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Pedagogy of Whole Language Hearts: Fostering Relational Ways of (Re)Connecting to the Land With Multilingual Refugee Children

Sophia Thraya¹  | Miwa A. Takeuchi¹  | Jèrène Rahm² 

¹Werklund School of Education, University of Calgary, Calgary, Canada | ²Faculté des sciences de l'éducation, Université de Montréal, Montreal, Canada

Correspondence: Sophia Thraya (sophia.thraya@ucalgary.ca) | Miwa A. Takeuchi (miwa.takeuchi@ucalgary.ca)

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ABSTRACT

Colonial monolingual norms are a present oppressive force within schooling spaces, with a direct assimilative target on the linguistic practices of historically marginalized peoples, histories, and knowledge systems. For racially minoritized multilingual refugee learners, the space of in-school science learning can be experienced as an involuntary detachment from linguistic wholeness, intergenerational ways of knowing, and community practices. Our work offers a disruption of the deficit-based narratives that leave the brilliances associated with multilingualism invisibilized. Based on facilitator reflections and video-based interaction analyses, our findings shed light on the pedagogy of whole language hearts that actively resist colonial and racialized linguistic norms and center social interactions and relations transcending divides across languages, geopolitical locations, and species. The pedagogy of whole language hearts was enacted to embrace how children and teachers located themselves within land-based networks of interrelated communities. We offer to look at this network intersectionally, lovingly, and relationally to imagine otherwise, refusing the predefined disciplinary possibilities for eco- and socially just science futures together. Extending further the literature on translanguaging, our article focuses on the transformative possibilities of language emerging from our work with diasporic refugee children hailing from the “Middle East,” which transcends the borders of the named languages of Arabic, Kurmanji, and English. With the pedagogical enactment of language with whole hearts, we demonstrate how teachers can open space for science teaching grounded in the lives and worlds of multilingual refugee children and in embodied interactions on the land. We argue that ways of coming to know sciences are inseparable from our sense of community, stories, and relations.

1 | Introduction

Science learning connected to the land centers ways to respect and learn from intergenerational land stewardship and embodied scientific knowledges (Kim and Czuy 2024; Marin and Bang 2018; L. B. Simpson 2014). In this article, we argue that science learning does not always have to start from or be bound by any curriculum or standards but rather can

be emergent from our joint practices on and with the land. Narrowly defining science learning merely with set science standards could risk reproducing “dominant ways of knowing, while omitting, subsuming, and erasing others” (Ballard et al. 2023, 1617). Our work seeks to see how we can open space through our pedagogy for science to emerge and flourish—a science that is grounded in the lives and worlds of children across time (Ballard et al. 2023; Tan and Faircloth 2023). We

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see science learning as relational, implying engagement with the world through the cultivation of and being in relationship with people, concepts, and tools that foster scientific inquiries and action relevant to one's life (Ballard et al. 2023; Bang et al. 2012; Davis and Schaeffer 2019; Tan and Faircloth 2023). Doing science also implies enactment and affective moves centering care to non-humans (El Halwany and Alsop 2023). By grounding science learning as emergent from relations and being on and with the land, teachers and students can engage jointly in opportunities that offer rich, relational, and emergent moments of learning in place (McDaid Barry et al. 2023). Numerous researchers have eloquently shown that including different orientations to science desettle what has been considered as science education (Marin and Bang 2018).

Research has also made a strong case for community garden spaces' role in science education given their affordance of abundant informal science learning opportunities (Dutta and Chandrasekharan 2019; Rahm 2002). Grounded in community garden spaces, our paper explores the role of pedagogy enacted in and through emergent learning opportunities in science to disrupt colonial monolingual norms and deficit-based narratives, emphasizing the brilliance, relationality, and wholeness of racialized multilingual refugee learners. The journey toward wholeness, according to Battiste (2013), refers to the restoration of an inner sense of connection and unity that has been alienated, disrupted and fragmented through Eurocentric systems of education. According to the work of Alexander (2002), decolonial efforts in education must be enacted with "the deep yearning for wholeness" (99). Our way of seeing wholeness emphasizes the importance of honoring the full, complex, and layered relational selves that have been masked by dominant colonial deficit narratives. Translanguaging pedagogy recenters the speaker's unitary repertoire comprised of features and meanings—countering colonial monolingualistic ideologies and the deficit gaze on language minoritized individuals and communities (García et al. 2017; Suárez 2020; Wei and García 2022). Translanguaging pedagogy honors the brilliance of racially and linguistically minoritized learners, recognizing their inherent potential and the rich knowledges of wholeness—linguistic and beyond—that are passed down to them intergenerationally (Harper and Kayumova 2023; Kayumova et al. 2025).

In this article, we shed light on the pedagogical rightful presence (Tan and Faircloth 2023) of teachers, children and community members who collectively embarked on the journey of seeking to reimagine linguistic design, to center individual and collective wholeness and brilliance of linguistically and racially minoritized refugee children. For this vision, we focus on the voice and reflections of Author 1, Sophia Thraya, who was a teacher-in-transition: as a teacher candidate, a trained teacher, and a teacher/researcher over the period of 3 years in this study. It must be noted that while centering Sophia's voice in the naming of the work she led, the pedagogy we highlight emerged in relation. The pedagogy we illustrate in this paper was notably enacted *together* through a shared vision and orientation, alongside her fellow teachers who embraced it on their own terms. The participating children were actively co-creating and enacting the translanguaging corriente (García et al. 2017) together with pre- and in-service teachers, on and with the land, thereby challenging the dominant linguistic norms imposed upon them.

We refer to this pedagogy as the pedagogy of whole languaging hearts, conceptually grounded both in the literature on translanguaging and the work of scholars in science education who have engaged in unsettling hierarchies of science knowledge systems and epistemic boundaries. The pedagogy centers on the intellectual brilliances of multilingual youth that are often masked in schooling as they engage in science (Kayumova et al. 2025).

In this article, we show how the pedagogy of whole languaging hearts emerged in place through co-constructions—following the lead of the participating children—and culminated in the co-designed land-based program we call Soil Camp. Soil Camp was further enriched through the collaboration with community partners and a wide network of teachers, researchers, and children who offered feedback, perspectives, and experiences over time (see more <https://soilcamp.ca/>; Takeuchi et al. 2021, 2024). Our emergent co-design was centered around a vision to design and study land-based learning to amplify learning opportunities for refugee children and youth by moving toward transdisciplinary learning grounded in intergenerational and community knowledge of soil, ecosystem and farming on a community regenerative farm. Within the context of Soil Camp, drawing from the reflections and perspective of a teacher, we ask: How did the pedagogical moves emerge to emphasize the wholeness of language and the brilliance of refugee children? Given that our pedagogy was co-constructed and shared among all other teachers who were a part of the program, we ask: How did teachers relationally enact whole languaging hearts pedagogy with children on the land?

1.1 | Researcher Positionality

Although our positionality goes beyond what can be summarized in these few sentences, our analyses were guided by our personal and collective histories that shape sensitivity to certain aspects of learning (Boveda and Annamma 2023). Our analysis emerged from analytical gazes wherein first-, second-, and third-person testimonies are intertwined (Espinoza et al. 2020). Multiple analytical gazes allowed us to surface the layered translanguaging practices and the interactional co-fostering of the translanguaging space through collective movements with the land.

Sophia Thraya: I am a second-generation Canadian of the Lebanese diaspora and self-identify as bilingual, holding both English and Arabic in my linguistic repertoire and dear to my heart. My partially shared histories, acute sense of geopolitics and previous engagements with and within the community have provided me with ethical engagement affordances, but more importantly the responsibility to continue to seek guidance. Shaped by my ongoing linguistic research design work, I intentionally seek to center histories in places transcending borders, bodies beyond labels, transdisciplinarity and epistemic plurality in learning (Takeuchi et al. 2022). I joined the Soil Camp project as a teacher candidate, a teacher, and a researcher, while co-coordinating the efforts for teacher education and co-leading the pedagogical design. Building relations while engaging in iterative linguistic design work has been a true privilege. I hold both the memories of facilitation and the collected data with great care, seeing them as gifts that I live with, which

further my thinking and help us reimagine what is possible. I have brought my lived racialized experiences and deep insights of being a multilingual teacher in both teacher education and in school teaching into the design of an alternative space to challenge English monolingualism. My commitment to the unsettling of the deeply entrenched geopolitical and colonial matrices of power (Takeuchi 2021) within learning spaces stem from my own experiences as a young child within the public education system in the very city where this work takes place. Holding non-dominant stories, languages, and land-based knowledges that are all too often expected to be left at the peripheries of dominant spaces. I have experienced significant healing through my time at Soil Camp, moving away from the deficit-oriented descriptions I've heard throughout my life, which often characterized my languaging as fractured or broken. These experiences informed the theorization of whole language hearts, and this work has been transformative in seeing and bringing my own wholeness as an educator together with children. I seek to contextualize my positionality in embedded and represented ways in the writing of the research findings and explicated pedagogical moves.

Miwa Aoki Takeuchi: For the analysis of languages in transdisciplinary learning spaces, I bring forth my embodied experiences of the beauty and the pain of being a racially minoritized, multilingual immigrant. Anti-colonial relationality, the design of the collective spaces for earth-centered learning and healing, and plural ways of listening to the voices of the soil—these visions that I share with my team members have been largely guided by my critical analysis of hegemony and oppression as a racially minoritized, queer, multilingual immigrant committed to learning to unsettle my immigrant settler identity. As the principal investigator of the Soil Camp project, I commit to continuously reflecting on, revisiting, and renewing our visions, ways to lead, and ways to design in conversations with each of my collaborators, including local Indigenous Elders and Knowledge Keepers, community partners, teachers, and children who participate in the project. From this positionality, I bring critical analysis to languages and languaging enacted in the Soil Camp, which cannot be detached from relationality.

My questions about power and privilege through the reflection on positionality led to accepting the invitation from a community partner to co-design the Soil Camp project during 2020, in the midst of the COVID-19 pandemic. In the time of an unforeseen pandemic during our lifetimes, we together questioned what our responsibilities are toward families and children who have experienced forced displacement in colonial ways. Becoming more attuned to the voice of more-than-humans as some normative human activities slowed down in the face of the pandemic, we together dreamed the possibility of designing land-based learning opportunities that embrace knowings from local and global Indigenous communities toward socio-environmental justices, while centering the voice of the soil, which is crucial for our environment, ecosystems, and food justice. Our design hopes are depicted in the form of a community report completed in the initial year of the Soil Camp design, together with our community partners (Takeuchi et al. 2021) and repeatedly revisited through our website (<https://soilcamp.ca/>). To me, working relationally, longitudinally, and ethically with community partners meant

the act of intentionally slowing down and prioritizing design and knowledge mobilization efforts that matter to community partners.

Jrène Rahm: As a multilingual first-generation immigrant to Canada with European roots, I bring to the Soil Camp project insights from longitudinal work on informal science learning and identity work in gardens and other out-of-school settings. This research, conducted jointly with children, youth, and communities in ethnically diverse urban spaces, informs my contributions. Languaging through relational work with the land and the more-than-human world has also emerged as a central aspect in Indigenous-led environmental stewardship projects, which I had the opportunity to describe jointly with its participants. The latter led to a deep interest in the decolonization of knowledge systems and practices in science education which would open up science to youth it currently pushes out. Those experiences nourished my work with the co-authors on this paper. Accordingly, learning a second or third language is understood as not simply implying mastery of a new grammar but as a way of becoming, which can sometimes feel disenfranchising. This perspective has significantly contributed to the notion of languaging discussed in the paper and reflects our individual experiences as multilingual speakers on our respective journeys. The centrality of becoming in relation to land and others is something we as co-authors continuously engaged with in our work as a research team and as co-authors of this paper.

1.2 | Centering Multilingual Brilliance and Justice-Oriented Pedagogy in Science Education

Children hold a brilliance and foresight that we as teachers must listen to and center, especially as we have the power to take up roles of reimagining and designing learning environments *with* children—notably those children whose voices have historically been suppressed in institutional learning spaces. Aligning with the movement and calls for justice-oriented pedagogy in teacher-education and language practices in science teaching and learning, we seek to contribute to the critical area of science education which engages with translanguaging pedagogy. The current body of scholarship drawing connections between translanguaging and disciplinary learning such as science and mathematics (e.g., Karlsson et al. 2020; Lemmi and Pérez 2023; Maldonado Rodriguez et al. 2020; Suárez 2020; Vogel et al. 2019) offers rich insights into a possibility to “actively desettle normative forms of communication” that focus on “sanctioning the use of resources from a broader semiotic repertoire” (Suárez 2020, 820). As such, Suárez (2020) describes the need for science educators to encourage students to collaboratively problematize scientific phenomena, through drawing on their full semiotic repertoires and calls for work on and support for pre-service and in-service teachers in enacting translanguaging in conjunction with resistance to the deficit discourses that exist on multilingual learners in STEM learning spaces.

Building on these calls, our work is grounded in scholarship that centers the brilliance and rich onto-epistemologies held by racialized multilingual children, specifically those who have experienced forceful displacement (Harper and

Kayumova 2023; Kayumova and Dou 2022). We do so by attending to the manner pre- and in-service teachers pick up and put into practice such a positioning of learners in science learning spaces beyond schooling. We aim for a disruption of the deficit-based narratives that continue to be reproduced, leaving the brilliances associated with multilingualism unseen and invisibilized (Ryu et al. 2019; Tan and Faircloth 2023). Deficit narratives are often palpable and continue to be centered through means of language instruction, assessment and categorization in in-school learning spaces (González-Howard and Suárez 2021). We understand practices of labelling of children as “refugee learners” and “English language learners” (ELL) as entangled with ongoing racialization and coloniality, forces that decenter and position these children as intellectually and linguistically inferior, stripping them of their dignity, heterogeneity and membership in science (Takeuchi et al. 2022; Harper and Kayumova 2023; Wilson-Lopez and Hasbún 2023). Our work seeks to share what can emerge from holding space for, and honoring, the voices of those we are in relation with by “centering their full-humanities, rights, dignities, self-determination, and self-expression” (Harper and Kayumova 2023, 11).

Given our orientation, we seek to also pay attention to the political context our pedagogical work is situated in, particularly the discourses surrounding the languages held in the hearts of the children and teachers engaged in this work that still too often are censored, surveilled and subjugated at school and ultimately left within the safety of their homes. For example, take Arabic. In the context of the post-9/11 ‘War on Terror’ era, raciolinguistic profiling has become even more visible and audible in Western societal contexts (Flores and Rosa 2015). The flawed conflation of the Arabic language with the faith of Islam and Islam with terrorism and extremism is grounded in Islamophobic rhetoric and tied to the larger anti-immigration and othering ideologies which persist (Ghaffar-Kucher et al. 2022). Those who are Muslim or Middle Eastern-looking or Arabic-sounding have been targeted and unjustly treated in exclusionary ways within public settings—including STEM learning spaces (Avraamidou 2020). Seen within these educational spaces and holding major impacts on STEM is the deviance ascribed to marked peoples’ disciplinary engagement in disciplines like engineering—as seen in the arrest of 14-year-old American student Mohamed Ahmed in 2015. The way the assumed “Other” (Said 1978) is perceived in learning spaces in this deficit and criminalized manner intersects with English hegemony and colonial monolingualism—leading to further silencing and exclusion. In this context, our work brings perspectives to languages in science learning spaces that seek to actively challenge the colonial coupling of race and languages and interrogate intersectionally as it pertains to othering (Takeuchi et al. 2022). While much of the existing translanguaging scholarship in science education has emerged from U.S.-based, Spanish-English bilingual classroom contexts, our work contributes a distinct perspective grounded in the experiences of multilingual refugee children in Canada, whose families have historically maintained intimate connections to the land, within local out-of-school, land-based learning environments. Such complex reconnections with land, marked by different space–time configurations also make evident new possibilities for translanguaging pedagogies that are

relational, ecological, and tied to histories of displacement and reconnection.

Our work brings forth the complexity of the linguistic ecology that children we work with navigate in. Our work is committed to the “shift away from [the] damaging narrative[s] of deficiency, incompleteness, and insufficiency imposed upon learners under the guise of development and learning” (Takeuchi et al. 2022, 1724). Suspending the damage repeatedly done on the communities we work with through “damage-centered research” (Tuck 2009, 409) or damage-centered media coverages, we try not to depict these children from one aspect of their lives. Instead, we focus on relational ways of (re)connecting to the land in and through languaging pursued by children on their own terms.

2 | Reframing Language Relationally

As we conceptualize “language” in this manuscript, we focus on relational ways of languaging emphasizing how land-based interactions and pedagogical enactment can lead to unveil non-western ways of knowing, being and seeing science, deeply grounded in and emergent from the children’s lived experiences and relations with the land. For this conceptualization, we draw both from the framing of translanguaging and Indigenous ways of seeing languages. A translanguaging stance, as described by García et al. (2017) refers to “the belief that bilingual students’ different language practices need to be leveraged together and performed collaboratively with others” (184). The translanguaging stance allows for the enactment of features of languages that best foster understanding and connection. Such pedagogical approaches allow for aligning learning environments with students “actual languaging practices” (García et al. 2017, p2) and lived experiences and by following the translanguaging flow, termed “translanguaging corriente” (García et al. 2017, 21).

The notion of translanguaging shifts away from the traditional bilingualism conceptualization of language, which sees languages as independent named autonomous systems that one employs as deemed appropriate by dominant listeners in the contextual climate (García and Wei 2014). This limiting perspective demobilizes the rich unified linguistic resources that linguistically minoritized peoples and communities hold, and its potential for the co-creation of “new social realities” (García and Leiva 2014, 204). Translanguaging also refers to the pedagogical approaches employed to move beyond linguistic validation by leveraging learners’ whole repertoire use and practices in learning spaces (Wei and García 2022). These pedagogical approaches allow for the streamlining and designing of learning environments that are reflective of the “actual languaging practices” (García et al. 2017, 2) of students which are also deeply entangled with their lived experiences of learning and knowledge sharing. As such, the “trans-” in translanguaging indicates the transcending beyond the social construction of named languages, implying an act of “revealing how bilinguals inhabit a world with different knowledge bases and linguistic/cultural practices” (Wei and García 2022, 313). This transcending view of translanguaging acknowledges the link that exists in the realities of multilingual peoples’ languaging, knowing, and lived histories.

As we mobilize the notion of translanguage for forcefully displaced peoples to (re)connect to the land, and also by challenging what science learning is, we also draw from Indigenous ways of seeing languages. Collectively, these perspectives rooted in Indigenous epistemologies and ontologies push us further to conceive languages as a locus of building and rebuilding relations. The work of Hermes et al. (2023) shows how meaning-making by the Ojibwe speakers on the walk of Ojibwe lands implies the resurgence of relationality that sees humans as a part of the natural world, and that centers the act of building loving relations “grounded in place” (3). Such an act of “restoring learning and interaction to our bodies in motion” (Bang et al. 2022, 159), and in place, disrupts the Western notion that learning and languaging begins and ends in the mind and tongue of the individual. Henne-Ochoa et al. (2020) advances the ideology of “language-as-a-process-of-sustaining-relationality” (483), including relationality with the more-than-humans as well as the land. Bigelow and Engman (2020) see the expansive possibilities of language, coming from and mediating “intergenerational interactions on or with the natural world” (480). With such expansion to the ways of seeing language and languaging, we must also create space for the “alternative conceptions of language teaching and learning” (Bigelow and Engman 2020, 480).

Many Indigenous languages bring language and land together and thereby center an ontology deeply marked by relationality, respect and reciprocity (Hermes et al. 2023; Kimmerer 2017). Many Indigenous languages afford “ecological compassion” (Kimmerer 2017, 239), relations built with more-than-human teachers (McDaid Barry et al. 2023) and thereby disrupts the anthropocentric hierarchy and instead centers language, land, humans and more-than-humans as inseparable and as entangled in a web of relations (Bang and Marin 2015; Hermes et al. 2023; Marin and Bang 2018). Such Indigenous ways of seeing languages extend the notion of translanguage by centering obscured ways of knowing which has a possibility to challenge what science is and what science learning is.

With decolonizing perspectives on languages, we seek to destabilize exclusionary institutional practices that center white dominant speakers and “the white listening subjects” (Flores and Rosa 2015, 151). The teachings held in non-dominant languages’ onto-epistemologies are often intentionally left at the peripheries of STEM spaces due to disciplinary norms and English monolingual superiority (Kayumova et al. 2025; Kayumova and Dou 2022). The act of challenging white monolingual norms is also a direct counter to the colonial matrix of power shaped through geopolitics and imposed by English imperialism, which can be reinforced through STEM learning environments (Takeuchi 2021; Takeuchi et al. 2022). As Harper and Kayumova (2023) illuminated, Black and Brown girls’ linguistic experiences shape their relations with(in) the science disciplinary spaces that often leave them invisibilized as agents of science. Our views toward languages cannot be inseparable of the fact that non-dominant peoples’ lived experiences and intergenerational knowledges have also often been excluded and deemed “unscientific” according to Western science epistemology, as they are claimed to not follow the notions of objectivity and scientific reasoning (Bang and Marin 2015; Strong et al. 2016). As we highlight the “whole languaging hearts” of children who have experienced forced displacement, we amplify

language as a tool to (re)affirm multilingual repertoires and (re)connect them with their onto-epistemological brilliance in science learning (Kayumova and Dou 2022). This shift also underscores the need for a long-overdue reexamination of what counts as science teaching and learning—and who gets to decide—an issue we return to in the discussion.

What the pedagogy of whole languaging hearts offers and extends is a view of language and science learning that is rooted in the heart, with land, and with relations. Drawing from translanguage theory (García et al. 2017; García and Wei 2014; Wei and García 2022) and Indigenous onto-epistemologies (Bang et al. 2022; Henne-Ochoa et al. 2020; Hermes et al. 2023; Kimmerer 2017), this pedagogy moves beyond linguistic validation toward (re)centering languages as storied, lived, and relational practices. It affirms languaging not solely as a cognitive or communicative process, but as deeply affective, spiritual, and ecological. Whole languaging hearts foregrounds the brilliance of linguistically and racially minoritized refugee children and challenges colonial, racialized, deficit-oriented linguistic norms—including dominant framings of fluency and linguistic legitimacy (Flores and Rosa 2015; Kayumova and Dou 2022). This pedagogy extends the translanguage stance by attending to how languages emerge from and move through our bodies—through motion, embodiment, and in relation with the land (Bang et al. 2022; Henne-Ochoa et al. 2020). It sees languaging as supporting relationality with each other, with the land, and with more-than-humans and as a way to (re)connect with the onto-epistemological teachings that have long been silenced or sidelined in science learning (Bigelow and Engman 2020; McDaid Barry et al. 2023). It offers a pedagogy of connection rooted in children’s whole selves, their stories, and their expansive repertoires. In doing so, the pedagogy of whole languaging hearts contributes to the reimagining of what counts as science teaching and learning, and who gets to decide (Bang and Marin 2015; Strong et al. 2016; Takeuchi et al. 2022).

3 | Methodology

For our larger Soil Camp project (<https://soilcamp.ca/>; Takeuchi et al. 2021), we draw from social design research methodology (Gutiérrez and Jurow 2016) that centers historicity, diversity, equity and ecological resilience as design principles and aims to co-design just practices and futures in partnership with a range of communities. We are also guided by Indigenous ways of knowing and decolonizing methodology that acknowledge colonial relationships reinforced by research that honors and carefully listens to the voices of Indigenous Peoples (Tuhiwai Smith 2012). The program took place on a 30-acre community urban farm where newcomers participate in local and sustainable agriculture with visions for decolonization and reconciliation with Indigenous communities. Our university team, composed of educational researchers, and educators with diverse disciplinary expertise (e.g., mathematics, sciences, arts, and social sciences) designed and led activities to better understand the soil and ecosystem. Our educator community at Soil Camp was comprised of teachers, teacher candidates, educational assistants, and community-based teachers who all honored the pedagogical expertise rooted in Indigenous ways of knowing and the experiences of racialized multilinguals of diaspora.

Aligned with social design-based research that values iterative cycles of development, implementation, and study of design (The Design-Based Research Collective 2003), our design has emerged from multi-year collaborations and redesign. One of the focuses of redesign that we center in this article are the linguistic practices, guided by our reflections on linguistic design for equity and justice. Our methodological commitment orients us to center voices of our racialized children and teachers, with a specific focus on the interactional phenomenon of translanguaging (García and Leiva 2014), while also historicizing translanguaging in light of its macro histories and politics. In our analysis of interactions, we closely attend to the power dynamics surrounding the participants, colonial histories, and linguistic norms that are reproduced or challenged in particular interactions (Marin 2020; Takeuchi 2021). We depict the detail of pedagogical design that is relevant to this article in Section 3.3.

3.1 | Context and Participants

Within the last 10 years, Canada has had 302,890 persons making claims for refugee status (Government of Canada 2024). All children who joined our program were refugees who had resettled in Canada within the last 5 years. The largest proportion of children were from Syrian and Yazidi communities, but we intentionally try to shift away from labelling and fixing their experiences or “characteristics.” We describe a glimpse of histories and backgrounds that were shared voluntarily by children as we deepened relationships with them. In other words, the memories of the land that children shared cannot be detached from the loving relationships developed over time between children and teachers in the spaces of the Soil Camp project. We are aware of and have heard first-hand some of the traumatic experiences that they have endured but acknowledge that we can never fully understand. Stories of family separation, missing and murdered family members, and memories of the lands they were displaced from were part of shared experiences for children we worked with. However, we reject to reproduce the damages that media portrayal or damage-centered scholarship have perpetuated (Tuck 2009) and recognize that the stories we share here will always be partial and need to stay so, to challenge such othering.

Since many of the children who participate in Soil Camp hold invaluable connection to ways of knowing from the land, one of our goals in design has been to co-create learning spaces with these children, aligned with the literature and guided by the goal to harness opportunities to (re)connect and learn together about the soil, plants, and animals along with key concepts in Science, Technology, Engineering and Mathematics (STEM) and socio-environmental justice (Takeuchi et al. 2024). Such (re)connection with the land is an act of “refiguring the presence” (Nxumalo 2016, 640), through which the histories erased under settler-colonialism and relationalities with more-than-humans are brought to attention for both children and teachers.

3.2 | Data Collection and Analysis

Our data collection and analysis draw from critical interaction analysis (Philip and Gupta 2020) and decolonial interaction

analysis (Krishnamoorthy et al. 2021; Marin 2020) to bring forth the issues of power and macro contexts surrounding interactional phenomena of translanguaging. The use of such methods of analysis afforded the necessary attention to moment-to-moment interaction, attending to the linguistic norms reproduced or challenged in particular interactions and the greater power dynamics involving participants and colonial histories.

Our conceptualization of relational ways of seeing language guided our methodological decision on documenting both the iterative process of linguistic and pedagogical design centering the voice of a growing teacher, Sophia (Author 1), and children's ways of connecting to the land through languaging. This documentation was entangled with embodied acts relating to the land which include dancing and languaging on and with the land. To capture embodied interactions on the land, video data was collected using three modes (Go-Pro cameras worn by both the participants and by the researchers, Handycam video cameras held by the participants and researchers, as well as still cameras that were stationed on tripods in the primary spaces of interaction). For the purpose of this article, among all the data collected, we selected to analyze 29.5 h of video data that directly connects to the design and pedagogy of whole languaging hearts. More specifically, these video clips were selected in relation to Sophia's reflections, focusing on moment-to-moment embodied and situated actions, primarily from segments where Sophia led the design and facilitation. This video data was selected from a larger data set collected through initial three iterations of Soil Camp design, to examine the development of pedagogy over time.

The first step in our analysis was to critically reflect on the segments of data where the participants were using non-dominant languages, both named languages and forms of translanguaging. The viewing of this data was done as a collective through collective interactional analyses. Our lived experiences on the land and our positionalities became guides of this collective analysis focusing on how languages were becoming a tool to connect with the land and more-than-humans. The wholeness and richness of our embodied interactions and languaging beyond spoken and written words were often captured on the move. Thus, our analysis focused beyond discursive interactions. During this collective viewing of video data, we focused on ways of knowing expressed by children on the land, when the opportunities for languaging were expanded by teachers. The transcription was completed using the conversation analysis conventions adapted from Hepburn and Bolden (2013), as outlined in the Appendix. These conventions have supported a comprehensive understanding of languaging by capturing the complexities of both the spoken and embodied language.

Along with the collective analysis of video, we chose to illuminate examples of the pedagogical design features developed iteratively over time. This part of analysis was guided by narratives around pedagogy that centers Sophia's pedagogical intentions, modeling of translanguaging, and children's invitations and leads in creating translanguaging spaces. This analysis was first led by Sophia's noticing of profound interactions during her facilitation, which pushed her pre-conceived boundaries of teaching and languaging. Sophia's reflections led us to revisit some of the selected video interactions closely to discuss both the design features and development of

linguistic design over time. Following Sophia's lead in identifying profound interactions, we collectively reviewed these video interactions to incorporate multiple perspectives on the phenomenon of focus.

Throughout we sought to shift away from the unethical nature of research on communities that exist and strive to do so *with* and *through* stories in which the voices of the participants come through (Tuihawai Smith 2012). Hence, weaved throughout the presented micro-interactional data sets are narratives of the interactions, as well as stories shared by the children. The nature of displacement, resettlement, geopolitics and histories are embedded in their storytelling. Intentional storying is more than a stylistic choice. We see this as an act of decolonizing our research by centering stories as they were shared and emerged in practice, stories however that are often flattened by dominant research methodologies and ways of colonial practices of storylines which we tried to shy away from (Tuihawai Smith 2012). We hope these findings capture the possibilities that emerged and were nurtured relationally.

3.3 | Iterations of Pedagogical Design

The intention behind foregrounding *hearts* in the pedagogy of whole languaging hearts rather than employing a word like bank or repertoire is to best encapsulate the expressive and embodied nature of and within language—the connectiveness that it is always with(in) us. As an educator and multilingual person, Sophia, described the subjugation of the named language of Arabic which she held in her heart as a multilingual child and now educator, in the very city where the Soil Camp project is situated. Her positionality and racialized experiences and noticings led to the understanding of pedagogy and pedagogical interaction as a space to honor what was left at the peripheries of learning spaces. Reflecting on her pedagogical experiences at the Soil Camp project, she wrote: “I sought to co-create a space with salient moments, where children and teachers’ linguistic repertoires, practices and identities are seen in a non-deficit light; as whole, rich and full of connective possibilities for learning and being. In addition, the ways in which we language in and with the places, peoples and more-than-human life dearest to our hearts and ways of being, were validated and held lovingly.” Her reflections repeatedly touched on the theme of “following the children’s lead,” the commitment she made, as it was these child-led moments and analyzing these interactions that foraged new pathways for equity and design. Through our video analysis, we observed how, following the teachers’ modeling, children and youth began to share their noticings around language and translanguaging in both planned and spontaneous learning moments. For example, during a soil absorption observation on the land, one child voiced her noticing of Sophia’s translanguaging—not as “broken,” but as “تخلطيم” (mixed together)—a loving challenge to the deficit-oriented descriptions she had heard throughout her life. This framing evoked an image of vibrant wholeness for Sophia. Reflecting on this moment, Sophia described it as “a transformative experience unlike any other in my roles as an educator, learner, or multilingual individual in other educational spaces.” Together, we explicitly challenged dominant narratives of linguistic perfection, affirming that we can hold and claim languages in our hearts without needing to justify how well or fluently we speak.

Together with other teachers and children, we aimed to co-design ways in which we could meaningfully make explicit the whole languaging hearts. Focusing on the first three iterations of our ongoing project, we came to understand children’s relationships to language as an avenue for (re)connection to the land and to others. This analysis is informing our ongoing design work. Each year there were noteworthy insights as we were on the land and with children and other multilingual teachers. In Year One, we noticed the salience of unplanned moments initiated by children to challenge dominant linguistic norms in moment-to-moment interactions (Thraya and Takeuchi 2022). This learning came from listening to the children, in the ways that they responded to one another, to the space and agentic and embodied experiences.

Concretizing the lead of our children as a central design element came from our recognition that co-fostering such a space would not be possible without this work being done *with* children. The linguistic design work in Year Two sought to bring forth the pedagogy of whole languaging hearts design for equity, as we attended to the need for “critical historicity, power and relationality” (Bang and Vossoughi 2016, 173), in order to create spaces that were nested in the larger vision for reclaiming power and shifting normative and oppressive power dynamics. With such a framing and guided by the voices, brilliance, languaging practices and whole identities of children, we were able to co-foster a space that ascribed power to ways of knowing by Non-Western peoples, languages, and histories.

Sophia’s reflection depicts how over time, she felt “a sense of wholeness linguistically and connection that she had never felt in a learning space before.” Exploring how we can continue to actively articulate our collective affirmative stance, Sophia found that the term “whole languaging hearts” emerged from her reflections, which she then introduced as part of a daily chant, which reads: *I will learn with my whole languaging heart, I will connect with my beautiful knowledges and speak with the words that flow naturally, I will reconnect and make new friendships using my whole self, with all the living things I meet, we will share, love and be together on this land.* The explicit and affirmative stance embedded in the chant was meant to counter the deficit linguistic norms present in institutionalized school practices. Through this chant, which became a constant part of our daily morning arrival, the collective stance toward challenging deficit language norms became renewed daily.

By Year Three, this explicit collective stance became a salient pedagogical practice where we all went around in a circle sharing the languages that we held in our hearts. In Year Three, together with other multilingual teachers, Sophia (Author 1) and Miwa (Author 2) designed a pedagogical activity that aims to highlight various ways of knowing attached to the languages that refer to the soil. In order for the pedagogical practices for whole languaging hearts to extend to the whole team and to all the educators, preservice and in-service teachers and the research team joined professional development sessions we designed to explicitly discuss the theory and pedagogy of languaging as a tool for (re)connection (Thraya and Takeuchi 2022). The pedagogical design of whole languaging hearts is entangled with teachers’ evolving relationships with their whole language hearts. For

example, in the case of Sophia's, drawing on her prior research with recently resettled Yazidi families (Banerjee et al. 2021), she was conscious of the complex histories and roles Arabic played in the lives of many of these families, and within the larger sociopolitical context of Northern Iraq. With such backgrounds, she initially approached the situation with care and even caution, avoiding the assumption that the Yazidi children spoke Arabic and seeking to align with a trauma-informed approach, she refrained from directly speaking to the Yazidi children in Arabic. Over time, she observed an increase in translanguaging that cannot be confined into named languages of Arabic, Kurmanji, and English, and took the lead on design elements and intentionally centered whole linguistic identities.

The complex and dynamic nature of their linguistic expressions were visible and shaped by an array of experiences, some of which seemed painful and other liberatory. For some of these children, not speaking Arabic would have meant silencing their wholeness. Some of the children who shared not speaking Arabic at home were seen to engage in science disciplinary conversations using predominantly Arabic. Commonly used labels like "home languages," "mother tongue," or "first language" proved inadequate as they lack attunement to the plurality and complexity of the linguistic identities of the children, even those of the same community, or even within the same family a few years apart due to family separation. By including full linguistic repertoires of children at Soil Camp, we aimed to hold this complexity which could easily be ignored with generalized assumptions around children's home languages and languaging.

4 | Findings

This section illustrates how the enactment of the pedagogy of whole languaging hearts emerged, gauged through teacher reflections and video interactional analyses. We highlight the emergence of pedagogy that centers linguistic wholeness, holding brilliance of linguistically and racially minoritized refugee children through relational ways of being. We illustrate some of the central pedagogical enactments. In the first episode, *Grounding Languaging in Histories, Stories, and Relational Networks: Community Collaging on the Land*, children rooted their languaging in personal and collective stories, articulating complex and layered relationships with language, place, people, and more-than-humans. In the second episode, *Embodied Storying, Dance, and Collective Remembering on the Land as Collage*, children transcended named languages through embodied storytelling, cultural movement, and collective remembering on their own terms. In the third episode, *Languaging with Whole Hearts: Honoring Spiritual, Ancestral, and Land-Based Knowledges Across Geographies*, children and teachers connected languaging to wholeness through words for soil held in their hearts—words carrying spiritual, cultural, and ecological meanings rooted in both ancestral and local land-based knowledges.

4.1 | Grounding Languaging in Histories, Stories, and Relational Networks: Community Collaging on the Land

Throughout our program, we emphasized diverse ways of communicating beyond verbal descriptions or texts. We saw

our whole languaging hearts pedagogy as the act of collaging (Franklin-Phipps and Rath 2018) where we collectively were able to make visible the complex network of connections we are situated in and our relationality and also cue in on ways of coming to know sciences as inseparable from our sense of community, stories, and relations (Ballard et al. 2023). As seen in the following episode, children and teachers located themselves within networks of community—geographically, locally and abroad, as ecosystems, culturally, linguistically, spatially, and through interest-based networks. This pedagogical enactment, viewed as a form of collaging, creates space for both collective and individual stories and experiences, highlighting their meeting points and divergences. This approach is evident in the chosen episodes, honoring the participants' ways of being in the world. During Year Two of Soil Camp, children were prompted to create collages of their collective and individual networks of community. This experience took place in an event tent on the land. Children came in to find the tables covered with a variety of craft and print materials spread out for them to cut and paste from, including recycled magazines. All children who participated in this activity were Yazidi-identifying from Iraq and worked alongside Sophia and Layelle, an educator of Syrian descent.

While the designed experience encouraged learner agency and embodied expression through the medium of collage, the activity became a site where children, unrestricted by the design of the activity, took the opportunity to showcase parts of their shared identity on their own terms. Through an initial discussion of unpacking what community meant to them, the children articulated their complex, layered, and emerging relationships with languages, places, peoples, and non-humans located within their network (Figure 1). The children collaboratively created community collage networks with images and words—such as "The Future," and "Planet Earth"—highlighting environmental sustainability, and the non-human beings they were in community with at Soil Camp and beyond.

During this activity, Dila (all names are pseudonyms except teachers), a Yazidi participant expressed:

I am still connected to Iraq, my language, I feel connected to Indigenous ways. It (Indigenous ways of knowing) shows us many things. Like Canada, like Calgary, and Arabic—it is kind of a language of ours but it's a little different. I connect to everything.

This quote captures how Dila connected to core pieces of her identity that are lived and transcend borders and divides, including complex historical dynamics embedded in her linguistic repertoire tied to the Arabic language. Arabic is the national language of the dominant majority in her country of origin and the officially adopted language of ISIL, who were responsible for the unjust genocide and forced displacement of the Yazidi people, as brought up by children during the activity. Evident forms of redefining such relations through the new spatial repertoires formed in translanguaging spaces surfaced across the 3 years of our co-design project. We can see that for these racialized multilingual children, language is seen as alive, embodied, and employed as an act of sustaining



FIGURE 1 | Networks of community collage.

relationality (Henne–Ochoa et al., Henne–Ochoa et al. 2020). Some children used the scrapbook letter stickers to create words naming the places with which they connected—including countries of origin (Iraq and Syria) as well as Canada. Both natural features and cultural monuments from local geography were taken from magazines. Images of The Elbow River Camp, Indigenous youth dancers performing in regalia, an archival photograph, and a current aerial image of two dozen tipis were featured on the poster. Following the completion of the collaborative poster, all were given a piece of scrapbook paper to use as a base for their collage. It is here where children articulated their complex, layered, and emerging relationships with languages, places, peoples including non-humans. We were able to see the complex, relational networks that children are grounded in—networks shaped by histories, geographies, languages, and the human and more-than-human relations that transcend conventional boundaries, including the disciplinary boundaries that too often separate science from lived experience.

4.2 | Embodied Storying, Dance, and Collective Remembering on the Land as Collage

The following interaction occurred as the children were completing their collages. This unstructured working time was met with conversation, singing and the playing of Kurdish music chosen by the children. Subsequently, children and teachers (who both identified as Muslim-Arab women) engaged in conversations about celebrations and customs dear to them such as the celebration of Eid and weddings across Yazidi and Lebanese communities. The children highlighted both commonalities and differences across these communities. Following this as the children continued cutting and pasting, a child-led moment of collaging emerged, moving beyond the designed learning experience into a space on the land they co-fostered relationally in situ. This interaction exemplifies the ways in which the children draw upon their lived-experiences, collective practices and other available spatial resources to engage in embodied storytelling, (re)connection, and collective remembering on their own terms. The moment which we see as a catalyst for this episode is the asking of permission by the group to play a popular Arabic song. The children showed a flow of joyful cheering, singing along and a child, Dila, started to dance from her seat (see Figure 2). Rolling her shoulders forward to the beat, she says “that is how Kurdish people dance.” Sophia met her sharing

with a “with their shoulders” showcasing her interest in knowing more (Excerpt 1).

Held by the land, a dance of Dilana Kurdi began with an Arabic song as background (usually this dance and its variations are performed to Kurdish wedding music) (see Figure 3). The children verbally shared how much fun they were having; after some time dancing together, Layelle asked if they would like to learn Debke, a circle-styled Levant folk dance, which they met with excitement (see Figure 2). This interaction held by the land brought the group together through the sharing of music, dance, and cultural traditions around weddings, which we enjoyed. While dancing to a Kurdish wedding song, a common word transcending linguistic and cultural divides between Arabic and Kurdish speaking communities—حياتي hayati—connected us (Excerpt 2).

All in the space shared, this endearing word meaning “my life” was a lyrical point of connection and the love it holds. By coming together, the children showed the circle dance's commonalities, variances, and possibilities non-hierarchically. At times, people were moving in unison, while others diverged on an exploration of movement to the same beat. Holding hands in a circle where no one was privileged over the other for what they had to share, no one voice was leading or directing—providing glimpses of possibilities.

In this moment, science was not an isolated subject but emerged as a lived and relational practice—a way of coming to know and be in the world through collective memory, movement, and story. These moments are central to our framing of science education as a relational and culturally situated practice, grounded in and emergent from the lives and lands that children carry with them. Movements and conversations came together as a collage of sorts, with a connective voice. But that voice was also layered with distinct features of memories and meanings—moving from collective to personal and back again. What could be seen as opposites, fond memories and painful realities, histories and the nature of displacement were talked about alongside each other. The children held the agency to do so on their own terms, in their own words as it flowed for them, without being elicited to share. Unlike hierarchical interviews, children initiated a conversation that was significant to each of us and not nested in a deficit framing of each other. Here, we see wholeness and place of connection through languaging. Embedded in those movements and on the land was their intimate sharing of everyday



FIGURE 2 | Dancing as collage stills.

Excerpt 1

Line	Time stamp	Speaker	Transcription
1	#12:22:49-5#	Dila (all children's names are pseudonyms)	Yeah
2		Lilan	Can I show you it
3	#12:22:52-0#	Tela	And kind of with their pinkies
4	#12:22:56-7#	Sophia	Do you hold pinkies?
5	#12:22:56-7#	Tela	Yes
6		Lilan	Can I show you it /this time running around the table to come next to Sophia and links pinkies. Dila runs over from around the table and Alal joins and the girls begin guiding Sophia through the dance.
7	#12:22:56-7#	Sophia	Can you show me?
8	#12:22:58-5#	All	Like this, yeah, and that /girls teach the isolated steps with arms rowing forward, gently guiding Sophia with encouraging and constructive language/
9	#12:24:01-5#	Dila	We can go outside and dance like this /holds pinky out/
10	#12:24:03-0#	Sophia	Should we ↑
11	#12:24:03-4#	Dila	Yeah let's go!
12	#12:24:06-2#	Lilan	Hold up, I have an idea
13	#12:24:07-8#	Dila	Bring the phone, yeah
14	#12:24:10-7#	Tela	Bring the phone everyone!
15	#12:24:20-3#		/Dila leads the group out of the event tent onto the land/

life in Iraq in the past and present for their loved ones. Both teachers, Sophia and Layelle, attended closely to the unfolding elements, actively listening to the divergent and convergent flows of movement and storytelling (Excerpt 3). We understand this kind of active listening as essential to—and a defining feature of—the emergent pedagogy of whole languaging hearts that Soil Camp nurtured and ultimately came to embody.

4.3 | Honoring Spiritual, Ancestral, and Land-Based Knowledges Across Geographies

Teachers' modeling of affirming their whole language hearts opened up a space to share children's ways of seeing the soil, rooted in the languages that they hold close to their hearts, as this episode makes evident. Sophia shared Arabic words for the soil that she



FIGURE 3 | Dancing in a circle.

Excerpt 2

Line	Time	Speaker	Transcription
1	#12:35:58-2#	Layelle	This sounds عربي /Arabic/
2	#12:36:00-8#	Lilan	Oh, حياتي /hayati/ means sweetheart
3	#12:36:01-8#	Layelle	[Yeah]
4	#12:36:03-3#	Sophia	[Yeah], that's a common word hey
5	#12:36:04-4#	Tela	Yeah, in ours
6	#12:36:08-1#	Layelle	Do your parents say حياتي to you?
7	#12:36:10-1#	All	Sometimes, yes
8	#12:36:11-1#	Zerya	They say hayati to each other

holds close to her heart and spiritual meanings associated with the word. Teachers and children together then created a poster representing diverse repertoires of languages and images around the soil. Sophia then also shared the spiritual teachings and ways of knowing and seeing that are embedded within the Arabic words أرض and تراب, rooted in Islamic worldviews that humans were created from the soil. She noted how she sees the soil as a part of herself, with spiritual teachings embedded in the Arabic word أرض that sees the earth as the witness of human activities and makes her reflect on whether she is a good friend to the earth. Her modeling of whole languaging hearts that embrace subjugated ontoepistemologies in dominant schooling was the context that invited children's sharing of rich ways of knowing the soil, as we describe in the following section. Other facilitators also shared their ways of languaging connected to the land. Liana, who is a Blackfoot Knowledge Keeper, shared important words in Blackfoot including Na'a, meaning the earth.

In the process of this poster making (Figure 4), going around in a circle, children shared all the languages held in their hearts (see Figure 5). This was a key moment of the assembly where teachers and children saw others with similar as well as different linguistic repertoires to their own coming together in the space. Languaging that was forced to be on the peripheries due to linguistic colonization (Bang and Marin 2015; Little Bear 2000) became centered in this co-created learning space.

Multiple connections children are making across languages and different ways of seeing the soil are reflected in the following interactions. They showcase how using one's whole languaging heart holds the possibility to (re)connect and remember the lands, spirituality, and ways of being that children were intimately connected to and stripped from due to forced displacement and faith-based persecution. When completing the poster representing diverse languages for the soil (Figure 4), Baran, a Yazidi child said how using the Kurmanji words for soil reminded her of Iraq, where she stated that there was "soil everywhere you go." This salient moment transpired following a collective remembering for Baran and other children who sat together at a single table during the facilitation. Baran began writing the words she gathered from her whole languaging heart from the named languages of Kurmanji, Arabic and Spanish, *erd*, *akh*, *turba*, and *suelo* were written on her sticky note. The Kurmanji words *erd* and *akh* were repeated many times among the table group of Yazidi children, and many of the older children visibly appeared excited by the sudden resurfacing of these words. Following this is when Baran shared with Miwa that the words she had in her heart for soil in Kurmanji reconnected her to the lands she was forced from in Iraq and felt the special presence of soil in. These memories of ecological connection were intimately entrenched with the ways these children see the soil. Such rich ways of seeing the soil came to be foregrounded during this activity.

Similarly, we witnessed Hana, a Yazidi girl-identifying child and Amal, a Muslim Syrian girl-identifying child share comments

Excerpt 3

Line	Time Stamp	Speaker	Transcription
1	#12:37:47-0#		/At this moment begins multiple conversations emerging across the circle including collective remembering—Sophia pays unwavering attention to the storytelling and silenced histories and memories shared across the circle/
2	#12:37:48-9#	Dila	For Easter Day, for Easter Day, we went to qā'ī
3	#12:37:54-5#	Lilan	Because for Êzidians back in the olden days they had to do what adults had to do like at the age of 6 or like 5. [They had to learn how to cook at that age and that stuff, because they weren't really treated pretty badly, and they really didn't have that much money. So, they had to make their own stuff and farm. But it was so much fun though, I miss those days]
4	#12:38:21-1#	Sophia	You miss those days?
5	#12:38:07-2#	Tela	[the people at Iraq, sometimes the people at Iraq do this in a big circle, there is a lot of people in the weddings in Iraq]
6	#12:38:14-9#	Dila	[Yeah there is video of the people for the weddings in Iraq]
7	#12:38:23-0#	Lilan	Now it's harder. I loved that.
8	#12:38:25-1#	Dila	You had family time, you had play time outside
9	#12:38:28-0#	Lilan	But now all everybody wants to do is just scroll through TikTok
10	#12:38:32-9#	Tela	I love the place that's, just like, flat and it is all green with daisy and flowers
11	#12:38:35-7#	Dila	and for Easter Day, we went to a place that was called qā'ī and it was so fun. We had, we broke a lot of eggs.
12	#12:38:40-6#	Sophia	قاعة /Sophia repeats the word/
13	#12:38:43-5#	Dila and Tela	Yeah
14	#12:39:03-4#		/Lilan continues to speak on silenced histories we see transition from hardship, happy memories and current pain of community, all overlapping/
15	#12:39:03-4#	Lilan	Uh, there is still people trapped by the Daiş which is basically people who just destroy your land just because they wanted more money [It's not really like a war]
16	#12:39:05-1#	Sophia	Mhmm /Continues to make eye contact and listen to Lilan/
17	#12:39:20-2#	Lilan	I am pretty sure people who are trapped by it, well they don't get treated fairly and they don't have that much money. The people who are trapped, that's why we had to move from that place.

on how bringing her whole languaging heart helps them to connect spiritually. Hana shared with Sophia and Miwa that the word for soil from her heart meant God in Kurmanji and the word shared by Amal meant prayer in Arabic, صلاة. When asked about what these words meant to them, and how they connected to soil, Amal shared her powerful grounding experience with prayer in making her feel secure in her life and more spiritually connected with nature. Hana added to this theme of grounding as she shared the importance of coming to and connecting with God in her life during many losses and how natural elements including soil and trees have helped her to do so. It is here we see a cross-religious connection grounded in these spiritually significant words chosen by these children as connecting them with soil.

In another interaction, a young Yazidi boy-identifying participant, Elend, showcased the power in using one's whole language heart to connect to new lands through Indigenous ways of seeing the soil. This activity centered and supported children

in bringing various ways of knowing the soil into the learning space through their own groundings rooted in knowledge systems of their peoples as well as the Blackfoot people. In this transcribed video recorded interaction with a teacher Anita, Elend showcases the importance for spaces that invite and welcome multiple ways of seeing the soil—the respectful care held by this child as he shares his connection to the Blackfoot way of seeing the soil.

This interaction begins when Elend, who was actively weeding (Figure 6), was asked by Anita if he could share a word for soil that he holds in his whole languaging heart, he paused his task of weeding to think. He then responded by saying, “I don't know how to say soil in my language.” Anita told him it was okay and proceeded with a follow-up question by rephrasing her original question, as seen in Excerpt 4 below.

He concludes this by saying: “All I know is Na'a is our beloved place for home.” Noteworthy in this interaction is how this



FIGURE 4 | Whole languaging hearts poster.



FIGURE 5 | Languages held in children's hearts.

young child shares his learning, seeing, and connection through heterogenous ways of knowing and being held within his expansive languaging heart. Although Elend did not know the word for soil in the language of Kurmanji, we see that he was able to articulate his relationality, connection, and the epistemic roots of the Blackfoot word he shared as seen in the utterance 6 of Excerpt 4 (“Na’a is our mother and creates all of these plants that help us in growing fruits and vegetables”). Employing words such as we (line 9), us (line 6 and 8) and our (line 6, 9 and his concluding statement) (Shanahan and Burke 2017) provides a glimpse into the shared responsibilities and collective belongings while centering rich ways of knowing for connection

and understandings rooted on the land (Marin and Bang 2018; McDaid Barry et al. 2023; Rahm et al. 2023).

5 | Discussion and Pedagogical Implications

The findings we share in this article make evident a liberatory possibility of pedagogical enactment and moves that go beyond isolating language teaching or disciplinary learning by following the lead of children—holding relationality and love at their core to make visible the wholeness and brilliance of children. The pedagogy of whole languaging hearts actively resists colonial,



FIGURE 6 | Elend sharing ways of seeing the soil on the land.

Excerpt 4

Line	Time stamp	Speaker	Transcription
1	#00:00:18-8#	Anita	What does soil mean to you?
2	#00:00:19-6#	Elend	Soil means to me Mother Earth, it is Na'a, Na'a is Earth.
3	#00:00:35-7#	Anita	Na'a is Earth, right. Do you remember what language that is from?
4	#00:00:38-4#	Elend	Blackfoot.
5	#00:00:39-7#	Anita	Blackfoot, [right].
6	#00:00:39-9#	Elend	[And] Na'a is our mother and creates all of these plants that help us in growing fruits and vegetables.
7	#00:01:04-7#	Anita	And what else does Mother Earth do for us?
8	#00:01:06-0#	Elend	It carries water for us, it has food for us and also soil has, umm and it also has soil, most importantly soil.
9	#00:01:28-2#	Elend	We put our homes on Na'a

racialized, and deficit-oriented linguistic norms. It transcends named languages and individualized linguistic practices, recognizing languaging as inherently relational. Grounded in histories and stories, it honors the lived experiences, memories, and cultural knowledges that learners bring. This pedagogy also connects languaging to a sense of wholeness—one that includes

our relations to the land and global land-based knowledges and networks. In doing so, it foregrounds the brilliance and wholeness of linguistically and racially minoritized children and reclaims languaging as a relational practice.

5.1 | Contributions of the Pedagogy of Whole Languaging Hearts to Science Education

Responding to the calls from scholars who have contributed to the growing body of literature on translanguaging in science education (e.g., Bonilla and Morales-Doyle 2025; García 2025; Grapin et al. 2025; Karlsson et al. 2020; Kayumova et al. 2025; Lemmi & Pérez, 2024; Pérez et al. 2025; Siry et al. 2025; Suárez 2020; Vogel et al. 2019), we aim to support pre- and in-service teachers by sharing our experiences and insights into how this practice has been enacted in informal, community-based learning settings that we have designed through the Soil Camp project. The pedagogy of whole languaging hearts refers to an enacted pedagogy that centers the wholeness of language and the brilliance and humanity of children, thereby resisting deficit discourses about multilingual learners in STEM learning spaces. At the core of this work, we see teachers seeking to co-create a space where children's whole language hearts, practices, and identities are seen in a non-deficit light; as whole, rich and full of connective possibilities for learning and being in science. Translanguaging practices were nested, spontaneous, and agentic and were done consciously as teacher saw how it could easily be extractive if done in ways that were too direct, such as having children communicate through engagement in superficial translation work which could replicate dominant oppressive languaging practices and ways of learning and becoming in science. Based on our findings, we see science pedagogy as being emergent from and grounded in the lives and worlds of our participating children and embodied interactions on the land. Bringing criticality and historicity forward in our engagement with translanguaging and science education, we further the argument that language is far from socio-politically neutral, and to ignore the history and coloniality associated with language would be a disservice to children's possibilities for learning and reconnection (Hermes

et al. 2023; Wei and García 2022; McDaid Barry et al. 2023; Takeuchi et al. 2022). As our findings demonstrate, children know how to relate to rich complexities, hold ways and inhabit worlds that are relational and expansive in nature, across lands, knowledge systems, and languages. Our pedagogical moves of honoring whole language hearts brought forth children's collaging of Western and non-Western knowledges, stories, and spiritual ways of being with land and one another which are held in our words. For instance, we showed how a child, Elend, was fostering new connections in his languaging heart, as he rearticulated the Blackfoot word Na'a with his emerging worldview taught by a Knowledge Keeper, Liana.

This moment illustrates the whole, living and always expanding heart and the importance of not boxing or projecting what would be assumed of children due to a perceived idea of their hearts. Our work responds to the calls to desettle the privileging of Western science and the "anthropocentrism in Western knowledge systems" (Bang et al. 2012, 312) and deepen our engagement with science teaching and learning in relational and dignifying ways (Ballard et al. 2023; Tan and Faircloth 2023).

The memories of ecological connections brought forth by the children hold great power especially in our efforts to work toward eco-social justice. Our work is ongoing, with the aforementioned commitments, to seek to continue such intentional design work to invite and nurture these kinds of scientific explorations and what can be. As stated by Nxumalo and Wallace (2022), "nature is always already pedagogical, agentic and in-relation with humans in different ways" (323). Not bound by outcomes or curricular constraints, our co-created space for (re)connection and the (re)building of relations with language and land created a space to be together and bring forth our knowledges toward our visions for socioenvironmental justice. The very implications for science education lie in what can come about when teachers embrace and intentionally make space for reimagining possibilities.

5.2 | Implications for Designing for Whole Languaging Hearts: Reimagining Inclusive Science Education

We sought to illustrate how the teachers at Soil Camp enacted and redefined pedagogical possibilities relationally with children, the land, and more-than-humans, by centering the voice of Sophia (Author 1) who was becoming in new ways in her role as a teacher and through the multiple iterations of pedagogical design. In doing so, we emphasize the significance of teachers' reflective work around pedagogy in informal science and what it means to be working with children in uplifting ways. As demonstrated in our findings highlighting Sophia's pedagogical lead, teachers' commitment to these children in our program was not about imposing pre-set curricular outcomes but about ethically engaging with their complex life trajectories, identities, and histories of power and oppression by doing science on the land. Analysis of Sophia's reflections depicts the transformative nature of this experience unlike any other pedagogical facilitation she has encountered in her roles as an educator, learner, or multilingual individual in other educational spaces—formative at many levels. In alignment with García and Leiva's (2014)

aims of translanguaging to attend to the lived experiences, we strive to do so in expansive ways, attending to the plurality and complex life-worlds of children and our own as teachers. A key feature in our design was the concretized key elements within the space that became transformational tools for deconstructing the colonial views of what it means to learn with all languages in informal educational spaces and see what comes to life interactionally. Our pedagogical design and enactment positioned language and languaging as embodied, living, and as a tool for rebuilding relationships with and through each other, with the land, and with science. Openness to linguistic design can also extend to openness about the future of science learning. An essential aspect of viewing science as emergent is creating space for child-led, spontaneous embodied interactions—such as dancing together.

Through the pedagogy of whole languaging hearts, teachers and children together created the context of science rooted in decolonial love (L. B. Simpson 2015), which has the power to expand the epistemological and ontological possibilities to embrace those who had been colonized and disciplined through colonial, hetero-patriarchal, racialized, gendered, and classist disciplinary practices in STEM (Takeuchi and Marin 2022). We collectively engaged in and through historically subjugated onto-epistemologies (Kayumova and Dou 2022) and stories (L. B. Simpson 2014), which were shared by the children on the land yet rarely validated in science classrooms and for our teachers. We hope our work contributes to redefining what science learning can look like to reimagining science learning as an experience rooted in care (El Halwany and Alsop 2023), love (Bazzul 2023; Takeuchi and Marin 2022), and justice (Morales-Doyle 2017). Our findings suggest the need to unpack binary visions of language use, especially in a world marked by global mobility and intersectionalities. More importantly, this unpacking compels us to critically examine the dominant ideologies and onto-epistemologies shaping science education, to move closer to a more socially just approach to science education.

5.3 | Pondering Questions

Our paper poses an essential question: what does it mean in this work to think about whole languaging hearts in and as science? To us, it is to see languages and scientific knowledges as living, loving, and integral to being yet also as continuously in the making in and through relations. As we are co-creating science spaces where students can bring their linguistic wholeness, how can we also connect to what that linguistic wholeness is holding and working dialogically with and what other possibilities exist to bring our knowing together to be better partners with the land? Is only centering language, disciplinary knowledge, and its intersections with one another enough to see and connect to the whole dynamic picture and life-worlds of children? And what does flattening such complexity and heterogeneity—leaving out histories of languages, places, and bodies, stories, and power—do in science education? And lastly, we as teachers must critically ask what we see as disciplinary learning, knowing, and being. By moving beyond the privileging of diverse linguistic and cultural practices, we offer to look at this work of reimagining science education—attending to its relations, complexities, and heterogeneity—intersectionally, lovingly, and relationally

to imagine an otherwise, refusing the predefined disciplinary possibilities for eco- and socially just futures together.

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Data Availability Statement

Research data are not shared.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Data S1:** Supporting Information.

Appendix A

Transcription Conventions Adapted From Hepburn and Bolden (2013) Introduced in This Article

Transcription conventions	
[]	Overlapping speech within brackets
?	Rising intonation indicative of a question
↑	Shifts in higher pitch in utterance immediately before arrow
.	Full stop, but not necessarily the end of a sentence
//	Non spoken, embodied or clarifying contextual information including translations