Ethnocomputing with Indigenous Knowledge

csdt.rpi.edu
(chrome browser)
The WRONG way to think about culture-based STEM education
The right way to think about it:

Colonial myths of “primitive knowledge” were created to justify land grabs.

Value extraction was the basis for colonialism.

Extractive STEM is still in use today.
Problems created by extractive STEM

Extraction of ecological value: global warming and pollution

Extraction of labor value: low paid, repetitive, boring jobs

Extraction of civic value: IT networks accelerated wealth inequality (10% own 70% of wealth)
Generative STEM allows value to circulate in unalienated forms
What does “generative” mean in “Generative STEM”?

Biomolecules: autocatalysis

Organisms: autopoiesis

Ecosystems: sympoiesis

At every scale, the power of life is due to self-generation

Erwin Schrödinger: “negative entropy”

Indigenous traditions also used this recursive loop of circulating value
Generative Justice in the Iroquois economy

Ecological value circulates: corn gets N2, beans climb corn, squash shades all

Labor value circulates: planting to harvesting to cooking to planting

Social value circulates: community to mutual care to culture to community
Value is **generated** by nature, labor, and creative expression. But then **extracted**. It only returns in diminished, alienated form (money for malls, pesticides for agriculture).
The purpose of Generative STEM is to use science and technology to re-enable value circulation.

**Ecological value:** Waste cycled as compost

**Labor value:** Worker-owned production

**Expressive value:** “Open source” in code, speech, spirituality, sexuality, etc.
The Generative Cycle in Anishinaabe Arcs

Indigenous knowledge and practices

Students develop ideas for STEM contributions to indigenous communities

Physical rendering and discovery learning

Students learn Heritage algorithms
Decolonizing Education with Anishinaabe Arcs: Generative STEM as a Path to Indigenous Futurity*

Pre/post for STEM knowledge and interest: statistically significant with $T=-11.159$, df 37, $p>.001$”

“I believe my design represents the two worlds I come from. One being of my Native heritage and the other of the technology era. With the completion of my structure I was able to combine two worlds and accumulate an interest in engineering.... This project has taught me that I can provide and give back for my people while incorporating important traditions and teachings to create a productive environment.”

*Term coined by Dr. Grace Dillon, Indigenous Nations Program, Portland State University.
Student: Jayme King
Title: Illusional Paradise
Description:
During the hour and a half of my creation I’ve been specifically concentrated on the detailed style I was making. Some of my thoughts included my defined self as a strong Navajo lady, close friends, my son Ezekiel (clan wise), and thinking just a bit about the college I am going to attend. Of course, I was bumping my phones, R&B baby!

Student: Monica Nockai
Title: The Clash Of Two Worlds
Description:
The Clash Of Two Worlds represents the western civilization coming in connection with the Dine Culture. When the two worlds collide in the center it is an intermingle of cultures. Almost a bliss, like Nirvana. A sharing. An Understanding, or an invasion? The connection creates an explosion that neither worlds can control. Our secrets burst away from us. Our culture, our respect, integrity, morals, our life explode in every direction. Leaving an emptiness.
CSDTs: Sensors and other hardware
Expanding Cultural Agency

Level 1: simulating original artifact from community
Level 2: creative exploration of heritage algorithms
Level 3: Creative physical renders
Level 4: Creative Community contributions
1. Work with artisans, elders, others to ensure we have a basis for collaboration and “cultural permission” (not just a matter of copyright!)

2. Interview artisans and research cultural background to understand the knowledge system from their point of view (“emic” not “etic”).

3. Translate their practices and concepts into equivalents in CS (weaving algorithms, geometric transforms, power law scaling, anti-aliasing, context free grammars, etc.).

4. Embed these concepts in a “design tool” applet that allows students to simulate the original designs and create their own innovations.