

Indigenous Knowledges, Encouragements, Engagements, and Experiences in STEM

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The Indigenous Knowledges,
Encouragements, Engagements
and Experiences ('IKE) Alliance

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Indigenous Knowledges, Encouragements, Engagements, and Experiences in STEM

Despite efforts aimed at diversifying Science, Technology, Engineering, and Mathematics (STEM) fields, Indigenous communities remain widely underrepresented. The Indigenous Knowledges, Encouragements, Engagements and Experiences (IKE) Alliance is comprised of a group of educators and Indigenous leaders from across the USA who support and facilitate the participation of Native American, Alaska Native, Native Hawaiian, and Pacific Islander (NANA-NHPI) students in STEM. IKE also seeks to strengthen relationships between Indigenous communities and STEM higher education institutions.

Article written by Dr Amy Shachter.

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Engaging Native Communities in STEM

Indigenous science, knowledge, and traditions are essential for tackling some of today's most crucial and long-standing problems. Yet, Indigenous communities in the USA and the Pacific have typically been widely underrepresented in traditional (Western) academic institutions, particularly in Science, Technology, Engineering, and Mathematics (STEM).

Indigenous peoples have utilised Indigenous knowledge and practices to manage their natural resources since time immemorial, as evidenced in areas of biodiversity protection, fire management, and maintaining traditional food systems and cultural practices. For example, a study funded by the United Nations showed that many lands owned by Indigenous communities offer rich biodiversity, as they are inhabited by countless animal species at risk of extinction and no longer found in other areas. Research has also noted the connection between biodiversity loss and the loss of Indigenous languages. This is raising serious issues since the knowledge of how best to sustain life in specific places is archived in language and represented in the worldviews of Indigenous peoples.

While including Indigenous communities in STEM fields enriches scientific efforts with invaluable perspectives and knowledge, IKE participants contend that educational pathways must be created that direct Indigenous students to higher education. At the same time, students must be secured pathways that allow them to return to their communities. To this end, some academic institutions and educators in the USA are devising programs and initiatives to increase the participation of Indigenous communities in STEM.

The Indigenous Knowledges, Encouragements, Engagements and Experiences Alliance

The acronym 'IKE means 'knowledge' in Hawaiian. This perfectly aligns with the project's key mission of encouraging the inclusion of Indigenous communities in STEM education. The IKE Alliance was established to connect academic institutions, organisations, programmes and people with Indigenous peoples and communities, establishing genuine and reciprocal relationships between these parties.

The goals of the IKE project are to 1) increase NAAN-NHPI (Native American/Alaska Native and Native Hawaiian/Pacific Islander) student representation in STEM to reflect the population of the USA; 2) achieve systemic change by Indigenising STEM education at IKE Alliance institutions; and 3) establish and expand a sustainable IKE Alliance.

To ensure this, the IKE approach has five objectives: 1) take full advantage of both Indigenous and traditional academic knowledge systems to tackle grand challenges; 2) weave Indigenous science, culture, and community into best practices in STEM education; 3) support STEM NAAN-NHPI student leadership through the IKE Alliance Student Corps; 4) create a collective infrastructure to support an Indigenised Networked Communities model; and 5) develop innovative and culturally appropriate assessment instruments.

The values guiding the IKE Alliance's work are aligned with those of Indigenous communities, with an emphasis on a Sense of Belonging, a Sense of Place, a Sense of Responsibility and Reciprocity, and a Sense of Becoming (i.e., having a vision of where one is headed in life), as well as establishing long-lasting, authentic relationships based on respect, humility, honesty, and

trust. The Alliance continues to strive to overcome the greatest challenges preventing NAAN-NHPI students from successfully pursuing education and careers in STEM-related disciplines.

Inspiring young people from Indigenous communities to apply for higher education STEM-related courses, ensuring that they complete these courses without losing interest, and facilitating their introduction into professional settings after they complete their academic training can sometimes be challenging. In fact, statistics suggest that NAAN-NHPI students are currently the least represented group in STEM fields.

One reason why NAAN-NHPI students might be discouraged from completing STEM-related courses is that science, as traditionally taught in academia, does not reflect their cultures and beliefs. The IKE Alliance is thus working to transform how STEM subjects are taught in Western institutions so that it welcomes, protects, and honours the beliefs, knowledge, and cultural integrity of Indigenous communities.

The creation of the IKE Alliance started as part of the project known as Transcending Barriers to Success: Connecting Indigenous and Western Knowledge Systems to Tackle Grand Challenges (TBS), which spanned three years, starting in 2017 and funded by the W. M. Keck Foundation. This project was a collaboration with the science education reform project SENCER, which stands for Science Education for New Civic Engagements and Responsibilities. SENCER connects over 6,000 educators working at 500 educational institutions across the USA, including the TBS pilot institutions of the University of Hawai'i at Mānoa, Kapi'olani Community College, University of Alaska, Humboldt State University, Northern Arizona University, and Salish Kootenai College. Faculty, staff, students, and Indigenous leaders from Indigenous nations and universities continued the work to create the IKE Alliance.

The Alliance's Unique Approach

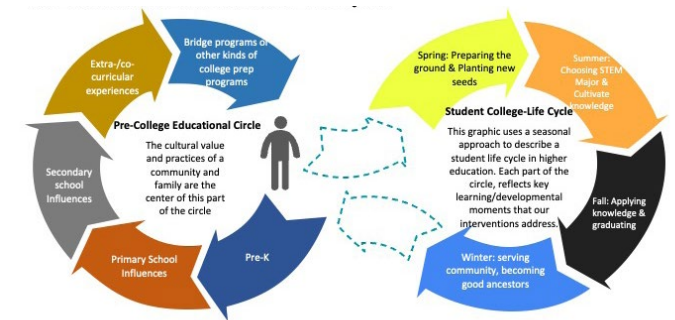
Instead of merely trying to recruit a higher number of NAAN-NHPI students for STEM higher education courses, the IKE Alliance works to weave Indigenous knowledge and cultural nuances into existing academic curricula and academic practices. This makes STEM courses more appealing to Indigenous communities while retaining NAAN-NHPI students because it demonstrates that Indigenous knowledge, practices, and peoples matter and have value.

Studies in education highlight the importance NAAN-NHPI students attribute to feeling that they belong to their chosen academic community and envision the professional path in front of them. By establishing authentic and reciprocal relationships with Native communities, STEM education environments will be more inclusive and aligned with Indigenous communities, making NAAN-NHPI students feel that they belong there and are more confident in pursuing a career in their field of interest.

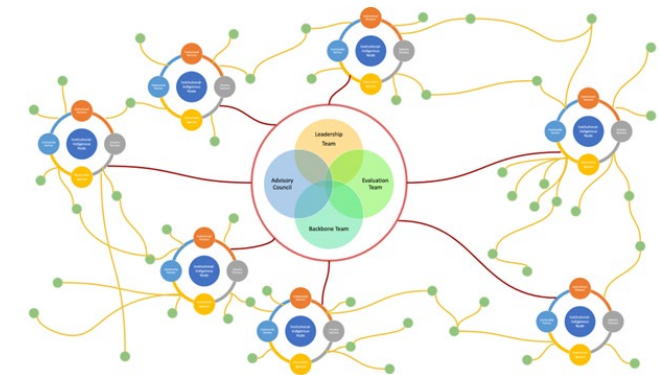
Reciprocity and responsibility are crucial values for many NAAN-NHPI communities, as their worldviews often emphasise the responsibility that individuals have towards others in their lives, their communities, their Nations, and nature, as well as the value of both giving and receiving what their non-human kin have to offer. Due to the history of colonisation in the USA, Indigenous communities also feel a responsibility to protect and cultivate their heritage, which is deeply entrenched in the IKE Alliance's mission.

Fostering Reciprocal Relationships with Indigenous Communities

Essentially, the Alliance devises strategies and resources that can guide institutions in establishing genuine, reciprocal, and long-lasting relationships with Indigenous communities so that they can effectively integrate generations-deep wisdom and knowledge



^ 'IKE Student Educational Life Cycle.



^ 'IKE Indigenous Network Draft Model.



into their curriculum and academic approach.

The Transcending Barriers project was designed to strengthen collaborations between Western science and Indigenous communities, specifically following traditional Hawaiian values promoting sustainability and community building.

To improve STEM education, the IKE Alliance strives to bring Indigenous leaders and the network of educators from the Transcending Barriers project together with educators from several new Universities, including the University of Arkansas, George Mason University, Texas Woman's University and Santa Clara University.

Gatherings are central components of the IKE Alliance. Educators, indigenous leaders, and students who are part of the Alliance are introduced to its mission and approach during IKE Alliance Summer Gatherings (IASG), where they discuss strategies and ideas for improving Western STEM education. Gatherings encourage new collaborative research partnerships while introducing the IKE Alliance Student Corps, a programme devised by the Alliance designed to support NAAN-NHPI students on their academic and professional journey. The IKE Alliance Student Corps programme offers students the opportunity to participate in different research projects, internships, and leadership programmes to increase their engagement with STEM and help them approach their careers of interest.

Events, Activities and Research Efforts

In preparation for the IASG and Student Corps gatherings, the IKE Alliance organises several focused events and activities. These include local and national strategic planning gatherings and talking circles, where members of the Alliance and other constituents meet to explore new strategies.

At these meetings, the Alliance's multicultural and interdisciplinary leadership team, including both Indigenous and Western scientists, are working together to develop academic curricula, assessments, and collaborative research strategies that integrate Indigenous knowledge and culture with Western knowledge systems and educational frameworks.

Strategic planning meetings are held in ways aligned with Indigenous traditions, for instance, asking participants to share their views in talking and listening circles, gatherings, or larger convenings.

The IKE Alliance also explores research projects involving Indigenous communities, introducing culturally appropriate protocols and strategies that promote reciprocal relationships between Indigenous and Western researchers, which acknowledge and integrate the Indigenous heritage. These projects are designed to create spaces for Indigenous and non-Indigenous scholars and leaders to work together to address capacious issues.

To evaluate the outcomes of the IKE Alliance, its leadership team first investigated the number of NAAN-NHPI students enrolled in higher education institutions and, where possible, in STEM courses. The Alliance found that there is an inherent problem with enrolment data. Most institutions do not disaggregate data to determine accurate counts of Indigenous students. The Alliance consequently held a gathering focused on more accurately determining the numbers of Indigenous students, which resulted in improvements in how Alliance institutions approach enrolment data. Kapi'olani Community College and Humboldt Polytechnic University are leaders in data management and were exemplars for the gathering. Ultimately, IKE aims to document the increased number of students over time, which may suggest that their efforts successfully attracted and retained more students from Indigenous communities.

Initial Outcomes and Future Horizons

The IKE Alliance is identifying exemplary Indigenous-driven research projects, strengthening collaborations between Indigenous and Western scientists, and introducing new opportunities for NAAN-NHPI students in STEM-related fields. Such exemplars are the basis for toolkits and other resource materials developed by the Alliance.

Evaluation data collected so far are preliminary but highly promising, highlighting the potential benefits of having large networks of institutions with the common goal of integrating Indigenous knowledges in STEM education and including Native communities in ongoing scientific research efforts. Further evaluations could soon help to deepen the understanding of the impact that the Alliance is having on STEM education at different Universities in the USA.

Importantly, the IKE Alliance offers a valuable example of how traditional Western educators and universities can start changing their approach to STEM education and research to encompass the valuable perspectives and knowledge of Indigenous communities, who have been curating natural environments and helping all beings to thrive from time immemorial. In the future, this large collaboration will lead to other impactful initiatives, which will collectively promote the formation of more scientists from NAAN-NHPI communities and the establishment of sustainable research initiatives aligned with Indigenous values.

Ultimately, this crucial work will help the global scientific community to identify new strategies, technologies, and solutions to better tackle long-standing problems – including climate change, the depletion of natural resources, and the extinction of animal species.



MEET THE RESEARCHER

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Dr Amy Marie Shachter is an Associate Professor of Chemistry at Santa Clara University (SCU). She earned a PhD in Inorganic Chemistry from the University of Colorado Boulder and a BA in Chemistry from Knox College. She has been at Santa Clara University since 1990. She also served as a Senior Associate Provost for Research and Faculty Affairs, Senior Associate Dean of the College of Arts and Sciences, and Founding Director of the Environmental Studies Institute. In addition to progressing the field of chemistry, Dr Shachter has been working to improve Science, Technology, Engineering and Maths (STEM) as the National Director of Regionalization for the science education reform project SENCER (Science Education and New Civic Engagement) by fostering the development of new course curricula, as well as innovative, inclusive and engaging academic programmes.

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