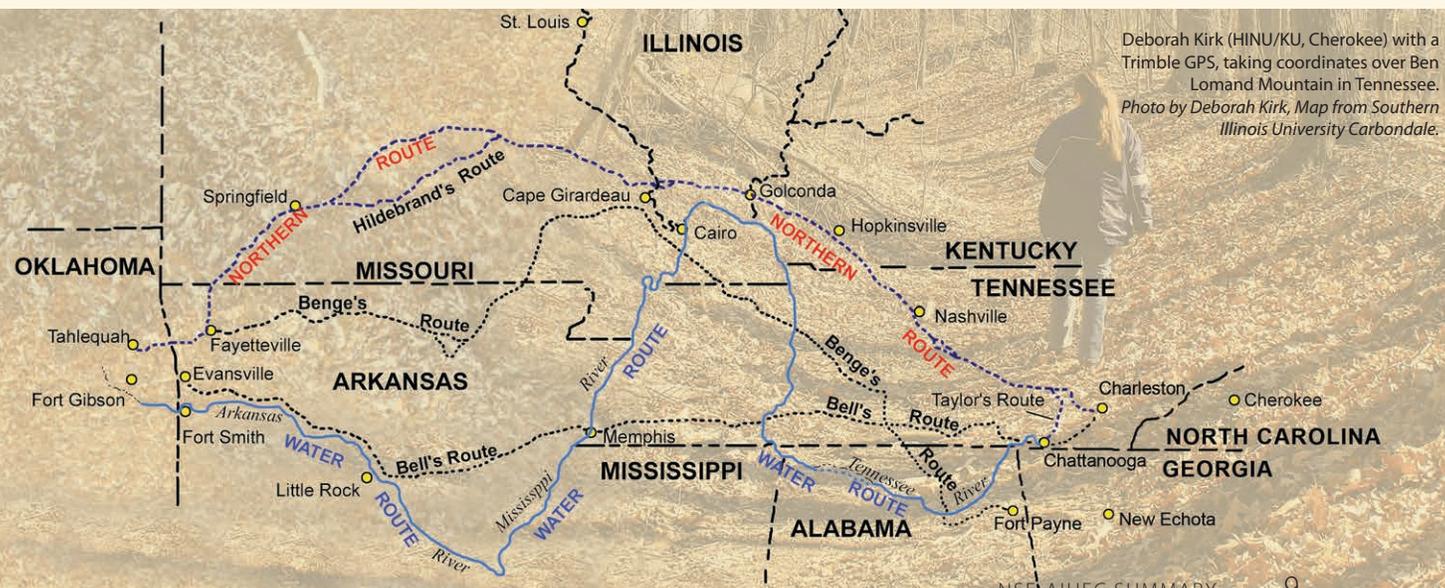
students can do the same thing with their histories of removal—and expand it to knowledge of homeland and knowledge of sacred sites," she says. By preserving that knowledge, Native students can contribute to their history. "Especially in mainstream education, the Trail of Tears, removal history, Indian people, it's all glossed over and romanticized."

Kirk notes that there is a clear distinction between the education students receive at a mainstream university versus a tribal college.

During the 2009–2010 school year, she left HINU to attend a mainstream university. Although she did well academically, Kirk felt unhappy as the only Native student.

Once she realized she could pursue a career in GIS, she returned to HINU and graduated with her bachelor's degree at the age of 44. Today, she's a graduate student at KU, and teaches GIS and cartography classes at the tribal college.

Now, she has her own students to inspire. "I want to encourage Native American students to use this technology in ways that represent us—not in the ways we're told to use it, but in ways that are creative or beneficial," she says. "There are environmental applications, historical applications, even business applications. There are so many ways to think about GIS in relation to our communities!"





# The Journey is the Destination

During her opening remarks to the STEM Leaders Forum, Dr. Jody Chase pointed out how crucial it is to increase STEM capacity at tribal colleges. It's important to individual tribal colleges and their students. It's in the nation's best interest, too.

Throughout the two days of meetings, tribal college presidents, deans, and STEM faculty members talked of how to move forward together, despite the differences among individual tribal colleges. One way to do that is by looking at success on the whole, then learning which elements different schools can use. When Dr. S. Verna Fowler (Menominee/Stockbridge-Munsee), president of the College of Menominee Nation (CMN, Keshena, WI) realized how terrified incoming students were of mathematics, she knew it was worth the investment to pay a tribal college instructor to teach in the local high school. She has also recruited diverse faculty and supported "authentic science" that inspires and trains students, while setting them to work on issues affecting the Menominee's forests.

President David Yarlott, Jr. (Crow/Korean), Ed.D., at Little Big Horn College (Crow Agency, MT) notes their success in helping students as young as five years old. The tribal college reaches out to K-12 students, offering summer camps and campus field trips. Time and again throughout the two days, tribal college presidents shared their successes with one another.

By the end of the forum, tribal college presidents had devised next steps to further improve STEM education:

## Steps to Improve STEM Education

- △ Facilitate TCU responsiveness to funding, partnership, and capacity building opportunities;
- △ Share and support broader implementation of successful TCU strategies and models for STEM research and education among the entire AIHEC membership;
- △ Encourage greater investment by NSF and other agencies in proven successful programs, such as NSF's TCUP and the TCU Rural Systemic Initiative.



Throughout the tribal college movement, individual schools have found ways to ease the transition from high school to college, employ culturally responsive teaching methods in mathematics, create inclusive classrooms in which everyone's background and expertise is respected, and teach authentic and meaningful science to students of all levels. Now, it's a matter of sharing those best practices with one another, with NSF, and with the rest of the world.



Chief Dull Knife College students (left to right) Angie Bearquiver (Northern Cheyenne), Jennie Bearquiver (Northern Cheyenne) and Ed Jones (Northern Cheyenne) collecting sediment samples from the Tongue River in Montana. *Photo by Bob Madsen, CDKC.*



As part of long-term population study, United Tribes Technical College students and REU-participants Jeremy McLeod (Turtle Mountain Chippewa) and Duane Jackson (Spirit Lake Dakota) prepare to band brown thrasher chicks. *Photo by Dr. Jeremy Guinn, UTTC.*



Jacob West (UTTC, Cheyenne River Lakota) prepares to release a northern pike as part of his study of pike movement in a recreation area on Standing Rock Reservation. *Photo by Dr. Jeremy Guinn, UTTC.*

AIHEC is the collective spirit and unifying voice of our nation’s Tribal Colleges and Universities (TCUs). AIHEC provides leadership and influences public policy on American Indian higher education issues through advocacy, research, and program initiatives; promotes and strengthens Indigenous languages, cultures, communities, and tribal nations; and through its unique position, serves member institutions and emerging TCUs.

Created as an independent federal agency by Congress in 1950, the National Science Foundation (NSF) mission is support for science and engineering education to help ensure that skilled people will be available to work in new and emerging scientific, engineering, and technological fields.

NSF and AIHEC partner to promote the development of Native scientific programs and initiatives at TCUs. This report was prepared with support from the National Science Foundation (NSF) under Grant No. HRD-1060204. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

*“Boosting representation of Native students in STEM fields requires small steps and extra dedication.”*

Instructor Matt Seeley, SKC



Student Brianna Moss (LLTC, Cass Lake, MN) conducting research. Photo by Mark Lewer, LLTC.

For more information on the tribal colleges and universities, contact:

American Indian Higher Education Consortium, 121 Oronoco Street, Alexandria, Virginia 22314  
703.838.0400 • info@aihec.org • www.aihec.org

Back cover: Chief Dull Knife College students launch a tethered “Kingfisher” balloon to take aerial photographs.  
From left: Felix Castro, Fred Blackwolf, Jr., and Isaiah Stotler. Photo by CDKC.

# *Indigenous Knowledge*

**Tribal Colleges and Universities excel  
at merging the world of discovery with  
research and education.**



AMERICAN INDIAN  
HIGHER EDUCATION  
CONSORTIUM