What Are the Supports and Challenges of Facilitating an OpenSciEd Unit on Energy at Chief Leschi Schools?




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I would also like to thank those who have advocated for me in the past. I would never have overcome all of the barriers by myself. I am humbled by the opportunities I have experienced and wish to be in a position where I can open doors for my students.

Research Question

My research question for this ethnographic qualitative Dissertation in Practice (DiP) is "What are the supports and challenges of facilitating an OpenSciEd unit on energy at Chief Leschi Schools?" Brayboy and McKinley (2005) argue that education in the United States is predominantly focused on mainstream structures, knowledge, and curriculum, and lacks Indigenous approaches and perspectives.

Introduction

My research question for this ethnographic qualitative Dissertation in Practice (DiP) is "What are the supports and challenges of facilitating an OpenSciEd unit on energy at Chief Leschi Schools?" Brayboy and McKinley (2005) argue that education in the United States is predominantly focused on mainstream structures, knowledge, and curriculum, and lacks Indigenous approaches and perspectives. Our fourth grade class used an ethnographic research method where we all researched together, utilizing complementary methodologies, such as *Etuaptmumk*, Two-Eyed introduced by Mi'kmaw Elder Albert Marshall (Bartlett et al., 2012; Hatcher et al., 2009), accounting for both mainstream and Indigenous perspectives.

My Teaching Pedagogy: Experiential Learning pt.1

Experiential Learning Cycle which follows eight important insights to learning such as:

- Learning is a recurring cycle. The experiential recurring cycle is imagined as a spiral of exchange between the learner's world and the external environment.
- Experience is necessary for learning. William James (1977) suggests that the experience be something that is not in the routine and strangeness of something outside of the normal experience. James (1977) calls this "pure experience"
- The brain is built for experiential learning. James Zull supports this claim in his research in the form of two books, The Art of Changing the Brain (2004) and From Brain to Mind (2011) which found the "learning cycle arises from the structure of the brain (Zull 2004,; Zull 2011)

The Experiential Learning Cycle

Figure A: The experiential learning cycle
(Kolb & Kolb, 2018)

My Teaching Pedagogy: Experiential Learning pt.2

- The dielectric poles of the cycle are what motivates learning. This means taking concrete sense learning and abstract learning and using them as tools to motivate next steps in learning as well as balancing active experimentation and analyzing with reflective observation.
- Learning styles are different ways of going around the learning cycle. This is important because each student has different learning styles and teachers can better facilitate the students' learning if teachers understand how their students' learn.

The Experiential Learning Cycle

Figure A: The experiential learning cycle (Kolb & Kolb, 2018)

My Teaching Pedagogy: Experiential Learning pt.3

- Full cycle learning increases learning flexibility and development where all learning styles are engaged in a wholistic and fluid manner.
- Teaching around the learning cycle involves four roles: Facilitator, Subject expert, Standard/Setter/Evaluator and Coach.
- The learning cycle can be a rubric for wholistic, authentic assessment. Learners should demonstrate knowledge and skills in their real life context. The outcome of authentic evaluation is to draw education close to real life.

Problem of Practice

The OpenSciEd curriculum adoption and full implementation in an Indigenous educational setting raises important questions about how students can access sustained, meaningful, place-based learning, for example walking to Lake Leschi to observe the natural systems of energy transfer with their teacher supervising. The overarching central problem of practice addressed in this DiP is student access. Chief Leschi Schools is uniquely situated on sovereign Puyallup land with a first food forest in development with UW Seattle. All CLS students should have access to the educational opportunities showcased to their parents on social media.

Research mentioned in the Literature Review

Bang et al. (2014) found that community-designed, land-based science education supported outcomes that extended beyond students' acquisition of scientific content. Bang et al. (2014) centered on learning relationships within Chicago's wetlands, ancestral village sites, medicinal and edible plants, and the effects of ecological change, allowing students to understand science through relationships among land, water, history, community, and identity.

Similarly, Hatcher et al. (2009) applied Two-Eyed Seeing in K–12 science and mathematics classrooms by engaging Elders as co-teachers and encouraging students to examine scientific concepts through both Indigenous and Mainstream perspectives. The researchers found that students developed a deeper understanding of science while strengthening their cultural identities because each knowledge system was respected within its own worldview. Likewise, Iwama et al. (2009) used Two-Eyed Seeing within community-based health research, demonstrating that collaborative inquiry between Indigenous Knowledge Holders and mainstream-trained researchers produced more culturally relevant interpretations and stronger relationships between researchers and communities.

Research mentioned in the Literature Review continued

Ringney et al. (2020) highlighted how Indigenous early childhood programs in Australia integrate Reggio's project-based methods with cultural protocols, ensuring that children's inquiries are tied to "Country" and community responsibilities. "On Country" learning involves children and youth engaging with ancestral narratives, astronomy, and ecological care through songlines, weaving, and ceremonial practices. The outcome was so positive and significant that the program is looking to expand.

Aikenhead and Michell (2011), who synthesized decades of cross-cultural science education research involving Indigenous learners across Canada. Their review found that Indigenous students were more successful when educators explicitly recognized Indigenous Knowledge alongside mainstream science. They described this process as "cultural border crossing", arguing that students are better able to navigate scientific concepts when schools intentionally build connections between Indigenous and mainstream knowledge systems. Their synthesis demonstrated that acknowledging multiple epistemologies increased student engagement while reducing the tensions Indigenous learners often experience when school science conflicts with their cultural understandings.

Design of the Study

This Dissertation in Practice employed a qualitative ethnographic research design informed by ethnography, practitioner inquiry, Indigenous methodologies, and relational place-based research. The design was intentionally selected because the purpose of this study was to understand the supports and challenges associated with implementing a fourth-grade OpenSciEd unit on energy while providing students with access to Lake Leschi and the elementary salmon program. This research question required a methodology that is not extractive, placing me with the participants conducting their research.

Design of the Study continued

This routine supported ethnographic research and the research question by allowing our students autonomy to make connections in the natural environment to compare them to the man-made methods of energy transfer presented in the OpenSciEd curriculum. This approach aligns with Indigenous scholarship that emphasizes wholistic understanding through relationships among intellectual, emotional, physical, spiritual, ecological, and communal dimensions of learning (Absolon, 2022, Cajete, 2015; 2000; Kimmer, 2013; Kovach, 2009; Wilson, 2008).

Lake Leschi Food Forest

Findings Theme One: Building a Relational Learning Community

Facilitating a positive classroom environment supported classroom relationships, scientist-story circles, negotiated expectations, and student agency established the conditions necessary for meaningful scientific inquiry. This theme demonstrates that trust, reciprocity, and shared responsibility formed the foundation for learning as students engaged with scientific concepts (Caxaj, 2015; Kirkness & Barnhardt, 1991; Wilson, 2008).

Implications for Practice

The findings from Theme One suggest that intentionally nurturing a relational learning community is an instructional support that strengthens students' participation in scientific inquiry. Daily morning and afternoon scientist-story circles, collaborative investigations, and opportunities for shared reflection created a classroom environment where students felt respected, heard, and confident contributing their ideas. These relational practices established the trust necessary for students to engage in scientific discourse, ask questions, revise their thinking, and collaboratively construct explanations of energy transfer.

Findings Theme Two: Access to Place Based Learning

Explores how regular access to Lake Leschi, the food forest, and the elementary salmon program supported students' scientific inquiry while also revealing logistical, structural, and institutional barriers to implementing outdoor learning. These findings illustrate that meaningful access involves more than physical presence, it requires sustained relationships with place, and opportunities for repeated engagement, (Bang et al.; 2014; Brayboy & Castagno, 2008; Cajete, 2015; Gruenewald, 2003; Simpson, 2014).

Implications for Practice

The findings of this Dissertation in Practice extend beyond instructional practice and raise broader implications for educational leadership, organizational culture, and ethical accountability. Implementing inquiry-based science instruction, place-based learning, and Indigenous-centered pedagogies requires educators to exercise professional judgment, adapt curriculum to meet students' needs, and build meaningful partnerships with community and place. These practices are supported by research demonstrating that culturally responsive and experiential approaches increase student engagement, strengthen scientific understanding, and affirm students' identities (Gay, 2018; González et al., 2005; Kolb, 2015; McCarty & Lee, 2014).

Findings Theme Three: Multiple Ways of Knowing and Demonstrating Learning

Examines how students documented and communicated their thinking through photography, illustration, scientific discussion, notice-and-wonder charts, concept and consensus models, scientist-story circles, and other student-selected representations of learning. This theme highlights Indigenous, experiential, and Reggio Emilia approaches that recognize learning is multimodal, relational, and socially constructed (Edwards et al., 2012; Kolb & Kolb, 2018; Rinaldi, 2006).

Implications for Practice

The findings from Theme Three suggest that providing students with multiple ways of knowing and demonstrating learning is not an accommodation for a select group of learners but an instructional practice that benefits all students. Student agency emerged when learners were given meaningful opportunities to investigate scientific phenomena, communicate their thinking, and select methods of documentation that reflected their strengths while working toward common learning goals. Offering multiple pathways for participation increased engagement, encouraged collaboration, and ultimately strengthened students' scientific reasoning.

For educators, Meyer et al. (2014) reinforces the importance of Universal Design for Learning (UDL) and culturally sustaining pedagogies that recognize oral language, visual representation, artistic expression, movement, and collaborative dialogue as legitimate demonstrations of scientific understanding.

Findings Theme Four: Indigenous Knowledge and OpenSciEd

Explores how students connected classroom science to observations of natural systems at Lake Leschi. By utilizing *Etuaptmumk*, Two-Eye Seeing, students moved between IK and mainstream science by comparing ecological relationships, salmon restoration, and energy transfer in natural systems with the human designed systems presented in the OpenSciEd curriculum (Aikenhead & Michell, 2011; Bartlett et al., 2012; Cajete, 2000; Kimmerer, 2013).

Implications for Practice

The findings from Theme Four suggest that integrating Indigenous Knowledge Systems (IK) with phenomenon-based science instruction strengthens students' engagement, scientific reasoning, and connections between classroom learning and their lived experiences. This DiP demonstrated that students were able to respectfully draw upon both knowledge systems while investigating authentic scientific phenomena. Students naturally connected classroom investigations with observations from Lake Leschi, the elementary salmon program, family teachings, and community experiences, illustrating that scientific understanding can be enriched through multiple epistemological perspectives.

Findings Theme Five: Challenges of Implementation

This section identifies the practical and institutional barriers encountered throughout the study, including limited instructional time, logistical constraints, competing curricular expectations, safety considerations, and the realities of implementing inquiry-based science within an elementary school setting that follows a different format. These findings illustrate that successful place-based science instruction requires flexibility, collaboration, and administrative support to fully realize the goals of inquiry-based learning (Levy et al., 2016; National Research Council, 2012; Rios & Brewer, 2014).

Implications for Practice

The findings from Theme Five imply that the successful implementation of inquiry-based science requires educational systems that are responsive, adaptive, and centered in professional trust. Although OpenSciEd provided a well-designed framework for scientific inquiry, meaningful implementation depended upon teachers' ability to make informed instructional decisions in response to students' questions, environmental conditions, and authentic learning opportunities. These findings indicate that curriculum implementation should be viewed as a dynamic process.

For classroom educators, the findings reinforce that effective science instruction requires sufficient time for students to investigate phenomena, revisit observations, revise explanations, and engage in collaborative discourse. Scientific understanding developed over multiple investigations, implying that rigid pacing guides may inadvertently limit opportunities for focused conceptual learning. Inquiry-based instruction requires educators to balance curriculum expectations with students' emerging questions and interests, recognizing that flexibility is fundamental to scientific practice itself (Kolb, 2015; Kolb & Kolb, 2018; Morris, 2020).

Findings Theme Six: Developing Scientific Identities as Researchers and Scholars

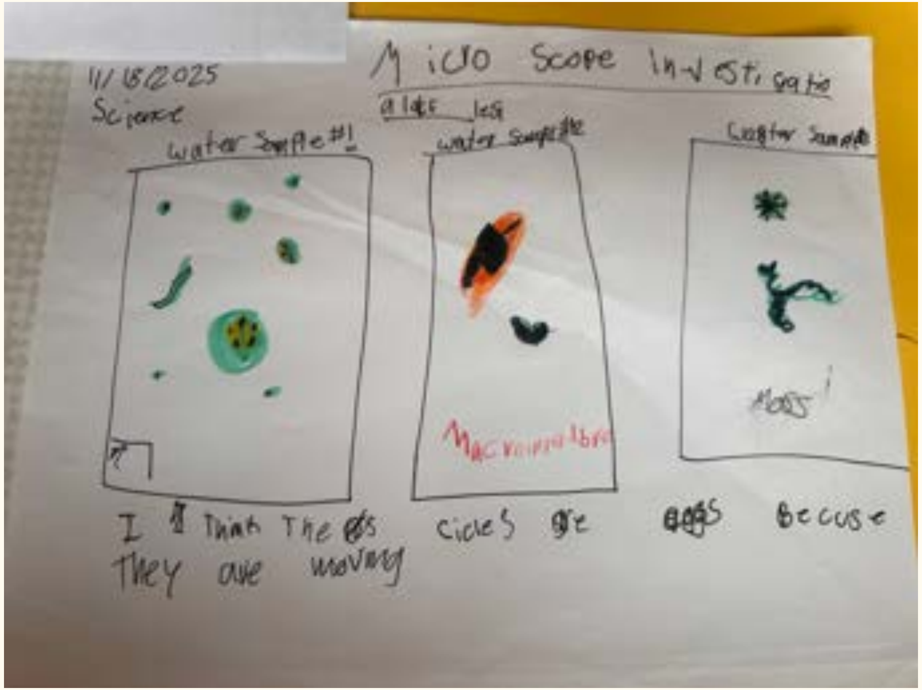
This final theme examines how students increasingly viewed themselves as scientists, researchers, and scholars contributing to a positive self-identity and creating and contributing to knowledge creation. As students assumed greater responsibility in the classroom they assumed greater responsibility in their learning. Students demonstrated growing confidence in their ability to ask questions, construct explanations, and contribute meaningfully to scientific inquiry. These findings support research suggesting that scientific identity develops through participation, collaboration, and relationships with meaningful phenomena (Bang & Medin, 2010; Cajete, 2015; Erickson, 1986; Kolb & Kolb, 2018).

Implications for Practice

The findings from Theme Six suggest that one of the most significant outcomes of implementing the OpenSciEd fourth-grade energy unit was not simply students' acquisition of scientific knowledge but the development of their identities as scientists, researchers, and scholars. As students repeatedly engaged in investigations at Lake Leschi, participated in the elementary salmon program, collaborated with classmates, and documented their thinking through multiple forms of expression, they increasingly viewed themselves as capable researchers and scholars contributing to scientific understanding. These findings indicate that inquiry-based science should be designed not only to teach scientific concepts but also to cultivate students' confidence, curiosity, agency, and sense of belonging within the scientific community.

Walk to the Lake Leschi Food Forest in Spring 2025

November 18th our class visited Lake Leschi and collected water samples. When the samples were projected on the classroom screen students illustrated what they saw and what other possible life forms benefit from seeing a variety of macroinvertebrates. This was revisited at Swan Creek when we released the salmon we raised.



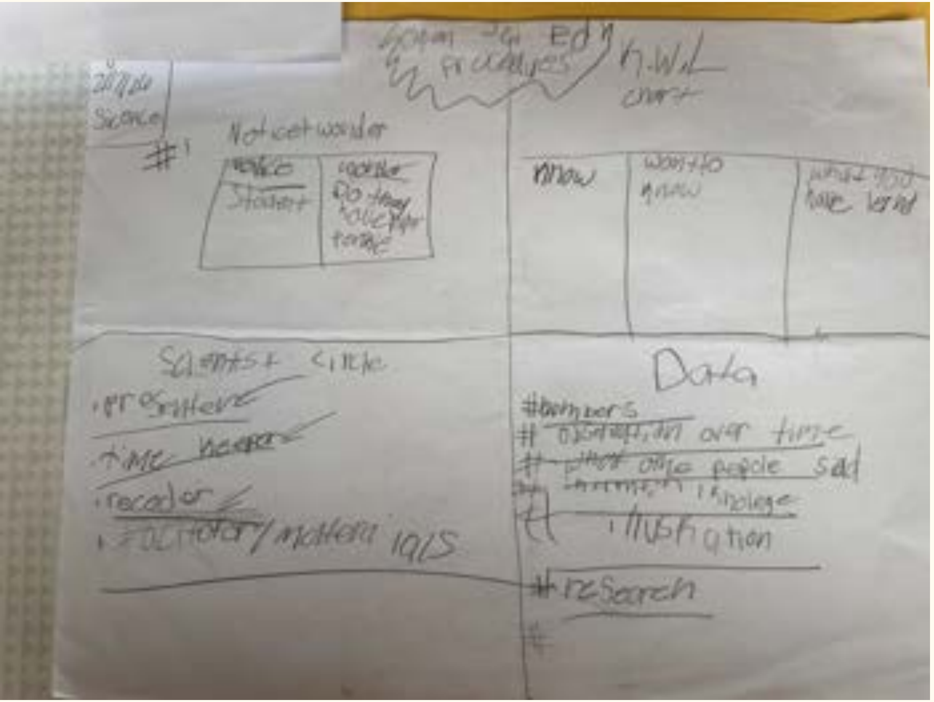
Lake Leschi Food Forest Spring

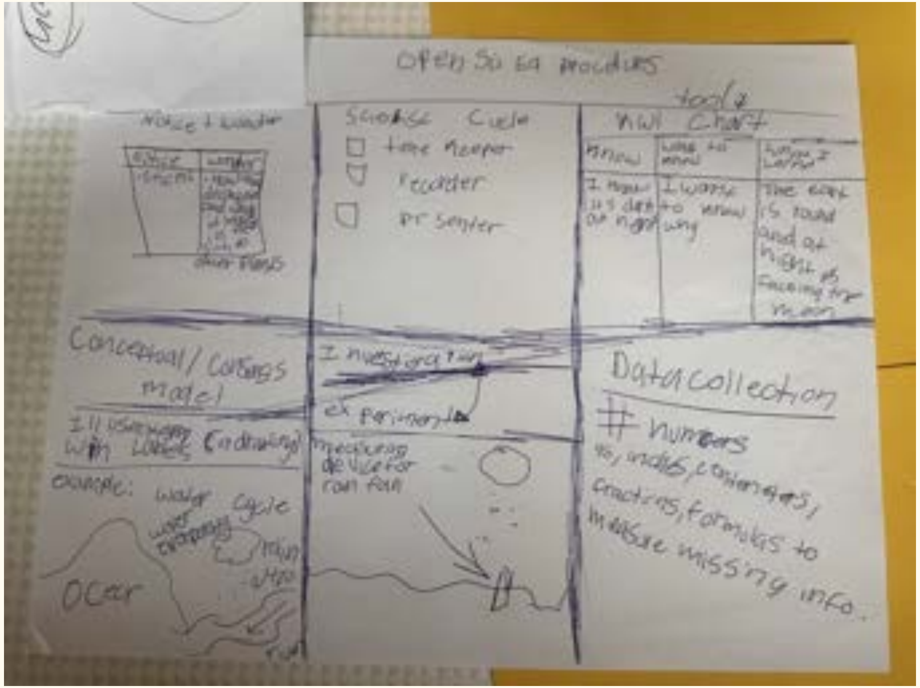
Salmon Release at Swan Creek March 2025

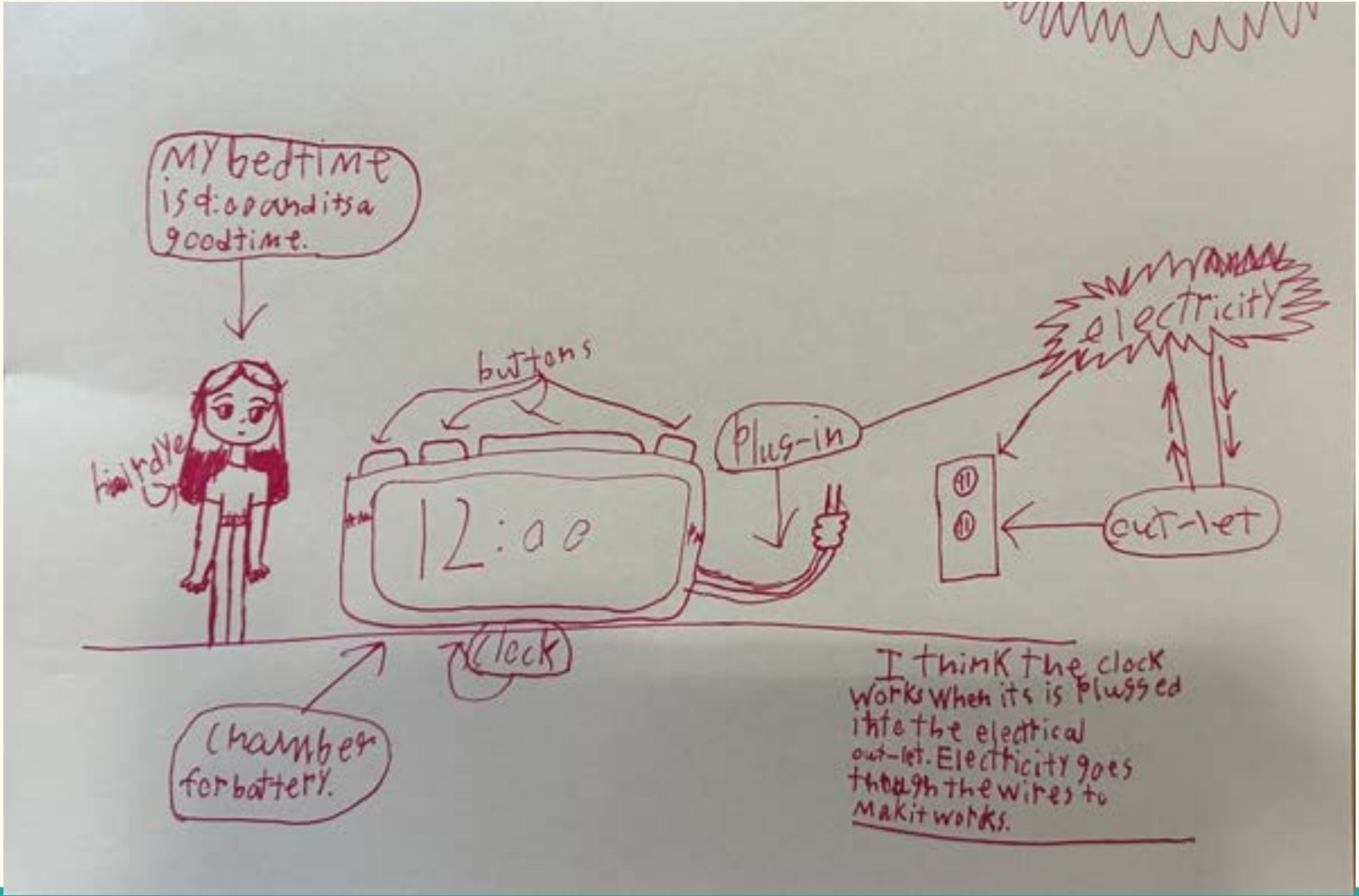
Macroinvertebrates and Biodiversity Scavenger Hunt

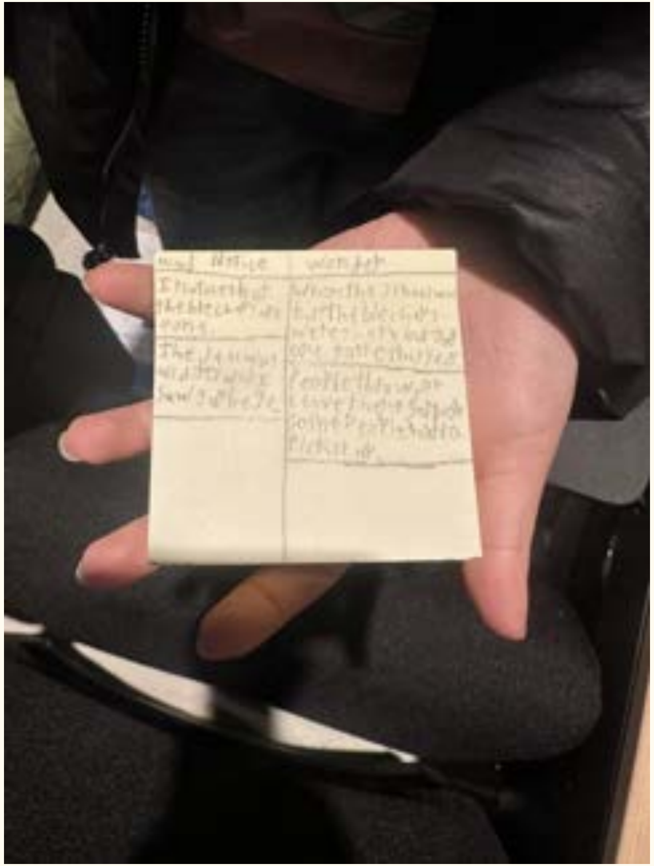
Expressions of Learning: Seeing a rainbow, recreating the patterns of colors in weaving

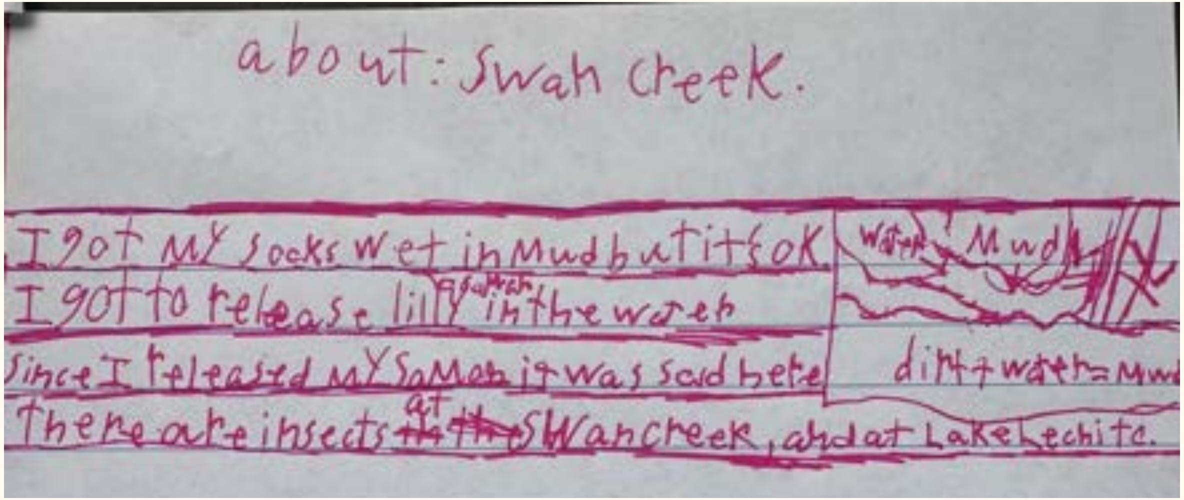
Science and Engineering Practices

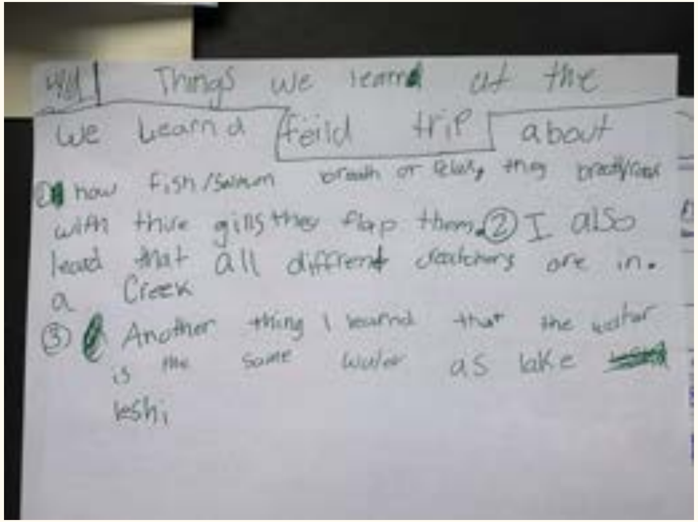


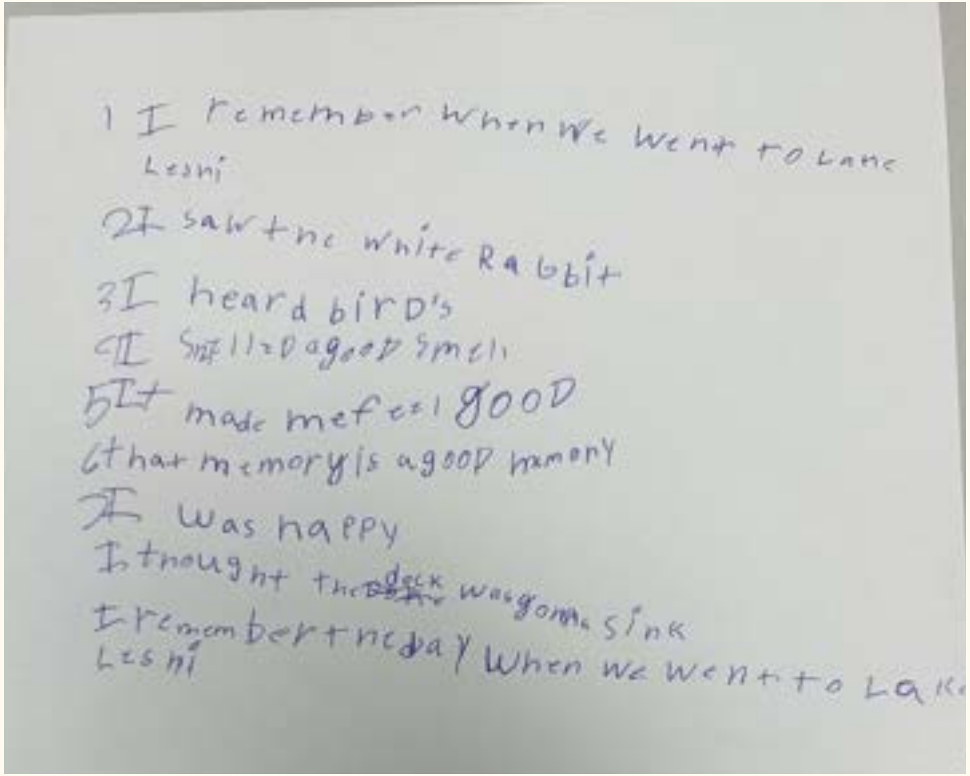



MYbedtime is 9:00 anditsa goodtime.
hairdye
buttons
12:00
clock
chamber forbattery.
plug-in
electricity
out-let
I think the clock works when its is plugged inte the electrical out-let. Electricity goes though the wires to Makit works.

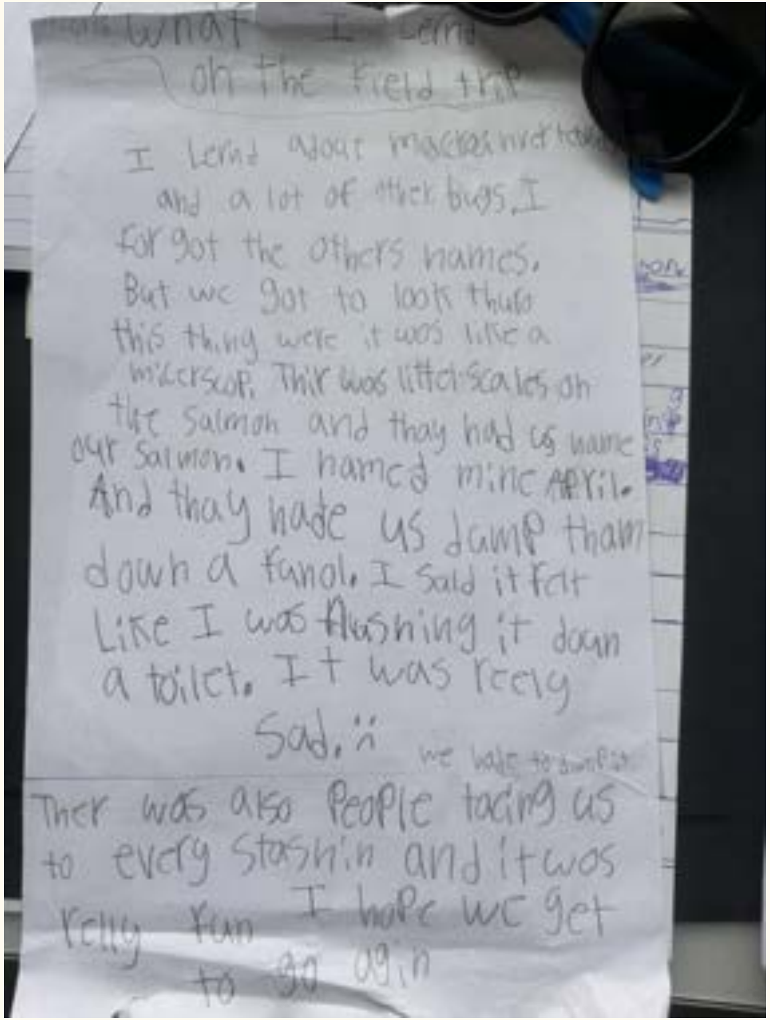



about: Swah creek.
I got my socks wet in Mud but it's OK
I got to release lilly salmon in the water
Since I released my Samon it was sad here
There are insects at Swan creek, and at Lake Lechite.
Water
Mud
dirt + water = Mud


Things we learnd at the feild trip
We Learnd about
1 how fish/salmon breath or relax they breath with thire gills they flap them. 2 I also learnd that all different creatures are in a Creek
3 Another thing I learnd that the water is the same water as lake leshi



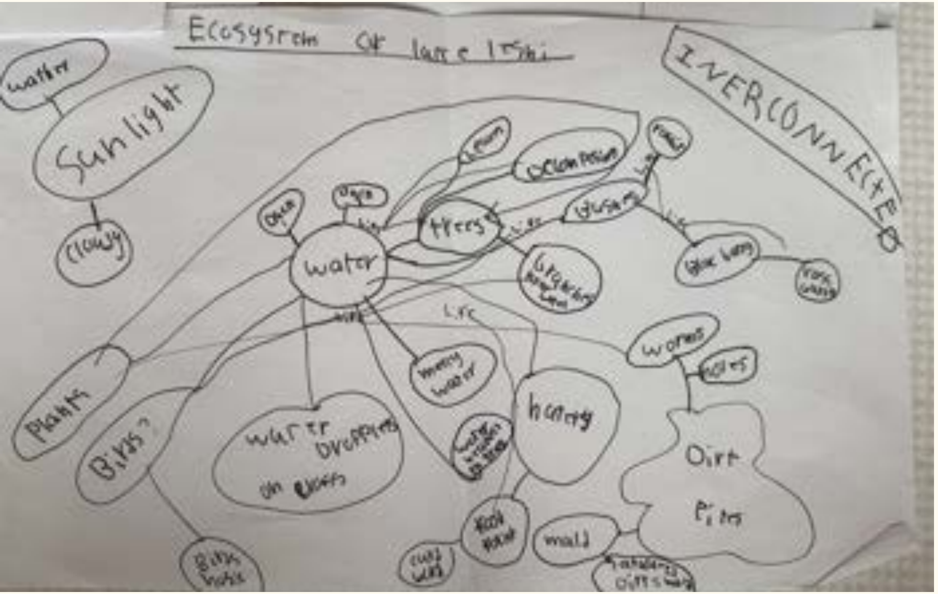
1 I remember when we went to Lake Lesni
2 I saw the white Rabbit
3 I heard bird's
4 I Smelled a good smell
5 It made me feel good
6 that memory is a good memory
7 I was happy
I thought the duck was gonna sink
I remember the day when we went to Lake Lesni



What I lernd on the field trip

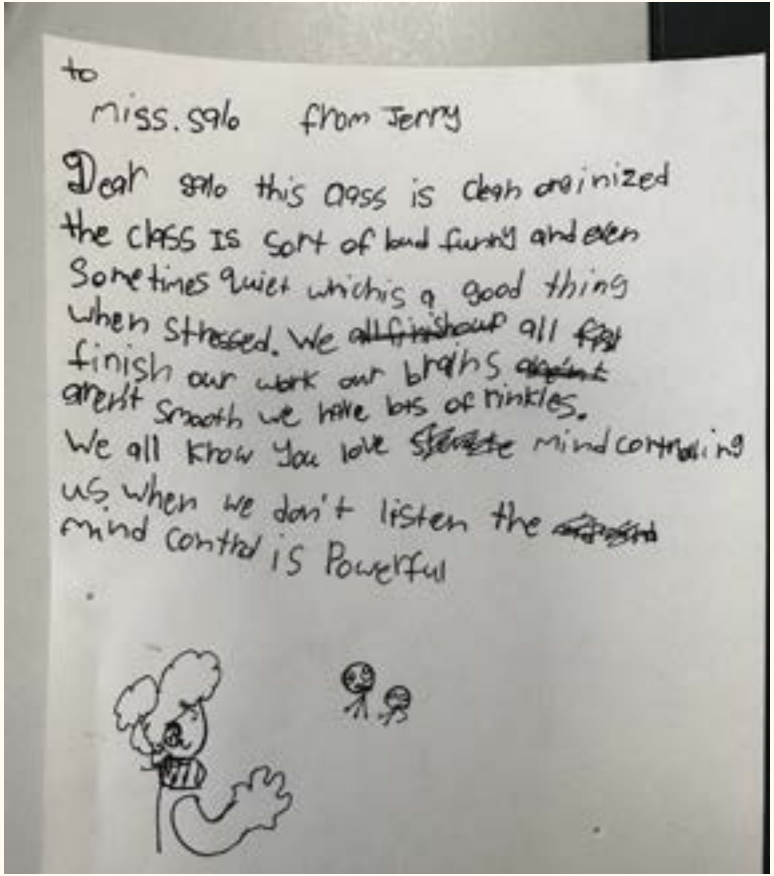
I lernd about macroinvert[illegible] and a lot of ther bugs. I forgot the others names. But we got to look thuro this thing were it was like a micerscop. Thir was littel scales on the Salmon and thay had us name our Salmon. I named mine April. And thay hade us damp tham down a fanol. I said it felt like I was flushing it down a toilet. It was reely sad. :(we hade to dump [illegible]

Ther was also people taking us to every stashin and it was relly fun I hope we get to go agin


Sunlight
water
Plants
worms
Dirt

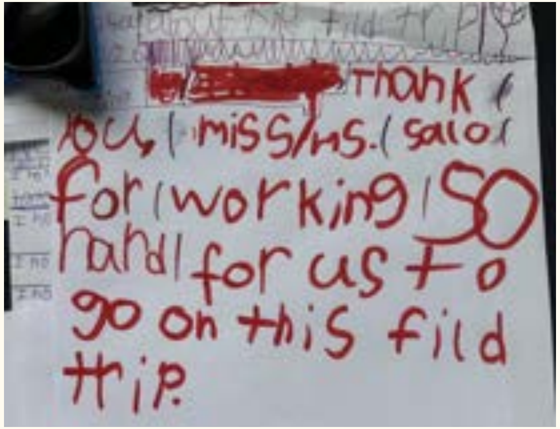

Energy
Power
Sun
Plants
car
Food
Brake


Chief Leschi Schools
Instructional
Salmon Hatchery

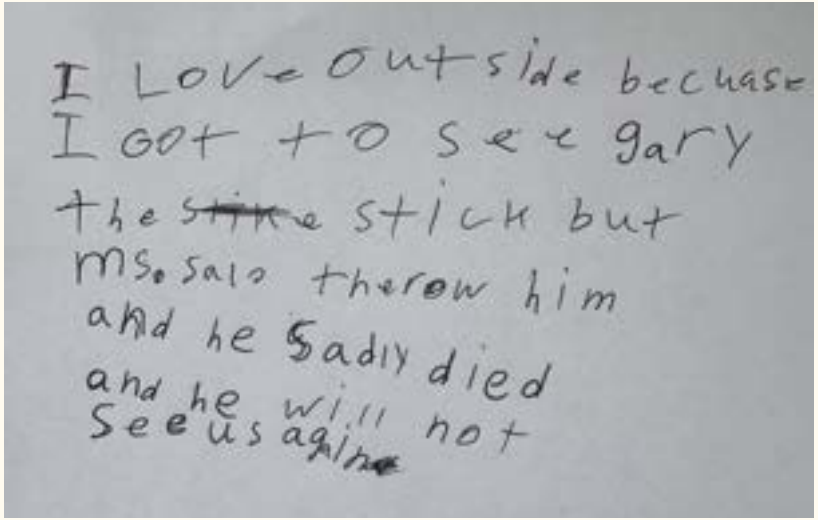


to
miss. salo from Jerry

Dear salo this class is clean orginized the class is sort of kind funny and even Sometimes quiet whichis a good thing when stressed. We ~~all finish our~~ all ~~fist~~ finish our work our brains ~~against~~ aren't Smooth we have lots of rinkles. We all know you love ~~Sterate~~ mind controlling us when we don't listen the ~~strength~~ mind control is Powerful



Thank you miss/ms. salo for working so hard for us to go on this fild trip.



I Love outside bechase I got to see gary the ~~stine~~ stick but ms. salo therow him and he sadly died and he will not see us again

Indigenous Knowledge (IK) Indigenous Knowledge Systems

Indigenous Knowledge (IK) is Wholistic, place-based understandings developed through long-standing relationships among people, land, water, and all living beings. It is relational, experiential, and sustained through storytelling, ceremony, observation, and practice across generations. In this research, Indigenous Knowledge is understood as a living system of knowing, being, and doing that guides respectful relationships, responsibility, and reciprocity within science education.

IKS is relational and inseparable from the communities, lands, responsibilities, and relationships that produce them.

Banks Definition of Culture

Banks' (2016) definition of culture as a dynamic, socially constructed framework of shared beliefs, values, traditions, languages, behaviors, symbols, and lived experiences that shapes how individuals interpret their world and engage with others. Banks explains that culture is acquired through participation in families and communities and continually evolves in response to historical, political, and social contexts. Research from Banks is used throughout this DiP, so it is logical to use the same definitions as it is expressed in Bank's research.

OpenSciEd and Indigenous Knowledge Systems

OpenSciEd introduces students to human-designed systems for generating, transferring, and storing energy. This study intentionally complements those investigations by providing students with opportunities to observe naturally occurring energy systems and compare them with engineered systems. Through a Two-Eyed Seeing perspective, students were encouraged to understand that scientific knowledge can be strengthened when mainstream scientific inquiry is learned alongside Indigenous Knowledge Systems (IKS) found in spaces such as the Lake Leschi Food Forest and through the elementary salmon program (Bartlett et al.; 2012; Hatcher et al., 2009; Wilson, 2008).