Ancestral Computing for Sustainability
Learning From Indigenous Mothering While (Re)Birthing Computing Education Toward Indigenous Futurities

CUEPONCAXOCHITL D. MORENO SANDOVAL
Stanislaus State University

Dedication

To all life forms whose wombs grow ideas, seeds, life for the communal wellness of Earth and the next seven generations.

Letter to un Retoñito Floreando,[1] Copitzin[2]

NOQUICHCONETL DIVINO, my greatest teacher, tierra sagrada, cielo divino, Tlazohcamati for offering me the deep privilege and sacred opportunity to live and learn by your side. You have taught me to imagine the world through your eyes and to give my inner child the opportunity to play, as if for the first time. Little, big growing tree, this journey together is largely the inspiration for this paper, and the path that I walk as your Nantzin.[3]

Te escribo estas pocas palabras con mucho amor y cariño, respeto, por la persona que eres.[4] In these pages, my hope is to share how you, Copitl, have inspired lessons in Indigenous Mothering so others, like computing education curriculum theorizers, can have the opportunity to see what our story of relational accountability for the stewardship of Earth is like. I trust that computing education curriculum theorizers and developers can dignify the universes of Indigenous epistemologies in education through these insights we humbly offer.

In writing this manuscript, I had a few considerations: What experiences are okay to share in public? For what purpose? How might I approach your consent, Copitl, in sharing this information? Is it even possible? I ask your forgiveness, Copitzin, if any unintended harm is done by these words. You are young and not yet old enough to consent to use your name in this manuscript. Therefore, we use anonymized versions of these stories to protect you from unintended harm. After careful consideration, including communications and active dialogue with our elders,

I offer this collection of stories to inform curriculum development for computing education as a way of nurturing Indigenous futurisms. May we continue to walk the flowery path of our ancestors, with dignity for all.

With love, Nantzin

Introduction

Indigenous Mothering is a sacred responsibility that nurtures generations of hope by preserving and revitalizing ancestral knowledge systems in times of spiritual, psychological, and physical warfare of white settler colonialism (Brant, 2023; Fiola, 2015; Keelan-Peebles, 2023; Ocampo, 2023; Revilla, 2021; Wall Kimmerer, 2013). This offering is a writing of critical reflexivity for nurturing Indigenous futurities in computing education curricula. In general, computing education curricula is in dire need of an ethical compass. April Lindala, Indigenous scholar and co-researcher of a research project I will later describe, posed a statement at one of our writing retreats that left me wondering, "Computer science education needs a womb." As a research team at this writing retreat, we pondered on how we might form that Indigenous womb for computing education over time.

Hence, I ask: How might Indigenous Mothering practices offer computing education, an otherwise military child, a radical rebirthing in a nurturing womb that intentionally centers the protection of children and Earth for future generations? Exploring the fortitude of Indigenous Mothering to understand how one might center relational accountability in computing education and production can promote sustainable, Indigenous futurities. As an example of exploring Indigenous Mothering in computing education, I offer my critical reflexivity of my first-time Indigenous Mothering as a Xicana Indigenous scholar, one of a team of Black and Indigenous researchers of Ancestral Computing for Sustainability[5] (ACS), a research project that interweaves seemingly disparate worlds of Indigenous Studies and computing education for Indigenous resurgence and the protection of Tlalticpac, Nahuatl word for Earth (Lopez-Quiñones et al., 2023; Moreno Sandoval, 2014, 2017, 2019).

My grandmothers' spirits live in me. Their language and worldview are grounded in Nahuatl cosmology and Earth-based (agricultural) practices. While Spanish language and culture were forced on us during the 500+ year colonial period, Nahuatl language and cosmologies remain grounded in subtle and sometimes overt ways. For example, to use a pick to loosen soil, neither my grandmothers nor parents use(d) the Spanish word "pico." Instead, they use "talachi/talache," which means to lift the earth's skin, and use their hands to feel the quality of the soil before planting seeds for the season. In doing so, they have instilled in me the importance of observing and engaging with the seasons and foods as if they were our relatives. I have heard my grandmother talk to the boiling water while cooking beans in a clay pot. One of my grandmother's metaphors for living has deepened my critical reflexivity; she stated: Cuando apuntas el dedo a alguien, te regresan tres a ti (When you point a finger at someone, three fingers point back to you.). For as far as the eyes can see and ears can hear, my family has spent their lifetimes tending/relating to the Earth. We are macehualli, commoner agricultural peoples from what is now known as Zacatecas, Mexico. For three generations, my family made the pilgrimage up North from Mexico to the United States to work as braceros (temporary agricultural workers), continuing to tend/relate to Earth in the best ways we know how. For over forty years, my parents have continued to scavenge for recycled material on the streets and in the dumpsters of local restaurants. In doing so, the

teaching I received was to minimize waste in landfills, conserve energy, promote ancestral memories of zero waste societies, and transform other people's trash into resources to make a living.

My family has shaped my worldview and research practice. I am part of a nourishing, unapologetically decolonial research team that facilitates Indigenous Motherhood by centering research as ceremony (Wilson, 2008) while being intentional about decolonizing time (Patel, 2015) and unlearning settler grammars in education (Calderón, 2014). To this end, I illustrate how Indigenous Mothering can offer computing curriculum theory a framework from which to engage Ancestral Computing for Sustainability (ACS) toward Indigenous futurities in computing education.

As a way of theorizing curriculum (Lee & Soep, 2023; Tuck, 2011), I apply the dynamics of Indigenous Motherhood throughout the article in ways that center children in the decisions one makes for communal wellness across environmental, social, and economic experiences. To this end, I ask what if:

- formal education institutions sharpened their ethos to challenge computing and its practices from war-mongering and capital gain over the collective well-being of all people and the planet?
- in consideration of a new ethos, computing education was offered a new beginning in a womb of radically unapologetic Indigenous Motherhood?
- we re-evaluated computing in support of Indigenous parenting as it asserts Indigenous futures and nurtures what Zapatista philosophy (Malott, 2008) promotes: a world where all worlds co-exist with dignity?[6]
- we imagine the design of curricula that produces and uses computer science hardware in socially and environmentally sustainable ways that consider the next seven generations?

These aforementioned questions prompt curriculum writers to consider the foreseen and unforeseen consequences of computing production in current times. This requires the unpopular questioning of the all-pervasive gadgets and the iterations of computing hardware we have come to depend on.

While the focus is on curriculum writers, curriculum studies are but one point in a constellation of factors that mitigate students' experiences in schools. The computing industry, for example, might set the tone for computing education. Similarly, economic demands for computing gadgets might supersede curricular advances in ethical and sustainable computing. Other factors are the professional development of educators and their resources to roll out radical ideas and calls to action like the ones presented in this paper. Whichever the case, Indigenous futures in computing education must be experienced as a village-like approach to living and learning—meaning, every point in the constellation of learning matters—especially when making decisions that impact the next seven generations (Doxtater, 2016).

This article offers an opportunity for readers to experience writing unconventionally. From this point forward, I invite you to leave off the usual expectations regarding the flow of academic papers. This is intended to be more of a conversation where the reader can reflexively participate rather than predictable approaches to writing that presume the reader to be an empty, passive receptacle to be filled by this knowledge (Calderón, 2014). In addition, this paper offers its readers an opportunity to imagine Indigenous Motherhood as a vessel, sustainer, and giver of life for

grounding Indigenous futurities through computing education.

In exploring the rich tapestry of Indigenous Motherhood, I adopt a lens that transcends traditional and biological confines. Indigenous Motherhood (Lavell-Harvard & Anderson, 2014; Lutz et al., 2022; Prior et al., 2023; Raval, 2023) is multifaceted. It extends beyond the physical act of giving birth and challenges the limitations of gendered and heteronormative frameworks. Indigenous Mothering extends beyond individuals with wombs, including those who embody motherhood through childbirth as well as those who nurture and guide future generations. It takes a village to raise the future. In embracing this more encompassing perspective, I strive to create a space that respects the varied paths and identities within Indigenous Motherhood, fostering a narrative that is reflective of the diverse and interconnected web of Indigenous life and futurities.

Learning from Indigenous Motherhood

Nelson et al. (2022) describe Indigenous Mothering as it relates to pre- and post-settler colonialism. They explore "how rematriating can allow us to begin not always with the story of settler colonialism but with a story grounded in place and motherhood" (p. 5). Indigenous Motherhood and land reclamation go hand-in-hand. For example, when mothers give birth aided by trees,[7] this birthing gives the baby an instant connection to Earth and place and tree relatives. Rematriating the land can include giving land back to the stewardship of Indigenous Nations for land restoration and communal wellness. For example, Sogorea Té Land Trust[8] is the first urban Indigenous women-led land trust in Lisjan territory (East San Francisco Bay Area). Their programs include reclaiming stolen land, growing medicine gardens and foods, distributing this produce to elders in the community, and revitalizing Indigenous languages and cultural practices. Rematriating Indigenous Motherhood may include a variety of cultural practices based on Native science of health and wellness—for example, (a) using a *rebozo* (shawl) during pregnancy, birthing, and baby carrying, (b) Indigenous chestfeeding, revitalizing ancestral foodways for baby's first foods, and (c) singing songs in Indigenous languages. These ancestral practices promote healthy bonding between baby and parents, but also environmentally sustainable practices.

One example of this rematriation of Indigenous Motherhood can be seen in the trilingual lullaby that I created with my Nahuatl teacher, Huitzilmazatzin, while breastfeeding Copitzin. As a first-time mother, and scholar warrior, it brings me great pleasure to share this song with you in Nahuatl, Spanish, and English. The lullaby was inspired by a vision I had while I was breastfeeding my Little One to sleep. I saw a White River flowing in a continuous motion from-and-to Mother Earth, passing through my body and into my baby's. The breastfeeding, the pearly-moon-glow-colored river is voluptuous, cascading over great valleys when my Little calls her. Other times she is soft and gentle in the quietness of her rejuvenation. All the rivers of breastfeeding mothers join the Great Mother Blue Ocean. These are the sacred ebbs and flows of breastfeeding. In a similar ebb and flow, the song's original form, which can be seen in the first column, begins in Spanish, moves to Nahuatl, and ends in English. The two additional columns are Spanish and English translations of the original lullaby. Notice the relationship between Indigenous Motherhood and the intimate connection with land and water. I use this lullaby to invite my baby to sleep, nurturing his cognitive and socio-emotional development and our sacred attachment. We give life to each other in this beautiful ecology of co-existing as we prepare to meet in the dream world.
May this lullaby nourish you, too.

Zan Xitēmiqui, A Trilingual Lullaby[9]

Duérmase mi niño	*Duérmase mi niño*	*Sleep, my child*
Duérmase mi bien,	*Duérmase mi bien, Sólo*	*Sleep, my love,*
Zan xitēmiqui	*sueña*	*Just dream*
Īcuexānco monān,	*En el regazo de tu madre,*	*In your mother's lap*
White river flow	*Fluye río blanco*	*White river flow*
Moon glow, moon glow	*Luz de luna, luz de luna*	*Moon glow, moon glow White*
White river flow	*Fluye río blanco*	*river flow*
Moon glow, moon glow	*Luz de luna, luz de luna*	*Moon glow, moon glow*

Indigenous Motherhood can also help us reimagine how computing education can be accountable to environmental protection and sustainability. Dawn Marsden (2014), a single Indigenous mother, was called to build a sustainable intergenerational starship society in which she delineated fifteen principles to nurture Indigenous Motherhood and the Protection of Mother Earth. These principles include the following: 1) center a spiritual-based living, 2) integrate interconnectedness, 3) nurture environment-centered thinking, 4) move towards self-sufficiency and self-discovery, 5) recognize the gifts in everyone, 6) engage in apprenticeship training, 7) assert self-determination, 8) find communal sources of food and water, 9) strengthen relationships in community, 10) work towards free trade and gifting, 11) adopt restorative justice approaches to conflict, 12) revitalize public rites of passage, 13) consistent circle talk, 14) consensus-making, and 15) leadership from below as opposed to top-down hierarchies (Marsden, 2014, pp. 215–230). Notice how Marsden centers cooperative living in a complex world. By including "strengthening relationships in community," "consistent circle talk," and "adopt restorative justice approaches to conflict," she acknowledges that Indigenous Motherhood does not exist in a vacuum.

Marsden's fifteen Indigenous Mothering principles can be applied to Ancestral Computing for Sustainability in ways that computing educational theorists and curriculum writers can ground for computing production. Despite the intentions of raising healthy children, life within white settler colonialism can bring about unforeseen challenges. This reality posits that asserting self-determination and experiencing joy is a radical, subversive act. Drawing from ancestral knowledge systems, Marsden's principles for Indigenous single mothering in a fragmented world offer us a third space where one draws from the deeply rooted ancestral knowledge systems despite and in the face of white settler colonialism.

These theories and practices of Indigenous Motherhood invite me to imagine: *What if formal education institutions sharpened their ethos to challenge computing and their practices from war-mongering and capital gain over the collective well-being of all people and the planet?*

Computing Education and Consumption within White Settler Colonialism

Computing education is deeply embedded within white settler colonialism and reproduces colonial harms and practices of extraction and consumption. Carroll-Miranda et al. (2023) contend that "advanced global capitalism has humanity to the brink of self-destruction" (p. 144). The extraction of wealth and natural resources in the 21st century is the continuation of conquest of Indigenous populations across the globe (Bruyneel, 2007). Advanced global capitalisms' aggressive extraction has systematized ongoing genocide/ecocide that is annihilating not only Indigenous communities (Crook & Short, 2020; Dunlap, 2021; Kahn et al., 2014) but has a total

disregard for the sacredness of our spaces and all other sentient beings that inhabit this earth. Moreover, "computing has expanded its invasive and extraction nature to the innermost regions of self, creating an Age of Disruption embodied by a form of technological madness" (Stiegler, 2019 as cited in Carroll-Miranda et al., 2023, p. 144). Computing education in its current form promotes imperialism and a reliance on extractivist economies making healthy ecosystems that have been sustained for millenia and the health of future generations nearly impossible to imagine.

In addition to questions about producing computing, there are other questions to be raised about computing consumption. At times, Indigenous parenting may be confronted with difficult questions related to digital technology.

Table 1 - Questions about Computing Consumption from General Parenting and Indigenous Parenting Viewpoints

General parenting questions may include:
1. When is screen time appropriate for children? 2. How much is too much screen time for children? 3. What digital programming content is appropriate for children? 4. Rather than *consuming* digital technology, what about *producing* digital technology through practicing coding, hardware and software production, web, and game development?
Centering Indigenous Parenting, I ask:
1. To what extent might avid digital technology use override children's interest in playing outside with un/structured learning time in Mother Earth? 2. How might the consumption of digital technology interfere with a child's spiritual well-being that can be centered on interdependence with Mother Earth? 3. How might digital technologies encourage the expectation of quick commodification of learning/consumption? At what price? For whom? 4. How is our physical health/general well-being prioritized while using digital technology, especially for long periods of time? (sleep deprivation, loneliness, EMF/radiation exposure, addictive qualities of over-consumption, comparisons of oneself to social media presence affecting self-esteem and identities, emotional turmoil, being treated as a babysitter, quick solution to lack of village surrounding us, considering a relationship with time—e.g., being connected with the land has a unique temporality vs. technology, which has a different rhythm, how to navigate in healthy ways, hypersensitization vs seasons) 5. How might digital technology impact relationships between people in the flesh? 6. How might we encourage children to produce computing when computing education remains a servant to a myopic sector of the world's population? 7. How might one reconcile (or not) with participating in computing production, including but not limited to data storage and supercomputing centers, that inevitably accumulates e-waste in poor communities and creates toxicity for Earth? 8. Is training for a high-paying job in the tech industry worth the unintended consequences of contributing to the digital toxicity of the world? 9. What options do I have for my five-year-old, Indigenous, brown-skinned son to set him up for success in the future? Is computing education as it is today one of those choices?

Indigenous epistemologies exist in various temporalities that are *not* centered on capitalist production and the severing of people's interdependence with place-based relationships. For example, slow cooking and slow processing are valued. We may feel pressured to "be more efficient" with time spent on life's activities from a capitalist point of view. It may take up to a year or more to prepare for the first hunt with relatives, passing down oral traditions of planting seeds and cooking, etc. Similarly, Ancestral Computing for Sustainability can center place-based relationships and relational accountability that embeds a constellation of factors that relate to teaching and learning computing education. For example, these factors may include positive ancestral identity formation, renewable energy, upcycling of computing hardware, localized cooperative economies, etc. How might computing educators, industries, and curriculum writers learn from Indigenous Mothering for the well-being of the next seven generations? What if, as part of considering a new ethos, computing education was offered a new beginning in a womb of radically unapologetic Indigenous Motherhood?

Ancestral Knowledge Systems

To understand how ancestral knowledge can inform computing, we can look to examples of ancestral knowledge, many of which are embedded in and shared through our stories, our songs, our foods, and our cooking. Ancestral knowledge systems are also intimately connected to Indigenous Motherhood. Nelson et al. (2022) tells of her grandmother reminding her to help others in her journey of Indigenous Motherhood. Elders are keepers of traditional ecological knowledges.

I fondly remember the long stories that the elders in my family shared in the kitchen, by the wood-burning stove. The stories about walking hundreds of miles over the years, shepherding cattle with the help of dog companions, crossing rivers, observing "*el lucero*"/Venus in the sky as a compass for planting seeds and harvesting, preparing and consuming ancestral foods, relying on the interdependence of life-giving elements to walk in the world as an *arriero*.[10] My maternal grandmother, Nana Lencha, was sought out by families in the village for her knowledge of healing and birthing. She was a bone-setter and midwife. She birthed some of her own children, unassisted, and often massaged dislocated bones into place. These knowledges about living and learning are precious and must be an accessible reality for children and the future of computing.

Another example of insights into millenia old ancestral knowledge systems is found in The Florentine Codex Book 6 Chapter 18, the *Huehuetlahtolli*. This volume was written by Nahua Indigenous people in Central Mexico. It was commissioned by Spanish clergy who were interested in learning about the worldview of Nahua Indigenous peoples. It is one of the codices that survived the burning of books during the colonial period. The *Huehuetlahtolli* includes an excerpt in which "rulers admonished their [children]" when they had reached the age of discretion. The excerpt reads:

> Hear well, … O my [child], the earth is not a good place. It is not a place of joy, it is not a place of contentment. It is merely said it is a place of joy with fatigue, of joy with pain on earth; so the old men went on saying. In order that we may not go weeping forever, may not die of sorrow, it is our merit that our lord [sic] gave us laughter, sleep, and our sustenance, our strength, our force, and also carnal knowledge in order that there be peopling. (Sahagún, ~1547/2012, p. 93)

The ancestral knowledge in this excerpt is akin to the Spanish adage, "*no hay mal que por bien no venga*."[11] Education does not exist in a vacuum. What we have learned from the global COVID-19 pandemic is that the personal, professional, and academic experiences of students interweave themselves in all aspects of their lives.

Drawing from ancestral knowledge systems, we raise the question of how we might include aspects of personal development in computing education as a way of nurturing positive ancestral identities. This approach nurtures students' connections to place-based (Tuck & McKenzie, 2014) learning modalities, regarding Earth as a relative reflected in one's unique footprints for we are Earth, and Earth is us (Bayha, 2018). I think of these words shared in the *Huehuetlatohli* when I imagine you, Copitzin, when coming of age, old enough to read these words with a careful meaning, hopefully, reflective of the intentions in writing them. Even though we may experience present-day colonialism in our everyday lives, we can also do what undocu-poet Yosimar Reyes[12] teaches us, to *document joy in times of despair* (Y. Reyes, personal communication, May 28, 2020). In one of his writing workshops with college students, he asked us to respond to a writing prompt: "Tell me the story of the year you discovered your power." In this exercise, he invited us to juxtapose our power with possible experiences of despair as a radical act that nourished self-determination. Systemic oppression relies on manipulative tactics to silence racialized communities in ways that impact mental/physical/emotional/spiritual wellbeing. Discovering our power and joy is a radical act, one that requires jedi-training,[13] and one that has been passed down for generations as a means of survival, and beyond towards *thriving* in the world. Though Earth is "not a good place," we can commit to joy as a radical act of love. Nana Lencha was orphaned at a young age and grew up in the aftermath of the Mexican Revolution, a time of political unrest and violence, as she recalls. She learned to sing at a young age and passed down songs to her children and grandchildren. I still sing Nana Lencha's song of joy:

> *Paloma blanca de cinco colores:*
> *blanco, amarillo, morado, nevado y azul. Y al verla tenía el buche blanco,*
> *el pico amarillo, la cola nevada y el copete azul. Paloma blanca, que vienes del norte,*
> *con tus anchas alas, volas para acá.*
> *¡Qué viva la generación, qué viva el placer,*
> *qué viva el amor*
> *y vámonos a pasear![14]*

My grandmother also shared joy in times of despair. This approach is not to be confused with toxic positivity in which one is encouraged to disregard systemic oppression as a made-up reality that can be wished away somehow. Rather, being intentional about experiencing radical pleasure while naming settler colonialism and acting on one's agency to transform internalized colonization, for example, can revolutionize how one might live in one's body—individually and collectively. By living in this dialectic, a liminal place of nepantla,[15] one might walk in this process toward the horizon of co-liberation.

Copitl, when you were a two-month growing seed in my womb, we slept next to Nana Lencha, tu bisabuelita,[16] who was on her last days. She was 99 years living on this Earth, having raised almost a dozen children and buried almost half of them. She was a healer who taught me so much about body, heart, mind, and spirit awareness. On one of those last nights of her life next to us, I had a dream that she passed down some of her weathered feathers to you—from the eldest

to the youngest members of our clan. Her words were short as one of her living philosophies was "habla poco, di verdades."[17] *She passed on her life experiences to you in those feathers.*

> *Baby and I are so grateful to have spent the last night of my grandmother's life sleeping in bed with her at home, cuddling. I felt her slowly take off her preciosas plumas de quetzal and sew them neatly onto our baby's developing wings. We are like a bird clan of Huejucar, Jalisco and La Colonia Benito Juárez, Jerez, Zacatecas. May she continue to soar, singing songs of freedom.*
>
> *We love you Abuelita Lencha.*
>
> *Tlazohcamati huei for your beautiful presence in our lives.*

I was able to spend time with my Grandmother while my son was still womb-side. Strong connections are passed from generation to generation in this way. We also make our own mythology. As we take up the mantle of an elder in our communities, we look to the life and the leaving of our abuelas for guidance as much as for comfort. We codify memory into stories and pack it tidily with lessons essential for our children's thriving. What ancestral knowledge systems are passed down intergenerationally that are disregarded in computing education? How might students bring their whole selves, ancestrally, into the computing education classroom, and most importantly, feel empowered to produce computing from their unique positionalities?

Indigenous futurities in computing education protect, rather than jeopardize, ancestral knowledge systems, including First Foods. Another way to access ancestral knowledge systems in times of diasporic, colonial erasure of Indigenous epistemologies is through Indigenous food sovereignty. Navigating food consumption with eyes for sustainability, roots in ancestral healthways, and living as close to decolonized, generative economic models as possible can be daunting. Yet we see new solutions to old problems arising: we see everything from teaching resources that help home and community gardens flourish, to producing products geared toward certain populations with otherwise underserved (and costly, in the consumptive model) needs, to community groups working toward better frameworks that incorporate ancestral knowledge systems. I recall my very first memories in the kitchen and how trauma can be transformed with a commitment to healing and restoration of ancestral foodways:

> *At best, we meal plan together using cookbooks I've gathered over the years. We make our cooking time an offering to our bodies. We set intentions, burn medicine and dress up. We use old cooking tools like a molcajete and molinillo chocolate spinner. When we add salt to the food, we repeat our offering as if we were setting down tobacco or burning copalli. After all, our salt comes from the oceans or from Earth (tequesquite), depending on which salt we use. We also talk about how black beans, for example, nourish our bodies so that we can feel stronger and our brains can be better at problem-solving, imagination, etc. We've read Indigenous Eagle books for kids on Native Wellness like Tricky Treats*[18] *that tells about "everyday foods" and "sometimes foods."*

It can feel quite impossible to balance these factors in daily life, and imparting knowledge to little ones at different stages of development can stir up flurries of opinion. Yet there is ancestral knowledge here too, in the form of inherited oral traditions connected to family recipes and stories.

What if we *re-membered* that these ancestral foods are our relatives who never accepted colonial forces? Indigenous food sovereignty is movement toward maintaining human rights for self-determination, cultural knowledge, land stewardship, water rights, and biodiverse preservation of communal wellness through ancestral foodways. These movements are central to nourishing Indigenous Peoples and future generations, not only from a human standpoint but also from a more than human perspective. The industrialization of food harms all life forms. Revitalizing ancestral foods and foodways native to the region in communal contexts can promote climate justice, which seeks to rectify the violences caused by colonial forces responsible for climate change.

Indigenous futurities involve continuous focus on self-determination in ways that uphold Indigenous epistemologies as indispensable as all knowledges. In other words, if all epistemologies can sit in a circle and value one another, white settler colonialism would be dismantled as a dominant force over others. Furthermore, a place-based approach to Indigenous food sovereignty would honor the native foliage and fauna of each region—meaning Indigenous peoples who embody knowledge, living and protective systems of that place, would be considered the stewards for understanding how to nurture biodiversity and live sustainably (Deloria et al., 2018). Similarly, Valdovinos et al. (2020) share stories that include their abuelas passing on ancestral foodways to the future generations, and the bittersweetness of those stories encodes a sense of gravitas that seems to transcend generations.

To apply the severity of need to reinstate Indigenous epistemologies, curriculum theorizers can turn to one tenant of computing curricula that was introduced in an Advanced Placement (AP) Computer Science Principles course, which includes the impact that computing has in a global context, analyzing the benefits and harmful effects of computing. Eglash et al. (2020a/2020b) note that server farms that store memory and provide energy critical to Big Computing destroy ancestral lands with hydroelectric dams and other forms of resource "extraction." Preservation of Indigenous foodway systems, as well as the protection of Earth, is a very real cost. This cost is the responsibility of us all, but oftentimes falls on the shoulders of Indigenous Peoples across the globe. As such, computing education must center an ethical compass outside of its binary existence that includes a protection of Earth and Indigenous peoples who hold this stewardship for time immemorial.

What if we re-evaluated computing in support of Indigenous parenting as it asserts Indigenous futures and nurtures what Zapatista philosophy (Malott, 2008) promotes: a world where all worlds co-exist with dignity?[19]

Merging Indigenous Motherhood/Studies + Ethical Computing Education = Ancestral Computing for Sustainability (ACS)

ACS was largely co-created to explore some of the aforementioned Indigenous Parenting questions about how to responsibly coexist with current computing options. In addition, and perhaps more importantly, ACS challenges the epistemological foundations of computing education in ways that offer curriculum studies a womb to (re)birth Ancestral Computing for Sustainability. ACS is informed by Indigenous Motherhood and created with the intention to nurture Indigenous computing futurities that root ancestral knowledge systems and Earth protection as sacred practices for future generations. Below are some examples of computing harnessed for sustainability for children and Indigenous futurities:

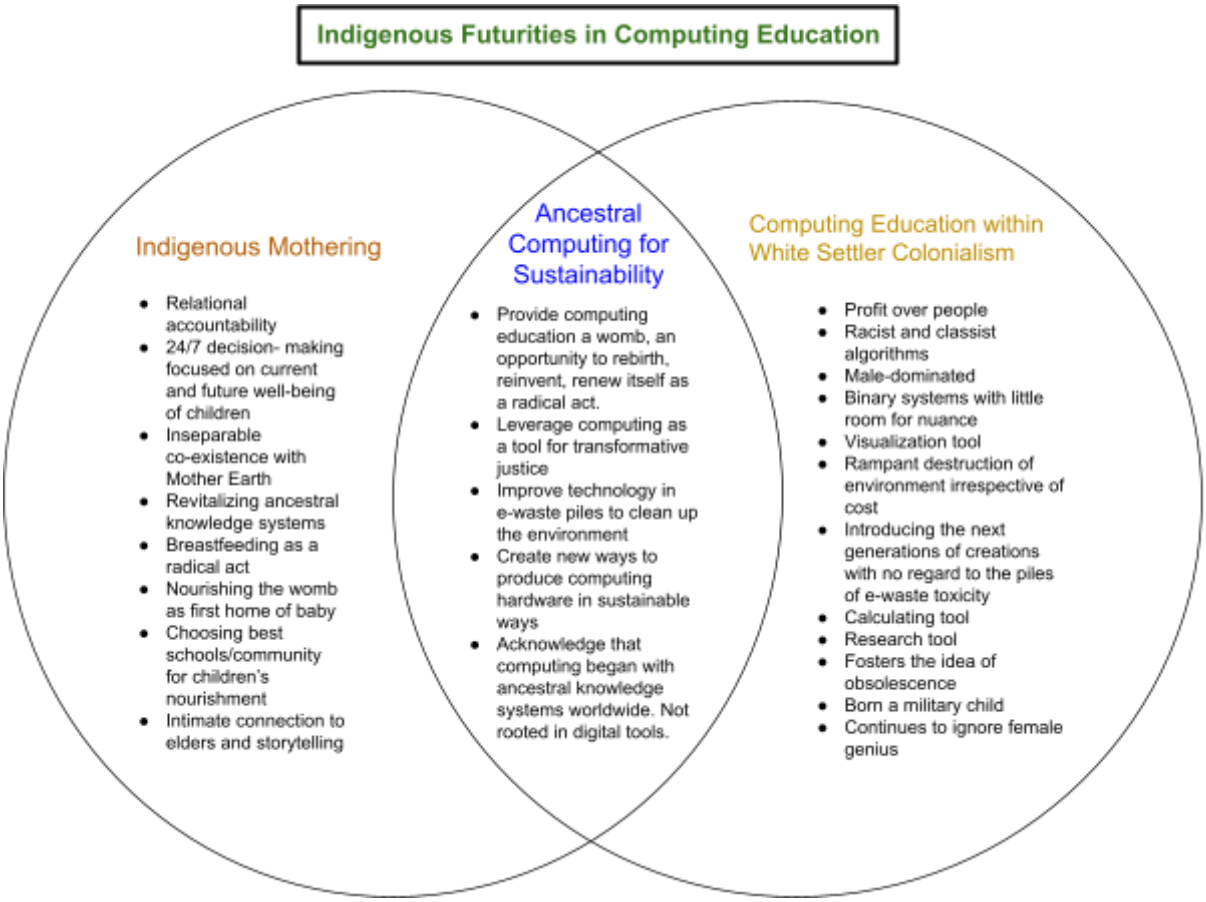
1. Gilberto Esparza of Mexico is a visual artist who combines science and recycled consumer technology found in e-waste piles, for example, to clean waterways. Esparza produces biotechnology to solve complex problems caused by the human footprint on Earth. He created Plantas Nómadas/Nomadic Plants (2008-2014), a robotic system that takes in contaminated water and breaks down toxic substances, while generating electricity, to clean local rivers.
2. Culturally Situated Design Tools (CSDT, found at csdt.org) hosts software that supports students' work with existing cornrow designs to develop new ones. Hair styles and treatments are often central to ancestral knowledge keeping, and democratizing access as well as holding cultural knowledge are both central to supporting decolonized, sustained generations to come.
3. CSforCA is an organization that promotes and supports computing education for California youth. They provide this list of interactive science museums: https://csforca.org/9-interactive-science-museums-to-visit-with-your-kids/
4. Elizabeth LaPensée's (2018) games "Along the River of Spacetime," "When the Rivers were Trails," and "Dialect" are Indigenous-centered digital games that center Indigenous epistemologies. See LaPensée et al. (2022) for a further theorization of sovereign games.
5. Nicole Turner's artificial intelligence equity lab fosters anti-racist and inclusive technological innovations.
6. Role-playing games like Coyote and Crow, a science fantasy role-playing game set in an uncolonized future, are produced by Native design teams.

Ancient Mexican computational thinking includes complex sustainable systems that may be reimagined, reinvented, and reinstated in today's time. For example, Mexican ancient civilizations observed and developed mathematical and astronomical systems that correlated with agricultural cycles, water management, social structures, archaeoastronomy, and other aspects of civilization. These systems were/are part of an ancestral identity that understands the interdependence of all life forms. How might we re-member this interdependence to promote a relational accountability in computing education? How might we re-member our relationships with the Star Nations to return to sustainable social and environmental structures? What may we be missing by not observing the cycles of these Star Nations, by remaining indoors, largely in light polluted urban centers?

Indigenous Mothering must be protected as one of the life-giving aortas of biodiversity. As mentioned earlier, April Lindala's comment on how computer science production needs a womb to rebirth and grow accountable to biodiversity and Earth protection remains more true than ever. As a military child, the initial productions of computer science profited from war-mongering and imperialist societies. We must hold computing accountable across social, environmental, and economic well-being. Refusing damage-centered research (for example, noting that Black and Indigenous women are too often erased from computer science education, see Tuck, 2009; Tuhiwai Smith, 2012) asserts affirmations of the spirit of Indigenous Mothering as part of Indigenous stewardship and communal wellness. Indigenous Mothering for ACS can help sustain both the abundance of Indigenous futurities and sustainable computer science production. The article closes with opportunities to expand Indigenous Mothering curricular lessons into professional development principles for educators across K12, higher education, and industrial contexts.

Indigenous Mothering is one of the foci in the active growth of Indigenous futures. When white settler colonialism does everything in its power to enact Indigenous physical and cultural erasure, Indigenous parenting draws from an older fountain of knowledge, which is ancestral knowledge systems (Moreno Sandoval et al., 2016) whose roots are older than systemic erasure. Therefore, unapologetically fierce Indigenous mothers can offer infinite possibilities of living, learning, and thriving with dignity. In particular, the moment-to-moment acts of creation and nourishment can offer computing curriculum developers a way of imagining ethical computing to protect Mother Earth and all her children, humans, and more than human relatives. Figure 1 illustrates the spaces in which Indigenous mothering, ACS, and computing education within white settler colonialism operate and intersect. In the next sections, I present a closer look at Indigenous Mothering and computing education within white settler colonialism.

Figure 1 - Indigenous Futurities in Computing Education



Ancestral Computing for Sustainability is a place of encounter, dialogue, and birthing potential. It did not begin with digital tools. Ancestral civilizations across the world engaged in complex, creative problem-solving. Figure 1 juxtaposes "Indigenous Mothering" and "Computing Education within a White Settler Colonialism" as two opposing forces. Ancestral Computing for Sustainability creates a third space of liminality that intersects modes of possibility for Indigenous Futurities. It is important to note that Indigenous sovereignty of Indigenous futurities imagines a

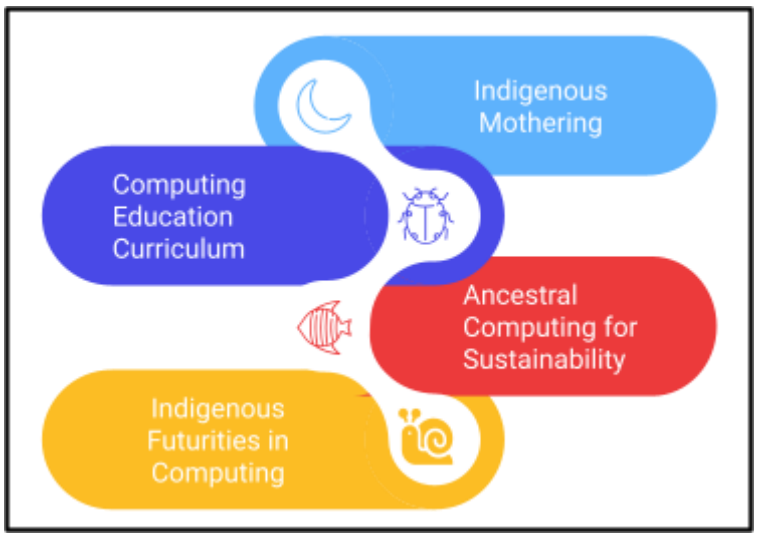
long-haul process of shifting mindsets, active relational accountability, and continued local re-creations based on place-based learning. *What if we imagine designing curricula that produce and use computer science hardware in socially and environmentally sustainable ways that consider the next seven generations?*

Conclusion

At the time of this writing, I attended a stimulating play by Minna Lee at the San Francisco Playhouse entitled, "My Home on the Moon," about a Vietnamese American elderly woman, Lan, who watches her neighborhood dwindle to gentrification. Lan feared her pho restaurant was next to close. The plot twisted when Lan was encountered by an Artificial Intelligent BOT that offered her a special "grant" that would help her business boom in the ways she always dreamed of. Lan and her assistant, Mai, accepted the "grant" and unknowingly moved into a simulation designed by a corporation selling Artificial Intelligence. In this simulation, all their pho restaurant dreams came true, but the ancestral dreams they kept were not manifested in the virtual world. After learning that the "grant" project meant that Lan stay in the simulated world, Mai decided to return to a world where her struggles would continue, likely with more complexities. This play strongly encouraged us to consider the controversies of blindly engaging in virtual worlds, as enticing as they might seem at times. What are we losing when we fall prey to capitalist ventures at the cost of losing ancestral knowledge systems?

As I have modeled in this article, Indigenous Motherhood, computing education, and Ancestral Computing for Sustainability and Indigenous Futurities are interconnected, and this is a constant movement among the areas, rather than a unidirectional approach to these concepts. By beginning with Indigenous Motherhood, through storywork (Archibald, 2008), I posited that children, youth, relationships among humans, and the protection of Mother Earth are at the core of Indigenous epistemologies (McLaurin, 2022). Computing education within a white settler colonial framework and conception surmises a dominance over these natural laws and diminish the complexities of relational accountability down to binary systems that can deeply harm all life.

Figure 2 - Connective Tissues Between the Sequence of Constructs that Detail this Article



These pages offered a vision of what Indigenous Motherhood could be in current times by exploring four key questions that tease out the relationships between Indigenous Mothering, computing education and Indigenous futurities. Are you listening, computing education? The resiliency, inner strength, and wisdom of Indigenous knowledge keepers must be valued and regarded as a compass for the ethics and sustainability of computing production and consumption for all learners and producers. We will not turn a blind eye to communities that are overlooked and ecological environments that are decimated by toxic e-waste, mining needed to produce the hardware of computers, and the use of life-giving elements that are needed for massive data storage units. The network of Ancestral Computing for Sustainability makes visible the dangers of a large part of computing education and production today. We implore the readers, curriculum writers, computing industries, and educators to consider (re)birthing computing education in sustainable ways for future generations. Thank you again, Copitzin, for the continued lessons we will continue to learn as we hope to nurture a world where many worlds fit. May we continue to walk the flowery path of our ancestors moving toward co-liberation, with dignity for all.

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Notes

1. Translation by Cueponcaxochitl: “My divine male son, ... sacred Earth, divine sky, blooming sprout.”
2. Copitzin is the Nahuatl term for “dear firefly.” Nahuatl is a Mexican Indigenous language with Uto-Aztecan roots currently spoken by approximately two million people.
3. Nantzin is the endearment Nahuatl term for “dear mother.”
4. Translation by Cueponcaxochit: “I write you these few words with lots of love and respect for the person that you are.”
5. The Ancestral Computing for Sustainability is a National Science Foundation-funded research team that includes Dr. Joseph Carroll-Miranda (Taino Arawak), Dr. April Lindala (Grand River Six Nations), Dr. Michelle Chatman (Mende, Yoruba, African American), Dr. Ebony Shockley (Black, African American, Maasai), Denise Cadeau, Dr. Jeffery Fleming (Black/African American), Dr. Fredric Ratliff (Black/African American), Dr. Alyssa Lopez Quiñones (Taino Arawak) and Marlen Martinez-Lopez (Trique Chicana). Together, we have envisioned and researched how to deconstruct and re-birth computing education for and by women of color. See decolonizing computing (Carroll-Miranda, et al, 2023) and centering Indigenous epistemologies in computing education (Lopez-Quiñones, et al, 2023).
6. Zapatista philosophy is born of resistance to corrupt and abusive tenants of the Mexican government. It centers Indigenous epistemologies as self-determination. Furthermore, considering Indigenous epistemologies of place, Abiayala (Keme & Coon, 2018) is one term used by the Kuna Peoples of present-day Panama to describe what is now called “The Americas.”
7. For more information on Indigenous birthing practices, see United Nations Population Fund (UNFPA, 2019).
8. For more information, see Sogorea Té Land Trust (n.d.).
9. To listen to the lullaby sung by Cueponcaxochitl, click here
10. A person who is on foot and guides large numbers of cattle from one place to another, usually walking hundreds of miles over a period of weeks.
11. There isn’t bad that good does not come from.
12. To learn more about Yosimar Reyes, see http://yosimarreyes.com/

13. In this case, jedi-training serves as an analogy for critical consciousness raising about dismantling white settler colonialism. Jedi training can also refer to adopting creative and dignified ways to heal from these systemic oppressions. Consider the wisdom of Yoda in George Lucas's Star Wars series. Yoda is presented as a wise individual who helps people live with dignity.

14. Translated by Nantzin: White dove of five colors: white, yellow, purple, snowy, and blue. And when they saw the dove, it had a white chest, a yellow beak, a snowy tail, and a blue crest. White dove, you come from the north, with your wide wings, you fly here. Long live the generation, long live love, long live pleasure, and let's go for an adventure!

15. Nepantla is a term by Chicana feminist Gloria Anzaldúa to describe a borderless place of the possibilities of freedom.

16. Your great-grandmother

17. Translated by Nantzin: "Speak little, speak truths."

18. See Eagle Books (https://www.cdc.gov/diabetes-ndwp/planning-guides/), a series of books for young people, written by Georgia Perez of Nambe Pueblo, New Mexico, and illustrated by Patrick Rolo and Lisa Fifield.

19. Zapatista philosophy is born of resistance to corrupt and abusive tenants of the Mexican government. It centers Indigenous epistemologies as self-determination. Furthermore, considering Indigenous epistemologies of place, Abiayala (Keme & Coon, 2018) is one term used by the Kuna Peoples of present-day Panama to describe what is now called "The Americas."

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